

SYLLABUS
For
Bachelor of Business Administration
(HONS.)
Under
Gauhati University (CBCS)

(This is approved in the Academic Council held on 08.11.2019)

REGULATIONS AND SYLLABI FOR THREE YEAR BBA (HONS.) COURSE IN SEMESTER UNDER CBCS FOR THE STUDENTS ADMITTED W.E.F 2019.

1.The Bachelor of Business Administration Course called the BBA Course hereafter shall comprise of three academic years and each academic year shall consist of two semesters. Each semester shall approximately consist of 19 weeks of teaching, 3 weeks of academic and other formalities including the semester examination and 4 weeks of semester break.

2.Eligibility Criteria: A (10 +2) degree in Arts, Science, Commerce or a Diploma in Engineering with minimum **45%** marks in aggregate from a recognized Board/ Council.

3.Admission Criteria: The selection of eligible applications will be based on the applicant's overall performance in (10+2) examination.

4.Examination:

- a) There will be 6 (six) examinations, one at the end of each semester
Duration of the semester period will be as follows:
First, Third, Fifth semester : June to December (July– Summer vacation)
Second, Fourth and Sixth semester : January to May.
- b) A candidate for the examination shall be examined as per syllabi where each written paper shall be of 3 hours' duration.
- c) A candidate shall not be sent up for a semester examination if he/ she has not attended at least 75% of the classes held for each subject including lectures, seminars, tutorials and case analysis.
- d) Each paper shall carry 100 marks, out of which 20 marks shall be allocated to internal evaluation. The minimum marks required for passing the examination shall be **35%** both in internal evaluation and written examination, in each paper separately and **45%** in the aggregate separately for each semester examination.
- e) If a candidate fails to secure pass marks in a subject paper in the internal evaluation, he/ she shall be debarred from appearing in the Term end Semester examination and he/ she will have to seek re- admission into that semester when it is offered.
- f) A candidate shall submit a Summer Project Report here in after referred to as Report, in duplicate to the Head of the Dept. within 2 weeks of completion of the project; generally by **31st August** in the 5th semester period. The Report shall carry 100 marks in total, out of which 20 marks be allotted for internal evaluation. The remaining 80 marks be divided into 50 marks for evaluation of the text of the report and 30 marks for Viva Voce . The Report shall be prepared under the guidance of a teacher of the Department. Who shall be referred to as the Guide for the purpose. The Guide in consultation with the candidate concerned shall determine the topic and exact title of the Report.
Two examiners to be appointed by the Controller of Examinations shall evaluate each Report. The average of the marks awarded to the candidate on the text part of the Report. The Guide and the external examiner shall conduct the Viva Voce examinations jointly.

The Viva Voce marks obtained by the candidate together with the average marks obtained in the text shall be the final marks awarded to the candidate on the Report.

- g) A failed candidate is eligible to appear in a maximum of 2 back papers in Term End semester examination, provided he/ she has secured minimum **45%** marks in aggregate in the concerned examination. A student will be allowed to clear six semesters in maximum five years. He/ She will not be allowed to take more than three chances in any semester.
- h) A student who could not appear or failed in any semester, will be allowed to clear the same as follows:
 - i. First semester with the regular Third/ Fifth semester.
 - ii. Second semester with the regular Fourth/ sixth semester
- i) If a candidate secures pass marks in internal evaluation but has not cleared any of the semester examination then he/ she will be allowed to appear in the next semester examination, but his/ her final results after Fourth semester will be kept with held until he/ she clears all the back log.
- j) If a candidate fails in a semester examination, the marks secured ny him/ her in internal evaluation in each subject shall be carried over to the next semester examination, provided he/ she obtains the minimum pass marks which shall remain valid for two years only.

Results: A candidate shall be awarded BBA Degree on passing all the six semester examination.

Final results will be worked out by adding up total marks secured in all the six semester examinations. Those candidates who **45%** or more but less than 60 percent in aggregate will be declared as having passed the examination in Second Class and those securing 60 percent or above will be declared as having passed in First Class.

A candidate will be declared to have passed with Distinction in the appropriate class provided the candidate passes all the semester examinations from First to Sixth regularly, without keeping any arrear subject at any semester and completes the BBA Course in three academic years from the date of his/ her admission and secures at least 75 percent marks.

**BACHELOR OF BUSINESS ADMINISTRATION (HONS.) 3 YEAR DEGREE COURSE
UNDER CBCS PROGRAMME**

COURSE STRUCTURE		
1ST SEMESTER		
BBA-AE-1014	BUSINESS COMMUNICATION (LANGUAGE : ENGLISH)	AECC-1
BBA-HC-1026	PRINCIPLES OF MANAGEMENT	CORE COURSE -1
BBA- HC-1036	MANAGEIAL ECONOMICS	CORE COURSE-2
BBA- HG-1046	MATHEMATICAL TECHNIQUES IN BUSINESS	GE- 1
2ND SEMESTER		
BBA-AE-2014	ENVIRONMENTAL SCIENCE	AECC-2
BBA-HC-2026	FINANCIAL ACCOUNTING	CORE COURSE-3
BBA- HC-2036	STATISTICS FOR BUSINESS DECISIONS	CORE COURSE- 4
BBA- HC-2046	INDIAN ECONOMIC SCENARIO	CORE COURSE- 5
BBA- HG-2056	COMPUTER FUNDAMENTALS	GE-2
3RD SEMESTER		
BBA-HC-3016	COST AND MANAGEMENT ACCOUNTING	CORE COURSE-6
BBA-HC-3026	HUMAN RESOURCE MANAGEMENT	CORE COURSE-7
BBA-HC-3036	PERSONALITY AND PERSONAL SKILL DEVELOPMENT	CORE COURSE- 8
BBA- HG-3046	OPERATIONS MANAGEMENT AND CONTROL	GE-3
BBA- SE-3054	COMPUTER APPLICATIONS	SEC-1
4TH SEMESTER		
BBA-HC-4016	ORGANIZATIONAL BEHAVIOUR AND INDUSTRIAL PSYCHOLOGY	CORE COURSE-9
BBA-HC-4026	FINANCIAL MANAGEMENT	CORE COURSE-10
BBA-HC-4036	PRINCIPLES OF MARKETING	CORE COURSE-11
BBA- HG-4046	BUSINESS RESEARCH	GE-4
5TH SEMESTER		
BBA-HC-5016	LEGAL ASPECTS OF BUSINESS	CORE COURSE- 12
BBA- SE-5024	SUMMER PROJECT	SEC-2
BBA-HE-5036 BBA-HE-5046	A student would be free to choose any four papers from one group. In 5 th and 6 th semester they have to choose two papers in each semester from the group given below. The course offers three groups namely Finance (DSE I), Marketing (DSE II) and Human Resource (DSE III)	DSE-1 & 2
6TH SEMESTER		
BBA-HC-6016	BUSINESS POLICY AND STRATEGY	CORE COURSE-13
BBA-HC-6026	TAXATION LAWS	CORE COURSE- 14
BBA-HE-6036 BBA-HE-6046	A student would be free to choose any four papers from one group. In 5 th and 6 th semester they have to choose two papers in each semester from the group given below. The course offers three groups namely Finance (DSE I), Marketing (DSE II) and Human Resource (DSE III)	DSE 3 & 4

DSE I : FINANCE

- INTERNATIONAL FINANCE
- INVESTMENT BANKING AND FINANCIAL SERVICES
- INVESTMENT ANALYSIS AND PORTFOLIO MANAGEMENT
- STRATEGIC CORPORATE FINANCE
- BUSINESS ANALYSIS & VALUATION

DSE II : MARKETING

- CONSUMER BEHAVIOUR
- MARKETING OF SERVICES
- ADVERTISING AND BRAND MANAGEMENT
- RETAIL MANAGEMENT
- PERSONAL SELLING & SALES FORCE MANAGEMENT

DSE III : HUMAN RESOURCE

- HUMAN RESOURCE DEVELOPMENT : SYSTEMS AND STRATEGIES
- MANAGEMENT OF INDUSTRIAL RELATIONS
- TALENT AND KNOWLEDGE MANAGEMENT
- PERFORMANCE AND COMPENSATION MANAGEMENT
- TRAINING AND MANAGEMENT DEVELOPMENT

FIRST YEAR
Semester –I

BBA-AE-1014 BUSINESS COMMUNICATION (LANGUAGE : ENGLISH)

(As per UGC syllabus)

(AECC-1)

BBA-HC-1026 PRINCIPLES OF MANAGEMENT

(CC-1)

Unit 1: Evolution of Management- Development of management Thought, Schools or Approaches to Management- The Classical School, The Neo Classical or Human Resource School, The Modern School, Management Thinkers and theorists.

Unit 2: Management Concept- Definition, Meaning, Characteristics, Importance/ significance, Objectives, Nature, Levels of management, Management Vs Administration, managerial Skills and Roles.

Unit 3: Management Principles- Henry Fayol's fourteen principles of management, F.W Taylor's scientific management principles.

Unit 4: Functions Of Management-

- i. Planning: Meaning and definition, Characteristics, Objectives, need/ importance, Limitations, Essential Elements of Effective Planning, Process/ Steps in planning, Elements/ Components of Planning, Tools and techniques.
- ii. Organizing: Meaning and definition, Characteristics, Objectives, need/ importance, Process, Theories, Formal and informal Organisation, Concept of Organization Structure, Forms of Organization Structure, Authority, Delegation, Centralization, decentralization, Span of Control.
- iii. Staffing: Meaning and definition, Characteristics, Need/ Importance, Elements of Staffing Function.
- iv. Directing: Meaning and definition, Characteristics, Need/ Importance, Objectives, Techniques of directing.
- v. Decision Making: Meaning and definition, Characteristics, need/ importance, Objectives, Classification, Decision making process, Techniques of Decision making.
- vi. Motivation: Meaning and definition, Characteristics, Objectives, Need and Importance, Theories- Maslow's Need Hierarchy Theory, McGregor's Theory X and Theory Y, Herzberg's Two factor Theory, Types of motivation, Techniques.
- vii. Leadership: Meaning and definition, Importance, Leadership Qualities, Leadership Styles.
- viii. Communication: Meaning and definition, Characteristics, Need and Importance, Objectives, Classification of Communication, Barriers to Communication, Measures to Overcome barriers.
- ix. Controlling: Meaning and definition, Characteristics, Objectives, Need and Importance, Process, Techniques, Difficulties.
- x. Budgeting: Meaning and definition, Characteristics, Objectives, Need and Importance, Techniques.

Unit 5: Concept of Coordination, MBO and MBE.

Unit 6: Emerging Horizons to Management.

• **Suggested Books:**

1. Essentials of Management – Kontz & O'Donnell
2. Functions & Principles of Management- J.K. Jain
3. Management- L.M. Prasad
4. Management: Theory & Practice- C.B. Gupta

Unit I: Demand, Supply and Market equilibrium: individual demand, market demand, Individual supply, market supply, market equilibrium; Elasticities of demand and supply: Price elasticity of demand, income elasticity of demand, cross price elasticity of demand, Elasticity of supply;

Theory of consumer behavior: cardinal utility theory, ordinal utility theory (indifference Curves, budget line, consumer choice, price effect, substitution effect, income effect for Normal, inferior and giffen goods), revealed preference theory.

Unit II: Producer and optimal production choice: optimizing behavior in short run (geometry of product curves, law of diminishing margin productivity, three stages of Production), optimizing behavior in long run (isoquants, isocost line, optimal Combination of resources)

Costs and scale: traditional theory of cost (short run and long run, geometry of cost curves, envelope curves), modern theory of cost (short run and long run), economies of scale, economies of scope.

Unit III: Theory of firm and market organization: perfect competition (basic features, Short run equilibrium of firm/industry, long run equilibrium of firm/industry, effect of Changes in demand, cost and imposition of taxes) ; monopoly (basic features, short run Equilibrium, long run equilibrium, effect of changes in demand, cost and imposition of taxes, comparison with perfect competition, welfare cost of monopoly), price discrimination, multiplant monopoly ; monopolistic competition (basic features, demand and cost, short run equilibrium, long run equilibrium, excess capacity) ; oligopoly (Cournot's model, kinked demand curve model, dominant price leadership model, prisoner's dilemma)

Suggested Books:

1. Dominick Salvatore (2009). Principles of Microeconomics (5th ed.) Oxford University Press
2. Lipsey and Chrystal. (2008). Economics. (11th ed.) Oxford University Press
3. Koutosyannis (1979). Modern Micro Economics. Palgrave Macmillan
4. Pindyck, Rubinfeld and Mehta. (2009). Micro Economics. (7th ed.). Pearson.
5. Managerial Economics – H L Ahuja

Unit 1: Arithmetic progression: n^{th} term (general term) of the general A.P. , sum of first n terms of the general AP, arithmetic mean, application of A.P. regarding simple interest.

Geometric Progression : : n^{th} term (general term) of the general G.P. , sum of first n terms of the general GP, arithmetic mean, application of G.P. regarding simple interest.

Unit 2: Logarithms: definitions, laws of logarithms and applications, concept of common logarithm, characteristic and mantissa of logarithms.

Unit 3: Set Theory: definition of set, representation of a set, different types of set, equality of sets, subsets of a set and properties, Union of sets and applications, Intersection of sets and applications, Difference of sets and applications, compliment of a set and its properties, theorems related to cardinal numbers.

Unit 4: Determinants : Minors and cofactors of the elements of a determinant, properties of determinants and its application, solving simultaneous equations with two or three unknown variables by Cramer's Rule.

Matrix: Difference between determinants and matrices, types of matrices, equality of matrices, Matrix addition and scalar multiplication, Matrix multiplication, transpose and Adjoint of a matrix, Inverse of a square matrix, Solution of Linear Equations by Matrix Inversion Method.

Unit 5: Functions: Definition of functions, Algebraic, Logarithmic and Exponential functions, even and odd function.

Unit 6: Calculus: basic concept of differentiation and integration, Application of theorems of Differentiation, value of Average Cost (AC) and Marginal Cost (MC) by derivative formulae, Integration by substitution, Integration by parts, Definite integral and application in business and economics.

Linear Programming Problem: Definition, requirement for a LPP, Basic assumptions of LPP, uses and limitations of LPP, solution of a LPP by graphical method.

• **Suggested Books :**

1. Business of Mathematics :Sancheti & Kapoor
2. Business Mathematics :Zameeruddin, Khanna, Bhambri
3. Quantitative Techniques in Management : N.D.Vora
4. A Textbook Of Business Mathematics : P.L. Hazarika

Semester- II

BBA-AE-2014: ENVIRONMENTAL SCIENCE

(AECC-2)

(As per UGC syllabus)

BBA-HC-2026: FINANCIAL ACCOUNTING

(CC-3)

Unit 1: Financial Accounting: Introduction, need and objectives. Generally Accepted Accounting Principles .

Unit 2: Double Entry System of Book-keeping: Books of Original Entry and Books of Final Entry; Journals, Books of Accounts and Ledger Books, Cash Book and Bank Account.

Unit 3: Final Accounts of Sole Proprietorship Firms: Preparation of Trial Balance, Rectification of Errors, Trading and Profit and Loss Account and Balance Sheet.

Unit 4: Accounts for Non-Profit Organization: Receipt and Payment Account and Income and Expenditure Account.

Unit 5: Accounting Information: Meaning of Accounting Information and its sources; Corporate Annual Report and its contents, Books of Account to be maintained by a company; Latest format of Profit and Loss Account and Balance Sheet as per Companies Act,2013.

• **Suggested Books:**

1. Advanced Accountancy- Jain & Narang.
2. Advanced Accountancy- S.N. Maheswari.
3. Accountancy- B.B.Dam, Sujit Sikidar, R.Barman & B.Bora.
4. Accountancy – D.K. Goel, Rajesh Goel, Shelly Goel, Arya Publications.

Unit I: Measures of Central Value: Characteristics of an ideal measure; Measures of Central Tendency - Mean median, mode, harmonic mean and geometric mean. Merits, Limitations and Suitability of averages. Relationship between averages. Measures of Dispersion: Meaning and Significance. Absolute and Relative measures of dispersion - Range, Quartile Deviation, Mean Deviation, Standard Deviation, Coefficient of Variation, Moments, Skewness, Kurtosis.

Unit II: Correlation Analysis: Meaning and significance. Correlation and Causation, Types of correlation. Methods of studying simple correlation - Scatter diagram, Karl Pearson's coefficient of correlation, Spearman's Rank correlation coefficient, Regression Analysis: Meaning and significance, Regression vs. Correlation. Linear Regression, Regression lines (X on Y, Y on X) and Standard error of estimate.

Unit III: Analysis of Time Series: Meaning and significance. Utility, Components of time Series, Models (Additive and Multiplicative), Measurement of trend: Method of least Squares, Parabolic trend and logarithmic trend; Index Numbers: Meaning and Significance, problems in construction of index numbers, methods of constructing index numbers- weighted and unweighted, Test of adequacy of index numbers, chain index numbers, base shifting, splicing and deflating index number.

Unit IV: Probability: Meaning and need. Theorems of addition and multiplication. Conditional probability. Bayes' theorem, Random Variable- discrete and continuous. Probability Distribution: Meaning, characteristics (Expectation and variance) of Binomial, Poisson, and Normal distribution. Central Limit Theorem.

Suggested Books:

1. S.P. Gupta (S.P.): Statistical Methods, Sultan Chand & Sons, 34th Edition.
2. Richard Levin & David Rubin : Statistics for management, Prentice Hall.
3. Anderson, Sweeny & Williams: Statistics for Business and Economics, South Western.
4. P.L. Hazarika : A textbook of Business Statistics
5. P.K.Mathur : Business Statistics

Unit 1: a) Business Environment:- Nature, Significance of Economic, Non-Economic Environment in India, Macro, Micro Environment.

b) Industrial Policy, Monetary Policy.

Unit 2: a) GATT / WTO:- Objectives, Principles, Impact in the India's Industrial and Business Sector.

b) Economic Integration:- Meaning, Types and Importance.

c) Globalization / Liberalization – Concept , Measures.

Unit 3: a) Foreign Collaboration / Capital, Investments- Role of Multinational Corporations – Types, Nature.

b) Role of Foreign Aid and World Bank.

c) Balance of Payments Concepts – Current Account, Capital Account, Disequilibrium, Measures , Trade Policy.

Unit 4: a) Government Budget: Types, Components, Fiscal Deficit.

b) Banking and Non-Banking Financial Institutions – Types, Importance.

Unit 5: a) Planning in India: - Achievements, Failures, De-centralized Planning.

b) Small and Medium Scale Industries: Problems and Prospects.

c) Trade Cycle – Meaning and Phases.

• **Suggested Books:**

1. Indian Economy – Dutt & Sundaram
2. Business Environment : H.L. Ahuja

BBA- HG-2056 COMPUTER FUNDAMENTALS

(GE-2)

Unit 1: Brief history of development of Computers, Generations and its evolution, characteristics of computers, Hardware, software, computer languages.

Unit 2: Criteria for using the computers, main areas of applications. Basic Architecture, Components And Functions Of Computers, Computer Accessories.

Unit3: Types of Computers: Analog, Digital, Hybrid, General purpose and Special purpose computers, Micro Computers, Mini Computers, main frame computers and Super Computers.

Unit 4: Operating System and Office Automation: Booking concept, MS and open source operating systems, Introduction to system management, overview of languages, Compilers, interpreters, Assemblers, LAN, MAN, WAN, WiFi, Communication Channels.

Unit 5: Basic commands in MS Excel, Features, functions and uses of MS word, Mail Merge feature in MS Word, Basic Concepts of MS Power point.

Unit 6: Information Technology: Fundamentals, Perspective, Applications and scope, Introduction to Internet, Browsers, applications and scope.

- **Suggested Books:**

1. Computer Fundamentals by D.P. Nagpal
2. First Course in Computers by Sanjay Saxena
3. Computer Fundamentals by V. Raja Raman
4. Introduction to Computers by Leon & Leon

SECOND YEAR

Semester-III

BBA-HC-3016 COST AND MANAGEMENT ACCOUNTING

(CC-6)

Unit 1: Meaning, Nature and Scope of Cost and Management Accounting, Objectives and Functions of Management Accounting. Relationship between Financial Accounting and Cost Accounting and Financial Accounting and Management Accounting.

Unit 2: Cost elements: Material Cost, Labour Cost and overheads, costing method, job costing, contract costing and process costing, Batch costing.

Unit 3: Standard Costing: Variance Analysis

Break-even Analysis: Marginal Costing

Unit 4: Budgets and Budgetary Control: Meaning, Objectives and Limitations of Budgetary control. Types of Budget, Master Budget & Functional Budget, Production Budget, Raw Materials Budget, Sales Budget, Flexible Budget and Cash Budget (Receipts and Payments Method)

- **Suggested Books:**

1. Cost & Management Accounting- Jain & Narang
2. Management Accounting- Khan & Jain

Unit I

Human Resource Management: Concept, Functions, roles, skills & competencies, HRD definition, Goals and Challenges. The changing environment of HRM – globalization, cultural environment, technological advances, workforce diversity, corporate downsizing, changing skill requirement, HRM support for improvement programs Work life balance, HR Role In Strategy Formulation & Gaining Competitive Advantage. HRM issues in Indian Organisations.

Unit II

Human Resource Planning: Process, Forecasting demand & supply, Skill inventories Human Resource Information System (HRIS) succession planning, Job analysis – Uses, Methods, Job description & Job specifications. HR accounting and Human Resource Development (HRD) audit concept. Recruitment, Selection & Orientation: internal & external sources, e- recruitment, selection process, orientation process.

Unit III

Training: Concept, Needs, Systematic approach to training, Methods of training. Management development: Concept & Methods. Performance management system: Concept, uses of performance appraisal, performance management methods, factors that distort appraisal, appraisal interview .Career planning: career anchors, career life stages. Compensation: Steps of determining compensation, job evaluation, components of pay structure, factors influencing compensation levels, wage differentials & incentives, profit sharing, gain sharing, employees' stock option plans. Brief introduction of social security, health, retirement & other benefits.

Unit IV

Industrial Relations: Introduction to Industrial Relations, Trade unions role, types, functions, problems, industrial dispute- concept, causes & machinery for settlement of disputes- grievance, concepts, causes & grievance redressal machinery, discipline concept, aspect of discipline & disciplinary procedure, Collective bargaining- concept, types, process, problems, essentials of effective collective bargaining .

Suggested Books:

1. De Cenzo, D.A. & Robbins: Fundamentals of Human Resource Management, New York: John Wiley & Sons.
2. Dessler, G: Human Resource Management, Pearson.
3. Monappa & Saiyaddin: Personnel Management, Tata McGraw Hill.
4. Rao, V.S.P.: Human Resource Management- Text and Cases, Excel Books.
5. R. Wayne Mondy & Rober M. Noe: Human Resource Management, Pearson

BBA-HC-3036 PERSONALITY AND PERSONAL SKILL DEVELOPMENT (CC-8)

Unit 1: PERSONALITY – Meaning, Elements/ Determinants, Types, Development of Personality, Concept of Self Esteem, Assertiveness, Interpersonal awareness (JOHARI) , Empathy, Drive Strength, Emotional intelligence, Time management, Stress management, Personal effectiveness, personal grooming, health & hygiene, body language gestures, Commitment Ethics, Growth Motivation.

Unit 2: TEAMS & GROUPS – Meaning of Groups, Features, Types, Theories of Group formation, Reasons of Group formation, Group Performance, Group Roles, Group Norms, Group Cohesion, Problems/ Difficulties of Informal Groups ; Meaning of Teams, Characteristics, Importance, Types, Building Effective Team.

Unit 3: CAREER DEVELOPMENT AND PLANNING – Meaning of Career, Meaning of Career Planning, Need/Importance of Career Planning, Steps in the Career Planning process.

Unit 4: BUSINESS ETIQUETTES & MANNERS – Meaning of Business Etiquettes, Advantages/ Benefits. Etiquette of the written word, Telephone Etiquettes, Business Meetings, Types, Handling business meetings, Sales and Customer Orientation.

Suggested Book:

Organisational Behaviour – S.S.Khanka, Publisher S.Chand.

BBA- HG-3046 OPERATIONS MANAGEMENT AND CONTROL

(GE-3)

Unit 1: Production management- definition, scope importance ,functions, system concept of production, types of production system.

Unit 2: Product design and analysis- concept, steps of product design, process planning and design, value analysis, standardization and simplification.

Capacity planning and investment decisions-determination of plant capacity ,capacity planning strategies, equipment selection.

Unit 3: Facility location- factors affecting plant location, facility location problems- single facility location problem, multi facility location problem.

Plant layout and material handling- classification of layout, Group technology ,material handling system.

Unit 4: Material Management and inventory control-Integrated Material Management, components of integrated Material Management, inventory control, models of inventory, purchasing management, store management -ABC analysis, XYZ analysis, VED analysis.

Production planning and control- objectives, importance, production planning and control procedure.

Scheduling -single machine scheduling ,flow shop scheduling- Johnson's model, extension of junction rule, job shop scheduling.

Unit 5: Work study- method study, time study ,work sampling

Quality control -objectives, importance, classification of quality control techniques, control charts, Six Sigma.

• **Suggested books:**

1. Production and operation management-R.Panneerselvam
2. Operations Management and Control- Dr C.B Gupta

Theory marks=50

Unit 1: Word Processing: Introduction to word processing, Creating and saving a documents, paragraph formatting techniques. working with tables, Spreadsheet: concept of worksheets and workbooks, creating charts and graphics in MS Excel, PowerPoint presentation: Creating graphs, tables, charts, use of animation and multimedia

Unit 2: Database management System:- Definition of Database, Traditional File Approach vs. DBMS approach, Characteristics of the Data Base Approach, DBMS user, Role of a DBA, Advantage and disadvantage of using DBMS, DBMS architecture. ER model as a tool for conceptual design entities, attributes and relationships, weak and strong entities, conversion of ER model into relational schema. ANSI SQL –92 Standards: DDL, DML.

Unit 3: System development life cycle:- System models and types of models, System analysis, feasibility analysis, cost benefit analysis, payback period.

Unit 4: Tally: Basic definition of Tally, Features of Tally, Advantage and disadvantage of Tally. Tally accounting, manual accounting, and financial accounting.

Practical marks=30

Tally.ERP9 Install.
GST in Tally.ERP9.
Interest calculation.
Bill Of Material.
Prepare profit and loss account, Balance sheet

• **Suggested Books:**

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|--|-----------------|
| 1. Computer Application in Business | R.Paraeswaram |
| 2. Introduction to database management system | C.J. Date |
| 3. Tally ERP9 Training Guide - 4th revised & updated edition | Asok K. Nadhani |

Semester-IV

BBA-HC-4016 ORGANISATIONAL BEHAVIOUR AND INDUSTRIAL PSYCHOLOGY

(CC-9)

Unit 1: Introduction: Meaning and concept of OB, Key elements of OB, Nature and Scope of OB, Importance of studying OB, Contributing disciplines to OB, Models of OB.

Unit 2: Individual Behavior: Personality- Concept, Determinants, Types, and Theories: Type theory, Trait theory, Psychoanalytical theory, Social learning theory, Self theory. Development of Personality: Erikson's Eight Life Stages, Influence of Personality in an Organization.

Perception- Meaning, Perceptual process, Factors affecting perception, Improvement of Perception, Application of perception in OB, Difference between perception and sensation.

Learning- Meaning, Determinants of learning, Learning Theories: Classical Conditioning, Operant Learning, Cognitive Theory, Social Learning Theory. Meaning of Reinforcement: Schedules of Reinforcement, Punishment, Effect of Learning on Behaviour.

Attitudes and Values: Concept and Meaning of Attitude, Features, Sources of Attitudes, Types of attitudes at work place, modification of attitudes. Concept and meaning of values, types, factors affecting values.

Unit 3: Interpersonal Behaviour: Concept, Types, Skills for Cooperative Interpersonal Behaviour. Concept of TA: Levels of Self Awareness, Ego States, Life positions, Transaction-Types, Benefits of TA.

Unit 4: Group Behaviour: Meaning of Group, Types of Groups, Reasons for formation of groups, Theories of Group formation, Stages of Group formation and development, Concept of Group Dynamics, Group Behaviour- concept of group norms, group cohesion, group role, role identity, role ambiguity, role conflict, role expectations, Inter-Group Behaviour.

Group Decision making- Meaning, Process, Techniques, Advantages and Disadvantages.

Teams- Concept, Types, Teams Vs Groups, Building and managing effective teams.

Unit 5: Organizational Issues: Organizational Conflicts- Meaning and definition, Sources, Types, Advantages and Disadvantages, Process/ Stages, Conflict Management.

Organizational Culture- Meaning and definition, types, functions, Factors influencing organization culture.

Organizational Change- Concept, Kinds, Resistance to changes, Causes, Overcoming resistance to Change.

Organizational Climate- Concept, Features, Elements.

Unit 6: Industrial Psychology: Meaning, Importance, Scope, Objectives, Characteristics/ Features, History of Industrial Psychology.

• **Suggested Books:**

1. Organizational Behavior by L.M.Prasad
2. Organizational Behaviour by Rakesh Gupta
3. Organizational Behaviour by S.S.Khanka

Unit I

Nature of Financial Management: Finance and related disciplines; Scope of Financial Management; Profit Maximization, Wealth Maximization - Traditional and Modern Approach; Functions of finance – Finance Decision, Investment Decision, Dividend Decision; Objectives of Financial Management; Organization of finance function; Concept of Time Value of Money, present value, future value, and annuity.

Unit II

Long-term investment decisions: Capital Budgeting - Principles and Techniques; Nature and meaning of capital budgeting; Estimation of relevant cash flows and terminal value; Evaluation techniques - Accounting Rate of Return, Net Present Value, Internal Rate of Return & MIRR, Net Terminal Value, Profitability Index Method.

Concept and Measurement of Cost of Capital: Explicit and Implicit costs; Measurement of cost of capital; Cost of debt; Cost of perpetual debt; Cost of Equity Share; Cost of Preference Share; Cost of Retained Earning; Computation of over-all cost of capital based on Historical and Market weights.

Unit III

Capital Structures: Approaches to Capital Structure Theories - Net Income approach, Net Operating Income approach, Modigliani-Miller (MM) approach, Traditional approach, Capital Structure and Financial Distress, Trade-Off Theory.

Dividend Policy Decision - Dividend and Capital; The irrelevance of dividends: General, MM hypothesis; Relevance of dividends: Walter's model, Gordon's model;

Leverage Analysis: Operating and Financial Leverage; EBIT -EPS analysis; Combined leverage.

Unit IV

Working Capital Management: Management of Cash - Preparation of Cash Budgets (Receipts and Payment Method only); Cash management technique, Receivables Management – Objectives; Credit Policy, Cash Discount, Debtors Outstanding and Ageing Analysis; Costs - Collection Cost, Capital Cost, Default Cost, Delinquency Cost, Inventory Management (Very Briefly) - ABC Analysis; Minimum Level; Maximum Level; Reorder Level; Safety Stock; EOQ, Determination of Working Capital.

Readings

1. M.Y. Khan & P.K. Jain: Financial Management Text Problem and Cases, Tata McGraw Hill Publishing Co. Ltd.
2. R. P. Rustogi: Financial Management: Theory Concepts and Practices, Taxmann Publication.
3. I.M. Pandey: Financial Management: Theory and Practices, Vikas Publishing House
4. R.A. Brealey, S.C. Myers, F. Allen & P. Mohanty: Principles of Corporate Finance, McGraw Hill Higher Education
5. J.V. Horne & J.M. Wachowicz: Fundamentals of Financial Management Prentice Hall

BBA-HC-4036 PRINCIPLES OF MARKETING**(CC-11)**

Unit I: Introduction: Nature, Scope and Importance of Marketing, Evolution of Marketing; Core marketing concepts; Company orientation - Production concept, Product concept, Selling concept, Marketing concept, Holistic marketing concept. Marketing Environment: Demographic, economic, political, legal, socio cultural, Technological environment (Indian context); Portfolio approach – Boston Consultative Group (BCG) matrix

Unit II: Segmentation, Targeting and Positioning: Levels of Market Segmentation, Basis for Segmenting Consumer Markets, Difference between Segmentation, Targeting and Positioning;

Unit III: Product & Pricing Decisions: Concept of Product Life Cycle (PLC), PLC marketing strategies, Product Classification, Product Line Decision, Product Mix Decision, Branding Decisions, Packaging & Labelling, New Product Development. Pricing Decisions: Determinants of Price, Pricing Methods (Non-mathematical treatment), Adapting Price (Geographical Pricing, Promotional Pricing and Differential Pricing).

Unit IV: Promotion Mix: Factors determining promotion mix, Promotional Tools – basics of Advertisement, Sales Promotion, Public Relations & Publicity and Personal Selling; Place (Marketing Channels): Channel functions, Channel Levels, Types of Intermediaries: Types of Retailers, Types of Wholesalers. Marketing of Services - Unique Characteristics of Services, Marketing strategies for service firms – 7Ps.

Readings:

1. Kotler, P. & Keller, K. L.: Marketing Management, Pearson.
2. Kotler, P., Armstrong, G., Agnihotri, P. Y., & Ul Haq, E.: Principles of Marketing: A South Asian Perspective, Pearson.
3. Ramaswamy, V.S. & Namakumari, S.: Marketing Management: Global Perspective-Indian Context, Macmillan Publishers India Limited.
4. Zikmund, W.G. & D' Amico, M.: Marketing, Ohio: South-Western College Publishing.

Unit I: Nature and Scope of Marketing Research – Role of Marketing Research in decision making. Applications of Marketing Research – marketing research; The Research process – Steps in the research process; the research proposal; Problem Formulation: Management decision problem Vs. Marketing Research problem.

Unit II: Research Design: Exploratory, Descriptive, Causal. Secondary Data Research: Advantages & Disadvantages of Secondary Data, Criteria for evaluating secondary Sources, secondary sources of data in Indian Context, Syndicated Research (in India)

Unit III: Primary Data Collection: Survey Vs. Observations. Comparison of self administered, Telephone, mail, emails techniques. Qualitative Research Tools: Depth Interviews focus groups and projective techniques; Measurement & Scaling: Primary scales of Measurement-Nominal, Ordinal, Interval & Ratio. Scaling techniques paired Comparison, rank order, constant sum, semantic differential, itemized ratings, Likert Scale; Questionnaire-form & design.

Unit IV: Sampling: Sampling techniques, determination of sample size; Data Analysis:

Readings:

1. Zikmund, Babin & Carr: Business Research Methods, South-Western.
2. Cooper & Schindler: Business Research Methods McGraw-Hill Education,
3. Churchill: Marketing Research: Methodological Foundations, Cengage Learning.
4. Aaker, Kumar, Day - Marketing Research. Wiley.
5. Naresh Malhotra – Marketing Research, Pearson.

THIRD YEAR

Semester-V

BBA-HC-5016 LEGAL ASPECTS OF BUSINESS

(CC-12)

Unit I:

The Indian Contract Act 1872: Meaning and Essentials of contract; Kinds of contract- Based on: validity, formation & performance, law relating to offer and acceptance, Consideration, competency to contract, free consent, Void agreements, performance of Contracts, discharge of contracts, breach of contracts and quasi contract, Special Contracts: contract of indemnity and guarantee, bailment and pledge, and agency.

Unit II:

Sale of Goods Act 1930: Sale and agreement to sell, implied conditions and warranties, Sale by non-owners, rights of unpaid seller.

Negotiable Instruments Act 1881:

Meaning of negotiable instruments, type of negotiable instruments, promissory Note, bill of exchange, Cheque.

Unit III:

The Companies Act 2013:

Meaning and types, Incorporation, Memorandum & Articles of association, Prospectus, Issue of shares and bonus shares, rights issue, sweat equity, role of Directors, share qualification, company meetings.

The Limited Liability Partnership Act 2008:

Meaning and nature of limited partnership, formation, partners & their relations, extent and limitation of liability.

Unit IV:

Consumer Protection Act 1986:

Objectives and machinery for consumer protection, defects and deficiency removal, rights of consumers.

The Right to Information Act 2005:

Salient features and coverage of the act, definition of terms information, right, record, public authority; obligations of public authorities, requesting information and functions of PIO.

Readings:

1. M.C.Kucchal: Business Law/Mercantile Law, Vikas Publishing.House (P) Ltd.
2. M.C.Kucchal,& Vivek Kucchal: Business Legislation for Management, Vikas Publishing House (P) Ltd.
3. Dr. G. K. Kapoor & Sanjay Dhamija: Company Law and Practice-A comprehensive textbook on Companies Act 2013, latest edition, Taxmann.
4. Avtar Singh: Principle of Mercantile Law, Eastern Book Company
5. Gulshan Kapoor: Business Law, New Age International Pvt Ltd Publishers.
6. Maheshwari & Maheshwari: Principle of Mercantile Law, National Publishing Trust
7. Rohini Aggarwal: Mercantile & Commercial Law, Taxmann.

BBA- SE-5024 SUMMER PROJECT

(SEC-2)

(Duration 1st July to 15th August)

BBA- HE-5036

(DSE-1)

BBA- HE-5046

(DSE-2)

A Student can choose any two papers from any one of the 3 groups of Discipline Specific Electives (Finance, Marketing or Human Resource) the detailed syllabus for which are given after syllabus for sixth semester.

Semester-VI

BBA-HC-6016 BUSINESS POLICY AND STRATEGY

(CC-13)

Unit I: Nature & importance of business policy & strategy: Introduction to the strategic management process and related concepts; Characteristics of corporate, business & functional level strategic management decisions.

Company's vision and mission: need for a mission statement, criteria for evaluating a mission statement- Goal, Process & Input formulation of the mission statement-Drucker's Performance Area, Bennis's Core Problem; formulation of mission statement.

Unit II: Environmental Analysis & Diagnosis: Analysis of company's external environment Environmental impact on organizations policy and strategy, organisations dependence on the environment, analysis of remote environment, analysis of specific environment- Michael E. Porter's 5 Forces model; Internal analysis: Importance of organisation's capabilities, competitive advantage and core competence, Michael E. Porter's Value Chain Analysis.

Unit III: Formulation of competitive strategies: Michael E. Porter's generic competitive Strategies, implementing competitive strategies- offensive & defensive moves. Formulating Corporate Strategies: Introduction to strategies of growth, stability and Renewal, Types of growth strategies – concentrated growth, product development, Integration, diversification, international expansion (multi domestic approach, Franchising, licensing and joint ventures), Types of renewal strategies – retrenchment and turnaround. Strategic fundamentals of merger & acquisitions.

Unit IV: Strategic Framework: Strategic analysis & choice, Strategic gap analyses, Portfolio analysis – BCG, GE, product market evolution matrix, experience curve, directional policy matrix, life cycle portfolio matrix, grand strategy selection matrix; Behavioural considerations affecting choice of strategy; Culture and Strategic Leadership: Implementing & operationalizing strategic choice, Impact of structure, culture & leadership, functional strategies & their link with business level strategies, Balanced Score Card; Introduction to Strategic control & evaluation, Strategic Surveillance.

Readings:

1. J.A. Pearce & R.B. Robinson : Strategic Management formulation implementation and control, TMH
2. Arthur A. Thompson Jr. & A.J Strickland III : Crafting and executing strategy, TMH

Supplementary Readings

1. Gerry Johnson & Kevan Scholes, Exploring corporate strategies, PHI
2. Upendra Kachru: Strategic Management, Excel books
3. Arthur A. Thompson Jr. and A.J. Strickland: Strategic Management –Concepts and Cases, McGraw-Hill Companies
4. Lawrence R. Jauch & William F. Glueck: Business Policy and Strategic Management (Mcgraw Hill Series in Management).

BBA-HC-6026 TAXATION LAWS

(CC-14)

Unit 1: Law relating to Income Tax : Basic concepts and definitions, Previous year, Assessment year, Assesses, Person, Agricultural Income, Casual Income, Exempted Incomes, Residential Status and Tax Liability.

Unit 2: Heads of Income: Income from Salaries, Income from House Property, Profits and Gains of Business or Profession, Capital Gains, Income from Other Sources. (Simple Problems)

Unit 3: Computation of Gross Total Income and Total Income, deductions from Gross Total Income of individuals.

Unit 4: Concept of Incidence, Impact and Shifting of Tax ; Tax planning, tax avoidance and tax evasions.

Unit 5: Goods and Services Tax (GST) : Basic concepts, Levy of GST.

• **Suggested Books:**

1. Direct Taxes – B.B.Dam, Sujit Sikidar, R.Barman, B.Bora.
2. Students' Guide to GST & Customs Law (Taxmann) – Dr. Vinod K. Singhanian
3. Students' Guide to Income Tax (Taxmann) – Dr Vinod K. Singhanian, Dr.Monica Singhanian.

BBA- HE-6036

(DSE-3)

BBA- HE-6046

(DSE-4)

A Student can choose any two papers from the same Discipline Specific Elective group from which he/she has chosen the two DSE papers in semester-V. The detailed syllabus is given below:-

DSE Group I : FINANCE

INTERNATIONAL FINANCE

UNIT-I

Introduction: concept of International trade, International Business, International Finance and differences among them. Theories of International trade, International trade financing in India, Balance of payments (of India)

International Monetary System: Different types of Exchange rate mechanisms- the gold standard, the gold exchange standard, The Bretton Woods System, Current monetary system, European Monetary Union. IMF and World Bank.

UNIT-II

Foreign Exchange Management: Forex market – Wholesale and Domestic market, Quotations- direct, indirect and cross currency; various kinds of transactions and their Settlement dates, forward rates, Swaps, Quotes for various kinds of Merchant Transactions; Early delivery, extension or cancellation of Forward contracts
Exchange Rate determination and Forecasting: Purchasing power parity and Interest rate Parity, relationship between PPP and IRP, reasons for deviation from PPP and IRP; models of exchange rate forecasting- forward rate as an unbiased predictor, the Demand-Supply approach, the monetary approach, the Asset approach, the portfolio balance Approach, other models

UNIT-III

Foreign Exchange Exposures: Financial Accounting and Foreign Exchange- Alternative Currency Translation Methods, Statement of Financial Accounting, Standards No.8, Statement of Financial Accounting Standards No.-52, Transaction Exposure, Managing Accounting Exposure- Managing Transaction and Translation Exposure, Designing a Hedging Strategy, Measuring and managing Economic Exposure- Foreign Exchange Risk and Economic Exposure, Identifying Economic Exposure, Calculating Economic Exposure, Operational Measure of Exchange Risk.

Multinational Financial System- Value of the Multinational Financial System, Intercompany Fund- Flow Mechanisms: Cost and Benefits, Designing a Global Remittance Policy, Transfer Pricing and Tax Evasion. Issue of GDR, ADR Euro bonds and Foreign bonds.

UNIT-IV

International Investment Management: International Portfolio Investment- Issues in Foreign Investment Analysis, International Bond Investing, Strategies for Direct Investment, Bond Investment & Portfolio Investment, Optional International Asset Allocation. International project appraisal- IRR and APV methods; Managing Political Risk- Measuring Political Risk, Country Risk Analysis, Managing Political Risk, Post expropriation Policies.

Multinational Working Capital Management: Current Asset Management for the Multinational- International Cash Management, Accounts Receivables Management, Inventory Management.

Text Books:

1. PG Apte: International Finance, TataMcgraw Hill.
2. Alan C. Shapiro: Multinational Financial Management- Prentice Hall

References:

3. Maurice D. Levi: International Finance- The Markets and Financial Management of Multinational Business, Mcgraw Hill.

INVESTMENT BANKING AND FINANCIAL SERVICES

UNIT- 1

Introduction: An Overview of Indian Financial System, Investment Banking in India, Recent Developments and Challenges ahead, Institutional structure and Functions of Investment / Merchant Banking; SEBI guidelines for Merchant Bankers, Registration, Obligations and responsibilities of Lead Managers, Regulations regarding Continuance of Association of lead manager with an issue

UNIT II

Issue Management: Public Issue: classification of companies, eligibility, issue pricing, Promoter's contribution, minimum public offer, prospectus, allotment, preferential Allotment, private placement, Book Building process, designing and pricing, Green Shoe Option; Right Issue: promoter's contribution, minimum subscription, advertisements, Contents of offer document, Bought out Deals, Post issue work & obligations, Investor Protection, Broker, sub broker and underwriters

UNIT III

Leasing and Hire Purchase: Concepts of leasing, types of leasing – financial & operating Lease, direct lease and sales & lease back, advantages and limitations of leasing, Lease Rental determination; Finance lease evaluation problems (only Lessee's angle), Hire Purchase interest & Installment, difference between Hire Purchase & Leasing, Choice Criteria between Leasing and Hire Purchase mathematics of HP, Factoring, forfaiting and its arrangement, Housing Finance : Meaning and rise of housing finance in India, Fixing the amount of loan, repricing of a loan, floating vs. fixed rate, Practical problems on housing finance.

UNIT IV

Venture Capital: Concept, history and evolution of VC, the venture investment process, various steps in venture financing, incubation financing.

Insurance: concept, classification, principles of insurance, IRDA and different regulatory norms, operation of General Insurance, Health Insurance, Life Insurance.

Credit Ratings: Introduction, types of credit rating, advantages and disadvantages of credit ratings, Credit rating agencies and their methodology, International credit rating practices.

Securitization: concept, securitization as a funding mechanism, Traditional and nontraditional mortgages, Graduated-payment mortgages (GPMs), Pledged-Account Mortgages (PAMs), Centralized Mortgage obligations (CMOs), Securitization of non mortgage assets, Securitization in India.

REFERENCES

1. M.Y.Khan: Financial Services, Tata McGraw –Hill.
2. Machiraju: Indian Financial System, Vikas Publishing House.
3. J.C.Verma: A Manual of Merchant Banking, Bharath Publishing House.
4. K.Sriram: Hand Book of Leasing, Hire Purchase & Factoring, ICFAI, Hyderabad.
5. Ennew.C.Trevor Watkins & Mike Wright: Marketing of Financial Services, Heinemann Professional

INVESTMENT ANALYSIS AND PORTFOLIO MANAGEMENT

Unit I

Basics of risk and return: concept of returns, application of standard deviation, coefficient of variation, beta, alpha. Bonds : present value of a bond, yield to maturity, yield to call, yield to put, systematic risk, price risk, interest rate risk, default risk. Yield curve and theories regarding shape of yield curve. Unsystematic risk and non-risk factors that influence yields. Duration and modified duration, immunization of a bond portfolio. Fundamental analysis: EIC framework; Economic analysis: Leading lagging & coincident macro-economic indicators, Expected direction of movement of stock prices with macro-economic variables in the Indian context; Industry analysis: stages of life cycle, Porter's five forces model, SWOT analysis, financial analysis of an industry; Company Analysis.

Unit II

Share valuation: Dividend discount models- no growth, constant growth, two stage Growth model, multiple stages; Relative valuation models using P/E ratio, book value to market value. Technical analysis: meaning, assumptions, difference between technical and fundamental analysis; Price indicators- Dow theory, advances and declines, new highs and lows- circuit filters. Volume indicators- Dow Theory, small investor volumes. Other indicators- futures, institutional activity, Trends: resistance, support, consolidation, Momentum- Charts: line chart, bar chart, candle chart, point & figure chart. Patterns: head & shoulders, triangle, rectangle, flag, cup & saucer, double topped, double bottomed, Indicators: moving averages. Efficient market hypothesis; Concept of efficiency: Random walk, Three forms of EMH and implications for investment decisions. (No numericals in EMH and technical analysis)

Unit III

Portfolio analysis: portfolio risk and return, Markowitz portfolio model: risk and return for 2 and 3 asset portfolios, concept of efficient frontier & optimum portfolio. Market Model: concept of beta systematic and unsystematic risk. Investor risk and return preferences: Indifference curves and the efficient frontier, Traditional portfolio management for individuals: Objectives, constraints, time horizon, current wealth, tax considerations, liquidity requirements, and anticipated inflation, Asset allocation: Asset allocation pyramid, investor life cycle approach, Portfolio management services: Passive – Index funds, systematic investment plans. Active – market timing, style investing.

Unit IV

Capital asset pricing model (CAPM): Efficient frontier with a combination of risky and risk free assets. Assumptions of single period classical CAPM model. Characteristic line, Capital Market Line, Security market Line. Expected return, required return, overvalued and undervalued assets. Mutual Funds :Introduction, calculation of Net Asset Value (NAV) of a Fund, classification of mutual fund schemes by structure and objective, Advantages and disadvantages of investing through mutual funds. Performance Evaluation using Sharpe's Treynor's and Jensen's measures.

References:

1. Fischer, D.E. & Jordan, R.J.: Security Analysis & Portfolio Management, Pearson Education.
2. Sharpe, W.F., Alexander, G.J. & Bailey, J.: Investments, Prentice Hall of India.
3. Singh,R: Security Analysis & Portfolio Management . Excel Books.
4. Frank K Reilly & Keith C Brown: Investment Analysis and Portfolio Management, Cenage India Pvt. Ltd.

STRATEGIC CORPORATE FINANCE

UNIT-I

Introduction to strategic corporate finance: Strategy Vs Planning, significance of strategy in financial decisions, Different types of financial strategy for Shareholders Wealth Maximization, overall corporate value addition and Economic Value Addition.

Strategic Cost Management: Traditional costing Vs Strategic Costing, Relevant costs Vs Irrelevant costs, Different types of strategic costing and their relevance- Target Costing, Activity based Costing, Life Cycle Costing, Quality Costing, Zero Based Budgeting, Strategic cost reduction techniques and value chain analysis.

Alternative sources of financing – alternative sources of financing, Different approach to infrastructure projects financing- Public Private Partnership (PPP) and its relevance.

UNIT-II

Management Buy-outs: Establishing feasibility of the buy-out, Negotiating the main terms of the transaction with the vendor including price and structure, Developing the business plan and financial forecasts in conjunction with the buy-out team for submission to potential funders, negotiations with potential funders so that the most appropriate funding offers are selected.

Management Buy-ins: Management Buy-in/Buy-outs (“BIMBOs”), Vendor initiated buy-outs/buy-ins.

Valuing Real assets in the presence of risk: tracking portfolios and Real Asset valuation, Different Approaches of Valuing Real Assets, Capital Budgeting and Strategic policy

Real options: Financial and real options compared, various types of real options, the Black-Scholes model, Decision tree analysis, application of Real options, Drawbacks of Real options

UNIT-III

Financial Distress and restructuring: Meaning of Bankruptcy, Factors leading to Bankruptcy, symptoms and predictions of bankruptcy, reorganization of distressed firms, liquidation of firms. Company disposals: retirement sale or the sale of a noncore Subsidiary, planned exit, forceful retirement and other disposals. Exit strategy most appropriate exit route, valuation, timing of sale and tax planning opportunities, Identification of potential purchasers, approaching the potential purchaser, negotiate with potential acquirers and selection of a preferred purchaser, calculation of the various tax implications.

Fundraising: identification of different sources of development capital, determination of capital structure and factors affecting the capital structure, cost of capital and cost saving strategy, production of a business plan and financial forecasts to enable potential funders to assess the proposition. Due Diligence: financial due diligence for both purchasers and financial institutions, good quality “added value” due diligence advice.

UNIT-IV

Company Valuation: an overview of valuation, valuation principles and practices more, the impact of “what if” scenarios, the key financial and commercial factors Affecting the business. Value enhancement tools & techniques, the link between valuation and corporate finance.

Other strategic issues: managing credit ratings, and setting dividend and share Repurchase policy, problem of too much cash. The issues of stock liquidity and Illiquidity, Strategic risk management, the substitutability of capital structure and risk Management choices, such as process control efforts, financial, physical, and Operational hedging, value-based management.

Text Books: (1). Aswath Damodaran: Corporate finance theory and practice; John Willey & Sons, Inc (2). Jakhota: Strategic Financial Management (Vikas Publication)

BUSINESS ANALYSIS AND VALUATION

Unit I

Analysis of Corporate Financial Statements: Income statements and Balance sheets
Through ratio analysis and analyzing the Chairman's statement, Directors' report,
Management discussion & analysis, report on corporate governance, auditor's report to
Evaluate the financial soundness of the company.

Unit II

Cash Flows: Firm cash flows, Earnings, Tax effect, Reinvestment needs; Equity cash
Flows: Dividend, Forecasted Cash flows, terminal value estimation approaches. Equity
Discounted cash Flow Models-Dividend discount models, extensions of DDM; free cash
flow to equity model

Unit III

Introduction to Valuation: Approaches to valuation, Discounted Cash Flow, Relative
Valuation, Role of valuation; Discounted Cash flow Valuation: Estimating discount rates cost
of equity, cost of equity to cost of capital; Valuation of an asset with guaranteed cash
flows, introducing uncertainty into valuation (valuing an asset with default risk & equity
risk), valuing an asset with an infinite life.

Unit IV

Firm Valuation Models: Cost of capital approach, adjusted present value approach, EVA,
Capital structure and firm value. Relative valuation-popularity and potential pitfalls;
reconciling relative and discounted cash flow valuation Equity Multiples; Value
Multiples; Valuation of different kinds of companies.
Value of Synergy; operating and financial synergy, Cash and tax benefits, debt capacity,
Evidence on synergy, common errors in valuing synergy; Valuing Real options

Text Books:

1. Foster, George *Financial Statement Analysis*, 2nd ed., Pearson Education Pvt Ltd
2. Damodaran, A. (2008). *Damodaran on Valuation, Security Analysis for investment and Corporate Finance* (2nd ed.). Wiley India Pvt. Ltd.

References:

1. Chandra, P. (2011). *Corporate Valuation and Value Creation*, (1st ed). TMH
2. Weston, Chung, Hoag, *Mergers, Restructuring and Corporate Control*, Prentice Hall of India

DSE Group II: MARKETING

CONSUMER BEHAVIOUR

Unit I

Consumer Behaviour: Nature, scope & application: Importance of consumer behaviour in marketing decisions, characteristics of consumer behaviour, role of consumer research, consumer behaviour- interdisciplinary approach. Introduction to 'Industrial Buying Behaviour' Market Segmentation: VALS 2 segmentation profile.

Unit II

Consumer Needs & Motivation: Characteristics of motivation, arousal of motives, Theories of needs & motivation: Maslow's hierarchy of needs, McLelland's APA theory, Murray's list of psychogenic needs, Bayton's classification of motives, self-concept & its Importance, types of involvement. Personality & Consumer Behaviour: Importance of personality, theories of personality- Freudian theory, Jungian theory, Neo-Freudian theory, Trait theory: Theory of self images; Role of self-consciousness. Consumer Perception: Concept of absolute threshold limit, differential threshold limit & Subliminal perception: Perceptual Process: selection, organisation & interpretation. Learning & Consumer Involvement: Importance of learning on consumer behaviour, learning theories: classical conditioning, instrumental conditioning, cognitive learning & Involvement theory. Consumer Attitudes: Formation of attitudes, functions performed by attitudes, models of attitudes: Tri-component model, multi-attribute model, attitude towards advertisement model: attribution theory.

Unit III

Group Dynamics & consumer reference groups: Different types of reference groups, factors affecting reference group influence, reference group influence on products & brands, application of reference groups. Family & Consumer Behaviour: Consumer socialisation process, consumer roles within a family, purchase influences and role played by children, family life cycle. Social Class & Consumer behaviour: Determinants of social class, measuring & characteristics of social class. Culture & Consumer Behaviour: Characteristics of culture, core values held by society & their influence on consumer behaviour, introduction to sub-cultural & cross-cultural influences. Opinion Leadership Process: Characteristics & needs of opinion leaders & opinion receivers, interpersonal flow of communication.

Unit IV

Diffusion of Innovation: Definition of innovation, product characteristics influencing diffusion, resistance to innovation, adoption process. Consumer Decision making process: Process- problem recognition, pre-purchase search influences, information evaluation, purchase decision (compensatory decision rule, conjunctive decision, rule, Lexicographic rule, affect referral, disjunctive rule), postpurchase evaluation; Situational Influences Models of Consumer Decision making: Nicosia Model, Howard-Sheth Model, Howard- Sheth Family Decision Making Model, Engel, Kollat& Blackwell Model, Sheth Newman Gross Model of Consumer Values.

NOTE: Cases & application to marketing will be taught with respect to each topic.

Readings

1. Leon G.Schiffman & Leslie L.Kanuk: Consumer Behaviour, Prentice Hall Publication, latest Edition
2. Solomon, M.R.: Consumer Behaviour – Buying, Having, and Being, Pearson Prentice Hall.
3. Blackwell, R.D., Miniard, P.W., & Engel, J. F.: Consumer Behaviour, Cengage Learning.
4. Hawkins, D.I., Best, R. J., Coney, K.A., & Mookerjee, A: Consumer Behaviour – Building Marketing Strategy, Tata McGraw Hill.
5. Kotler, P. & Keller, K. L.: Marketing Management (Global Edition) Pearson

MARKETING OF SERVICES

Unit I: The emergence of service economy: contributory factors, consumption pattern analysis, economic transformation unique aspects of services: goods, services, products, managerial challenges

Unit II: Marketing mix: concept of value and value drivers, extended framework Service marketing system: production, marketing, human resources, sequential analysis.

Unit III: Service system positioning: service delivery process, blueprinting Service buying behaviour; difference in perspective, risk analysis, decision process.

Unit IV: Service marketing strategy; segmentation, targeting and positioning, market innovation Competitive differentiation; competitive advantage and value chain analysis

Unit V: Service quality; concept, technical and functional quality, Service quality models and measurement Demand and supply imbalances management; challenges and strategies; Service culture; managing by values, recovery and empowerment; Relationship building: relationship marketing, bonding and life time value Service industries: insurance, banking, air transportation, courier, education etc.

Text Books:

1. Fisk, R. P., Grove, S. J., & John, J.: Interactive services marketing. New York. Houghton Mifflin.
2. Glynn, W. J., & Barnes, J. G.: Understanding services management - Integrating marketing, organizational behaviour, operations and human resources management, Prentice Hall.

References:

1. Gronroos, C.: Service Management and Marketing - A customer relationship management approach, New York: John Wiley.
2. Hoffman, K. D., & John, E. G. B.: Marketing of services: Concepts strategies and cases, Thomson-South Western.
3. Shanker, R. (2002). Services Marketing: The Indian perspective, Excel Books.

ADVERTISING AND BRAND MANAGEMENT

Unit I

Advertising need & importance: Definition & growth of modern advertising, advertising & the marketing mix, types & classification of advertisement, advertising spiral; Social & economic aspects of advertising; Marketing communication models: AIDA, hierarchy of effect, innovation adoption model, action first model, quick decision model; Planning framework of promotional strategy

Unit II

How advertising works: Exposure, salience, familiarity, low involvement, central route & Peripheral route & cognitive learning; Positioning strategies ; Associating feelings with a brand; Developing brand personality ; Creating copy strategies: Rational & emotional Approaches, selection of an endorser, creative strategy & style- brand image, execution, USP, common touch & entertainment, message design strategy, format & formulae for Presentation of appeals (slice of life, testimonials, etc.), different types of copy; Art & layout of an advertisement: Principles of design, layout stages, difference in designing of Television, audio & print advertisement

Unit III

Media planning & scheduling: Introduction to broadcast & non -broadcast media; Budgeting decision rule: percentage of sales method, objective to task method, competitive parity, & all you can afford; Key factors influencing media planning; Media decisions: media class, media vehicle & media option; Scheduling: flighting, pulsing, & continuous

Unit IV

Management of sales promotion: Importance & need for sales promotion, planning for consumer schemes & contests, different types of consumer schemes.

Unit V

Introduction to brands and brand management, Concept of a brand, brand evolution, Branding challenges and opportunities, Strategic brand management process.

Unit VI

Identifying and establishing brand positioning and values; Brand building, brand Positioning and values brand repositioning.

Unit VII

Designing and implementing brand strategies; Brand extension. Brand hierarchy Kapfrer. Brand equity, brand personality, brand image, managing brands overtime.

Integrating advertising and brand management

Note: Applied cases would be taken up in class.

Readings:

1. Aaker, Myers &Batra : Advertising Management , Prentice Hall.
2. Wells, Moriarity & Burnett : Advertising Principles & practices , Prentice Hall.
3. Kleppner's Advertising Procedure: W.Ronald Lane, Kane Whitehill king and J. Thomas Russell, Pearson Education.
4. George E.Belch& Michael A. Balch : Advertising and Promotion, TMH
5. S.H.H Kazmi and SatishK.Batra : Advertising and sales promotion, Excel books
6. Cowley. D: Understanding Brands, , Kogan Page Ltd
7. Jean Noel Kamperer: Strategic Brand Management, Kapferer Free Press
8. David Aaker: Brand Leadership, Simon & Schuster
9. Wright, Winter, Ziegler: Advertising, Atlantic Publishers & Dist.
10. Sandage, Fryburger,: Advertising Theory & Practice, Ratroll Longman Group

RETAIL MANAGEMENT

Unit I:

Introduction to Retailing, Definition, Characteristics, Evolution of Retailing in India, Retailing in India, Emerging Trends in Retailing, Factors Behind the change of Indian Retail Industry.

Unit II:

Retail Formats: Retail Sales by ownership, On the basis of Merchandise offered, nonstore Based retail mix & Non traditional selling.

Unit III:

Store Planning: Design & Layout, Location Planning and its importance, retailing image mix, Effective Retail Space Management, Floor Space Management.

Unit IV:

Retail Marketing: Advertising & Sales Promotion, Store Positioning, Retail Marketing. Mix, CRM, Advertising in Retailing.

Unit V:

Retail Merchandising: Buying function, Markups & Markdown in merchandise management, shrinkage in Retail merchandise management.

Unit VI:

Merchandise Pricing: Concept of Merchandise Pricing, Pricing Options, Pricing Strategies, Pricing Objectives, Types of Pricing.

Unit VII:

Retail Operation: Elements/Components of Retail Store Operation, Store Administration, Store Manager –Responsibilities, Inventory Management, Management of Receipts, Customer Service, Management of Retail Outlet/Store, Store Maintenance, Store Security.

Readings

1. Cullen & Newman: Retailing – Environment & Operations, Cengage Learning EMEA
2. Berman & Evarv: Retail Management, Perntice Hall.
3. Bajaj, Tuli & Srivastava: Retail Management- Oxford University Publications
4. Gibson G Vedamani: Retail Management: Functional principles & practices, Jaico Publishing House.
5. Harjit Singh: Retail Management, S. Chand Publication.

PERSONAL SELLING AND SALES FORCE MANAGEMENT

Unit I Introduction to Personal Selling; functions of a sales person, qualities of an effective Sales Person; Personal Selling situations.

Unit II Theories of Selling: AIDAS, Right Set of circumstances, Buying formula theory.

Unit III The Selling Process: Preapproach – acquiring product knowledge, acquiring competition and market knowledge, Identifying and qualifying prospects – sources of prospecting, conditions for qualification, Opening a sale – methods of approaching, Sales presentation – presentation strategies and methods, Sales demonstration – planning effective demonstration, use of sales tools, Handling objection – types of objections, determining hidden objections, strategies for handling objections, Closing a sale – trial close, closing techniques, Post sales follow up.

Unit IV Introduction to sales force management: Objectives of Sales management, Role of a sales manager; Managing Sales force – Recruitment, Selection, Training, Compensation and evaluation of sales force; Sales Territory Coverages: Sales Territory Concept, Reasons for establishing sales territories, procedures for selling up sales territories.

Readings:

1. Still, Cundiff & Govani: Sales Management, Prentice Hall of India
2. Charles Futrell: Fundamentals of Selling, McGraw Hill

DSE Group III : HUMAN RESOURCE

HUMAN RESOURCE DEVELOPMENT : SYSTEMS AND STRATEGIES

UNIT - I:

Human Resource Development (HRD) : Concept, Origin and Need, Relationship between human resource management and human resource development; HRD as a Total System; Activity Areas of HRD : Training, Education and Development; Roles and competencies of HRD professionals.

UNIT - II:

HRD Process: Assessing need for HRD; Designing and developing effective HRD programs; Implementing HRD programs; Evaluating HRD programs.

UNIT- III:

HRD Interventions: Integrated Human Resource Development Systems, Staffing for HRD; Physical and Financial Resources for HRD. HRD and diversity management; HRD Climate; HRD Audit.

UNIT – IV:

HRD Applications: Coaching and mentoring, Career management and development; Employee counseling; Competency mapping, High Performance Work Systems, Balanced Score Card, Appreciative inquiry. Integrating HRD with technology.

UNIT – V:

Evaluating the HRD Effort; Data Gathering; Analysis and Feedback; Industrial relations and HRD. HRD Experience in Indian Organizations, International HRD experience, Future of HRD.

Readings:

1. Nadler, Leonard: Corporate human Resource Development, Van Nostrand Reinhold / ASTD, New York.
2. Rao T.V. and Pareek, Udai: Designing and Managing Human Resource Systems, Oxford and IBH Publication Ltd.
3. Rao T.V.: Reading in human Resource Development, Oxford IBH Publication .Ltd.
4. Viramani B.R. and Seth, Pramila: Evaluating Management Training and Development, Vision Books.
5. Rao T.V.: Human Resource Development, Sage publication.
6. Kapur, Sashi: Human resource Development and Training in Practice, Beacon Books.
7. Lynton, Rolf P. and Pareek, Udai: Training for Development, Vistaar publication.
8. Werner J. M., DeSimone, R.L.: Human resource development, South Western.
9. Mankin, D.: Human resource development, Oxford University Press India.
10. Haldar, U. K.: Human resource development, Oxford University Press India.
11. Rao, T.V.: Future of HRD, Macmillan Publishers India.

MANAGEMENT OF INDUSTRIAL RELATIONS :

Unit I -Concept of industrial relations, aspects of industrial relations, conflict and Cooperation, parties in industrial relations, workers employers and government, trade unions, objectives collective bargaining.

Unit II -Workers participation in management, levels of participation, mode of Participation Works Committee, Joint Management councils, Worker Director, Grievance Procedure, Quality Circles.

Unit III Trade Union Act 1926, Immunity granted to Registered Trade Unions, Recognition of Trade Unions . The Industrial Employment (Standing Orders) Act 1946, Scope, coverage, certification process, modification, interpretation, and enforcement. The Industrial Disputes Act 1947, forum for settlement of disputes, instruments of Economic coercion, strikes, lockouts and closure.

Unit IV Salient features, coverage of employees and employers, rules and benefits relating to The Payment of Wages Act 1936, The Payment of Gratuity Act 1972, The Minimum Wages Act 1948, and The Payment of Bonus Act 1965.

Unit V The Factories Act 1948, definition, approval, licensing and registration, health and welfare measures ,employment of women and young persons ,leave with wages and weekly holidays.

Unit VI The salient features ,coverage of employees and employers, and benefits under The Provident Fund and Miscellaneous Provisions Act 1952 and Employees Pension Scheme and Employees State Insurance Act 1948.

References:

1. S C Srivastava: Industrial Relations and Labour Laws, Vikas Publishing House.
2. T N Chhabra: Industrial Relations and Labour Laws, Dhanpat Rai Publishing House.

TALENT AND KNOWLEDGE MANAGEMENT

Unit I

Meaning and importance of talent management, Talent management Grid, Creating talent management system, Strategies of talent management.

Unit II

Competency model, Competency mapping, Role of leaders in talent management, Talent management and competitive advantage.

Unit III

Elements of knowledge management, Advantages of knowledge management, Knowledge management in learning organisations. Types of Knowledge: Tacit and Explicit .Managing knowledge workers.

Unit IV

Knowledge management process, Approaches to knowledge management: Knowledge management solutions, Knowledge creation, Knowledge sharing, Knowledge dissemination, Knowledge management life cycle, Nonaka's model of knowledge. Knowledge capturing techniques: Brainstorming, Protocol analysis, Consensus decision making, Repertory grid, Concept mapping.

Unit V

Knowledge management strategies: Aligning individual needs with organisation, Reward systems for knowledge management, Knowledge audit, Benchmarking, Balance score card, Gap analysis.

Readings

1. Lance A. Berger, Dorothy Berger: Talent management handbook, McGraw Hill New York.
2. Cappeli Peter: Talent on Demand –Managing Talent in an age of uncertainty, Harvard Business press.
3. Awad.E.M and Ghaziri.H.M: Knowledge management, Pearson education International.
4. Stuart Barnes: Knowledge management system theory and practice, Thomson learning.
5. Donald Hislop: Knowledge management in organisations, Oxford University press.
6. Sudhir Warier: Knowledge management, Vikas publishing house.
7. T. Raman: Knowledge management –a resource book, Excel books.

PERFORMANCE AND COMPENSATION MANAGEMENT

Unit I

Introduction- Concept, Philosophy, History from performance appraisal to performance development. Objectives of performance management system; Performance management and performance appraisal; Performance Management process: Performance planning, Process and Documentation of Performance appraisal, Appraisal Interview, Performance Feedback and Counselling.

Unit II

Performance management and reward systems. Performance Coaching ,Mentoring and Counselling, Competency development, Use of technology and e-PMS, International Aspects of PMS. Performance systems trends, Ethical Perspectives in performance appraisal.

Unit III

Introduction to Job Evaluation.Methods of Job Evaluation.Company Wage Policy: Wage Determination, Pay Grades, Wage Surveys, Wage Components. Modern trends in compensation - from wage and salary to cost to company concept, Comparable worth, broadbanding, competency based pay.

Unit IV

Incentives plans for production employees and for other professionals. Developing effective incentive plans, pay for performance,. Supplementary pay benefits, insurance benefits, retirement benefits, employee services benefits. Benefits & Incentive practices in indian industry.

Unit V

Wages in India: Minimum wage, fair wage and living wage. Methods of state regulation of wages. Wage differentials & national wage policy Regulating payment of wages, wage boards, Pay commissions, dearness allowances, linking wages with productivity,. Special compensation situations: International compensation-managing variations. Expatriate Pay.

Readings:

1. Milkovich & Newman , Compensation, McGraw Hill.
2. T.J. Bergman , Compensation Decision Making, Harcourt, Fort Worth, TX
3. Richard Henderson: Compensation management in a knowledge based world, Prentice Hall.
4. T.N.Chhabra & Savitha Rastogi Compensation management, Sun India Publications.
5. Gary Dessler , Human Resource Management, Prentice Hall.
6. Armstrong's Handbook of Performance Management: An Evidence-Based Guide to Delivering High Performance :Book by Michael Armstrong
7. Herman Aguinis: Performance Management, Prentice Hill.
8. Armstrong, M. & Baron, A: Performance management and development, Jaico Publishing House
9. Armstrong, M., Performance management: Key strategies and practical guidelines, Kogan Page, London.
10. Bagchi, S. N.: Performance management, Cengage Learning India.
11. Bhattacharyya, D.K.: Performance management systems and strategies, Pearson Education.
12. Robert B.: Performance management, McGraw-Hill Education India.

TRAINING AND MANAGEMENT DEVELOPMENT

Unit I - Organization vision & plans, assessment of training needs, setting training objectives, designing training programmes, Spiral model of training.

Unit II - Tasks of the training function: Building support, overall training capacity, Developing materials, strategic planning, networking, designing training programmes.

Unit III -Training methods: On the job training, job instruction training, apprenticeship, coaching, job rotation, syndicate method, knowledge based methods, lecture, conferences, programmed learning, simulation methods, case study, vestibule training, laboratory training, in-basket exercise, experiential methods, sensitivity training, e-training.

Unit IV -Management Development Programme Methods:-Understudy, Coaching, Action Learning, Role Play, Management Games, Seminars, University related programmes, special projects, behavioural modeling, job rotation, case study, multiple management, sensitivity training. Post training: Training evaluation, Training impact on individuals and organizations, Evaluating Programmes, Participants, Objectives.

Unit V- Organisational Development (OD): Definition Foundations of OD, Managing the OD Process, Action Research and OD. OD Interventions: Overview of OD Interventions, Team Interventions Inter-group and Third-Party Peacemaking Interventions. Comprehensive OD Interventions, Structural Interventions and the Applicability of OD, Training Experiences. Issues in Consultant –Client Relationships, System Ramifications, Power, Politics and OD

Readings:

1. Blanchard P.Nick & Thacker James: Effective Training, Systems, Strategies and Practices, Pearson.
2. French Wendell, Bell Cecil and Vohra Veena: Organisation Development, Behavioral Science Interventions for Organisation Improvement, Prentice Hall.
3. Lynton Rolf & Pareek Udai: Training & Development, Prentice Hall.
4. Bhatia S.K.: Training & Development, Deep & Deep Publishers.

SYLLABUS
For
Bachelor of Business Administration
(HONS.)
Under
Gauhati University (CBCS)

(This is approved in the Academic Council held on 08.11.2019)

REGULATIONS AND SYLLABI FOR THREE YEAR BBA (HONS.) COURSE IN SEMESTER UNDER CBCS FOR THE STUDENTS ADMITTED W.E.F 2019.

1.The Bachelor of Business Administration Course called the BBA Course hereafter shall comprise of three academic years and each academic year shall consist of two semesters. Each semester shall approximately consist of 19 weeks of teaching, 3 weeks of academic and other formalities including the semester examination and 4 weeks of semester break.

2.Eligibility Criteria: A (10 +2) degree in Arts, Science, Commerce or a Diploma in Engineering with minimum **45%** marks in aggregate from a recognized Board/ Council.

3.Admission Criteria: The selection of eligible applications will be based on the applicant's overall performance in (10+2) examination.

4.Examination:

- a) There will be 6 (six) examinations, one at the end of each semester
Duration of the semester period will be as follows:
First, Third, Fifth semester : June to December (July– Summer vacation)
Second, Fourth and Sixth semester : January to May.
- b) A candidate for the examination shall be examined as per syllabi where each written paper shall be of 3 hours' duration.
- c) A candidate shall not be sent up for a semester examination if he/ she has not attended at least 75% of the classes held for each subject including lectures, seminars, tutorials and case analysis.
- d) Each paper shall carry 100 marks, out of which 20 marks shall be allocated to internal evaluation. The minimum marks required for passing the examination shall be **35%** both in internal evaluation and written examination, in each paper separately and **45%** in the aggregate separately for each semester examination.
- e) If a candidate fails to secure pass marks in a subject paper in the internal evaluation, he/ she shall be debarred from appearing in the Term end Semester examination and he/ she will have to seek re- admission into that semester when it is offered.
- f) A candidate shall submit a Summer Project Report here in after referred to as Report, in duplicate to the Head of the Dept. within 2 weeks of completion of the project; generally by **31st August** in the 5th semester period. The Report shall carry 100 marks in total, out of which 20 marks be allotted for internal evaluation. The remaining 80 marks be divided into 50 marks for evaluation of the text of the report and 30 marks for Viva Voce . The Report shall be prepared under the guidance of a teacher of the Department. Who shall be referred to as the Guide for the purpose. The Guide in consultation with the candidate concerned shall determine the topic and exact title of the Report.
Two examiners to be appointed by the Controller of Examinations shall evaluate each Report. The average of the marks awarded to the candidate on the text part of the Report. The Guide and the external examiner shall conduct the Viva Voce examinations jointly.

The Viva Voce marks obtained by the candidate together with the average marks obtained in the text shall be the final marks awarded to the candidate on the Report.

- g) A failed candidate is eligible to appear in a maximum of 2 back papers in Term End semester examination, provided he/ she has secured minimum **45%** marks in aggregate in the concerned examination. A student will be allowed to clear six semesters in maximum five years. He/ She will not be allowed to take more than three chances in any semester.
- h) A student who could not appear or failed in any semester, will be allowed to clear the same as follows:
 - i. First semester with the regular Third/ Fifth semester.
 - ii. Second semester with the regular Fourth/ sixth semester
- i) If a candidate secures pass marks in internal evaluation but has not cleared any of the semester examination then he/ she will be allowed to appear in the next semester examination, but his/ her final results after Fourth semester will be kept with held until he/ she clears all the back log.
- j) If a candidate fails in a semester examination, the marks secured ny him/ her in internal evaluation in each subject shall be carried over to the next semester examination, provided he/ she obtains the minimum pass marks which shall remain valid for two years only.

Results: A candidate shall be awarded BBA Degree on passing all the six semester examination.

Final results will be worked out by adding up total marks secured in all the six semester examinations. Those candidates who **45%** or more but less than 60 percent in aggregate will be declared as having passed the examination in Second Class and those securing 60 percent or above will be declared as having passed in First Class.

A candidate will be declared to have passed with Distinction in the appropriate class provided the candidate passes all the semester examinations from First to Sixth regularly, without keeping any arrear subject at any semester and completes the BBA Course in three academic years from the date of his/ her admission and secures at least 75 percent marks.

**BACHELOR OF BUSINESS ADMINISTRATION (HONS.) 3 YEAR DEGREE COURSE
UNDER CBCS PROGRAMME**

COURSE STRUCTURE		
1ST SEMESTER		
BBA-AE-1014	BUSINESS COMMUNICATION (LANGUAGE : ENGLISH)	AECC-1
BBA-HC-1026	PRINCIPLES OF MANAGEMENT	CORE COURSE -1
BBA- HC-1036	MANAGEIAL ECONOMICS	CORE COURSE-2
BBA- HG-1046	MATHEMATICAL TECHNIQUES IN BUSINESS	GE- 1
2ND SEMESTER		
BBA-AE-2014	ENVIRONMENTAL SCIENCE	AECC-2
BBA-HC-2026	FINANCIAL ACCOUNTING	CORE COURSE-3
BBA- HC-2036	STATISTICS FOR BUSINESS DECISIONS	CORE COURSE- 4
BBA- HC-2046	INDIAN ECONOMIC SCENARIO	CORE COURSE- 5
BBA- HG-2056	COMPUTER FUNDAMENTALS	GE-2
3RD SEMESTER		
BBA-HC-3016	COST AND MANAGEMENT ACCOUNTING	CORE COURSE-6
BBA-HC-3026	HUMAN RESOURCE MANAGEMENT	CORE COURSE-7
BBA-HC-3036	PERSONALITY AND PERSONAL SKILL DEVELOPMENT	CORE COURSE- 8
BBA- HG-3046	OPERATIONS MANAGEMENT AND CONTROL	GE-3
BBA- SE-3054	COMPUTER APPLICATIONS	SEC-1
4TH SEMESTER		
BBA-HC-4016	ORGANIZATIONAL BEHAVIOUR AND INDUSTRIAL PSYCHOLOGY	CORE COURSE-9
BBA-HC-4026	FINANCIAL MANAGEMENT	CORE COURSE-10
BBA-HC-4036	PRINCIPLES OF MARKETING	CORE COURSE-11
BBA- HG-4046	BUSINESS RESEARCH	GE-4
5TH SEMESTER		
BBA-HC-5016	LEGAL ASPECTS OF BUSINESS	CORE COURSE- 12
BBA- SE-5024	SUMMER PROJECT	SEC-2
BBA-HE-5036 BBA-HE-5046	A student would be free to choose any four papers from one group. In 5 th and 6 th semester they have to choose two papers in each semester from the group given below. The course offers three groups namely Finance (DSE I), Marketing (DSE II) and Human Resource (DSE III)	DSE-1 & 2
6TH SEMESTER		
BBA-HC-6016	BUSINESS POLICY AND STRATEGY	CORE COURSE-13
BBA-HC-6026	TAXATION LAWS	CORE COURSE- 14
BBA-HE-6036 BBA-HE-6046	A student would be free to choose any four papers from one group. In 5 th and 6 th semester they have to choose two papers in each semester from the group given below. The course offers three groups namely Finance (DSE I), Marketing (DSE II) and Human Resource (DSE III)	DSE 3 & 4

DSE I : FINANCE

- INTERNATIONAL FINANCE
- INVESTMENT BANKING AND FINANCIAL SERVICES
- INVESTMENT ANALYSIS AND PORTFOLIO MANAGEMENT
- STRATEGIC CORPORATE FINANCE
- BUSINESS ANALYSIS & VALUATION

DSE II : MARKETING

- CONSUMER BEHAVIOUR
- MARKETING OF SERVICES
- ADVERTISING AND BRAND MANAGEMENT
- RETAIL MANAGEMENT
- PERSONAL SELLING & SALES FORCE MANAGEMENT

DSE III : HUMAN RESOURCE

- HUMAN RESOURCE DEVELOPMENT : SYSTEMS AND STRATEGIES
- MANAGEMENT OF INDUSTRIAL RELATIONS
- TALENT AND KNOWLEDGE MANAGEMENT
- PERFORMANCE AND COMPENSATION MANAGEMENT
- TRAINING AND MANAGEMENT DEVELOPMENT

FIRST YEAR
Semester –I

BBA-AE-1014 BUSINESS COMMUNICATION (LANGUAGE : ENGLISH)

(As per UGC syllabus)

(AECC-1)

BBA-HC-1026 PRINCIPLES OF MANAGEMENT

(CC-1)

Unit 1: Evolution of Management- Development of management Thought, Schools or Approaches to Management- The Classical School, The Neo Classical or Human Resource School, The Modern School, Management Thinkers and theorists.

Unit 2: Management Concept- Definition, Meaning, Characteristics, Importance/ significance, Objectives, Nature, Levels of management, Management Vs Administration, managerial Skills and Roles.

Unit 3: Management Principles- Henry Fayol's fourteen principles of management, F.W Taylor's scientific management principles.

Unit 4: Functions Of Management-

- i. Planning: Meaning and definition, Characteristics, Objectives, need/ importance, Limitations, Essential Elements of Effective Planning, Process/ Steps in planning, Elements/ Components of Planning, Tools and techniques.
- ii. Organizing: Meaning and definition, Characteristics, Objectives, need/ importance, Process, Theories, Formal and informal Organisation, Concept of Organization Structure, Forms of Organization Structure, Authority, Delegation, Centralization, decentralization, Span of Control.
- iii. Staffing: Meaning and definition, Characteristics, Need/ Importance, Elements of Staffing Function.
- iv. Directing: Meaning and definition, Characteristics, Need/ Importance, Objectives, Techniques of directing.
- v. Decision Making: Meaning and definition, Characteristics, need/ importance, Objectives, Classification, Decision making process, Techniques of Decision making.
- vi. Motivation: Meaning and definition, Characteristics, Objectives, Need and Importance, Theories- Maslow's Need Hierarchy Theory, McGregor's Theory X and Theory Y, Herzberg's Two factor Theory, Types of motivation, Techniques.
- vii. Leadership: Meaning and definition, Importance, Leadership Qualities, Leadership Styles.
- viii. Communication: Meaning and definition, Characteristics, Need and Importance, Objectives, Classification of Communication, Barriers to Communication, Measures to Overcome barriers.
- ix. Controlling: Meaning and definition, Characteristics, Objectives, Need and Importance, Process, Techniques, Difficulties.
- x. Budgeting: Meaning and definition, Characteristics, Objectives, Need and Importance, Techniques.

Unit 5: Concept of Coordination, MBO and MBE.

Unit 6: Emerging Horizons to Management.

• **Suggested Books:**

1. Essentials of Management – Kontz & O'Donnell
2. Functions & Principles of Management- J.K. Jain
3. Management- L.M. Prasad
4. Management: Theory & Practice- C.B. Gupta

Unit I: Demand, Supply and Market equilibrium: individual demand, market demand, Individual supply, market supply, market equilibrium; Elasticities of demand and supply: Price elasticity of demand, income elasticity of demand, cross price elasticity of demand, Elasticity of supply;

Theory of consumer behavior: cardinal utility theory, ordinal utility theory (indifference Curves, budget line, consumer choice, price effect, substitution effect, income effect for Normal, inferior and giffen goods), revealed preference theory.

Unit II: Producer and optimal production choice: optimizing behavior in short run (geometry of product curves, law of diminishing margin productivity, three stages of Production), optimizing behavior in long run (isoquants, isocost line, optimal Combination of resources)

Costs and scale: traditional theory of cost (short run and long run, geometry of cost curves, envelope curves), modern theory of cost (short run and long run), economies of scale, economies of scope.

Unit III: Theory of firm and market organization: perfect competition (basic features, Short run equilibrium of firm/industry, long run equilibrium of firm/industry, effect of Changes in demand, cost and imposition of taxes) ; monopoly (basic features, short run Equilibrium, long run equilibrium, effect of changes in demand, cost and imposition of taxes, comparison with perfect competition, welfare cost of monopoly), price discrimination, multiplant monopoly ; monopolistic competition (basic features, demand and cost, short run equilibrium, long run equilibrium, excess capacity) ; oligopoly (Cournot's model, kinked demand curve model, dominant price leadership model, prisoner's dilemma)

Suggested Books:

1. Dominick Salvatore (2009). Principles of Microeconomics (5th ed.) Oxford University Press
2. Lipsey and Chrystal. (2008). Economics. (11th ed.) Oxford University Press
3. Koutosyannis (1979). Modern Micro Economics. Palgrave Macmillan
4. Pindyck, Rubinfeld and Mehta. (2009). Micro Economics. (7th ed.). Pearson.
5. Managerial Economics – H L Ahuja

Unit 1: Arithmetic progression: n^{th} term (general term) of the general A.P. , sum of first n terms of the general AP, arithmetic mean, application of A.P. regarding simple interest.

Geometric Progression : : n^{th} term (general term) of the general G.P. , sum of first n terms of the general GP, arithmetic mean, application of G.P. regarding simple interest.

Unit 2: Logarithms: definitions, laws of logarithms and applications, concept of common logarithm, characteristic and mantissa of logarithms.

Unit 3: Set Theory: definition of set, representation of a set, different types of set, equality of sets, subsets of a set and properties, Union of sets and applications, Intersection of sets and applications, Difference of sets and applications, compliment of a set and its properties, theorems related to cardinal numbers.

Unit 4: Determinants : Minors and cofactors of the elements of a determinant, properties of determinants and its application, solving simultaneous equations with two or three unknown variables by Cramer's Rule.

Matrix: Difference between determinants and matrices, types of matrices, equality of matrices, Matrix addition and scalar multiplication, Matrix multiplication, transpose and Adjoint of a matrix, Inverse of a square matrix, Solution of Linear Equations by Matrix Inversion Method.

Unit 5: Functions: Definition of functions, Algebraic, Logarithmic and Exponential functions, even and odd function.

Unit 6: Calculus: basic concept of differentiation and integration, Application of theorems of Differentiation, value of Average Cost (AC) and Marginal Cost (MC) by derivative formulae, Integration by substitution, Integration by parts, Definite integral and application in business and economics.

Linear Programming Problem: Definition, requirement for a LPP, Basic assumptions of LPP, uses and limitations of LPP, solution of a LPP by graphical method.

• **Suggested Books :**

1. Business of Mathematics :Sancheti & Kapoor
2. Business Mathematics :Zameeruddin, Khanna, Bhambri
3. Quantitative Techniques in Management : N.D.Vora
4. A Textbook Of Business Mathematics : P.L. Hazarika

Semester- II

BBA-AE-2014: ENVIRONMENTAL SCIENCE

(AECC-2)

(As per UGC syllabus)

BBA-HC-2026: FINANCIAL ACCOUNTING

(CC-3)

Unit 1: Financial Accounting: Introduction, need and objectives. Generally Accepted Accounting Principles .

Unit 2: Double Entry System of Book-keeping: Books of Original Entry and Books of Final Entry; Journals, Books of Accounts and Ledger Books, Cash Book and Bank Account.

Unit 3: Final Accounts of Sole Proprietorship Firms: Preparation of Trial Balance, Rectification of Errors, Trading and Profit and Loss Account and Balance Sheet.

Unit 4: Accounts for Non-Profit Organization: Receipt and Payment Account and Income and Expenditure Account.

Unit 5: Accounting Information: Meaning of Accounting Information and its sources; Corporate Annual Report and its contents, Books of Account to be maintained by a company; Latest format of Profit and Loss Account and Balance Sheet as per Companies Act,2013.

• **Suggested Books:**

1. Advanced Accountancy- Jain & Narang.
2. Advanced Accountancy- S.N. Maheswari.
3. Accountancy- B.B.Dam, Sujit Sikidar, R.Barman & B.Bora.
4. Accountancy – D.K. Goel, Rajesh Goel, Shelly Goel, Arya Publications.

Unit I: Measures of Central Value: Characteristics of an ideal measure; Measures of Central Tendency - Mean median, mode, harmonic mean and geometric mean. Merits, Limitations and Suitability of averages. Relationship between averages. Measures of Dispersion: Meaning and Significance. Absolute and Relative measures of dispersion - Range, Quartile Deviation, Mean Deviation, Standard Deviation, Coefficient of Variation, Moments, Skewness, Kurtosis.

Unit II: Correlation Analysis: Meaning and significance. Correlation and Causation, Types of correlation. Methods of studying simple correlation - Scatter diagram, Karl Pearson's coefficient of correlation, Spearman's Rank correlation coefficient, Regression Analysis: Meaning and significance, Regression vs. Correlation. Linear Regression, Regression lines (X on Y, Y on X) and Standard error of estimate.

Unit III: Analysis of Time Series: Meaning and significance. Utility, Components of time Series, Models (Additive and Multiplicative), Measurement of trend: Method of least Squares, Parabolic trend and logarithmic trend; Index Numbers: Meaning and Significance, problems in construction of index numbers, methods of constructing index numbers- weighted and unweighted, Test of adequacy of index numbers, chain index numbers, base shifting, splicing and deflating index number.

Unit IV: Probability: Meaning and need. Theorems of addition and multiplication. Conditional probability. Bayes' theorem, Random Variable- discrete and continuous. Probability Distribution: Meaning, characteristics (Expectation and variance) of Binomial, Poisson, and Normal distribution. Central Limit Theorem.

Suggested Books:

1. S.P. Gupta (S.P.): Statistical Methods, Sultan Chand & Sons, 34th Edition.
2. Richard Levin & David Rubin : Statistics for management, Prentice Hall.
3. Anderson, Sweeny & Williams: Statistics for Business and Economics, South Western.
4. P.L. Hazarika : A textbook of Business Statistics
5. P.K.Mathur : Business Statistics

Unit 1: a) Business Environment:- Nature, Significance of Economic, Non-Economic Environment in India, Macro, Micro Environment.

b) Industrial Policy, Monetary Policy.

Unit 2: a) GATT / WTO:- Objectives, Principles, Impact in the India's Industrial and Business Sector.

b) Economic Integration:- Meaning, Types and Importance.

c) Globalization / Liberalization – Concept , Measures.

Unit 3: a) Foreign Collaboration / Capital, Investments- Role of Multinational Corporations – Types, Nature.

b) Role of Foreign Aid and World Bank.

c) Balance of Payments Concepts – Current Account, Capital Account, Disequilibrium, Measures , Trade Policy.

Unit 4: a) Government Budget: Types, Components, Fiscal Deficit.

b) Banking and Non-Banking Financial Institutions – Types, Importance.

Unit 5: a) Planning in India: - Achievements, Failures, De-centralized Planning.

b) Small and Medium Scale Industries: Problems and Prospects.

c) Trade Cycle – Meaning and Phases.

• **Suggested Books:**

1. Indian Economy – Dutt & Sundaram
2. Business Environment : H.L. Ahuja

BBA- HG-2056 COMPUTER FUNDAMENTALS

(GE-2)

Unit 1: Brief history of development of Computers, Generations and its evolution, characteristics of computers, Hardware, software, computer languages.

Unit 2: Criteria for using the computers, main areas of applications. Basic Architecture, Components And Functions Of Computers, Computer Accessories.

Unit3: Types of Computers: Analog, Digital, Hybrid, General purpose and Special purpose computers, Micro Computers, Mini Computers, main frame computers and Super Computers.

Unit 4: Operating System and Office Automation: Booking concept, MS and open source operating systems, Introduction to system management, overview of languages, Compilers, interpreters, Assemblers, LAN, MAN, WAN, WiFi, Communication Channels.

Unit 5: Basic commands in MS Excel, Features, functions and uses of MS word, Mail Merge feature in MS Word, Basic Concepts of MS Power point.

Unit 6: Information Technology: Fundamentals, Perspective, Applications and scope, Introduction to Internet, Browsers, applications and scope.

- **Suggested Books:**

1. Computer Fundamentals by D.P. Nagpal
2. First Course in Computers by Sanjay Saxena
3. Computer Fundamentals by V. Raja Raman
4. Introduction to Computers by Leon & Leon

SECOND YEAR

Semester-III

BBA-HC-3016 COST AND MANAGEMENT ACCOUNTING

(CC-6)

Unit 1: Meaning, Nature and Scope of Cost and Management Accounting, Objectives and Functions of Management Accounting. Relationship between Financial Accounting and Cost Accounting and Financial Accounting and Management Accounting.

Unit 2: Cost elements: Material Cost, Labour Cost and overheads, costing method, job costing, contract costing and process costing, Batch costing.

Unit 3: Standard Costing: Variance Analysis

Break-even Analysis: Marginal Costing

Unit 4: Budgets and Budgetary Control: Meaning, Objectives and Limitations of Budgetary control. Types of Budget, Master Budget & Functional Budget, Production Budget, Raw Materials Budget, Sales Budget, Flexible Budget and Cash Budget (Receipts and Payments Method)

- **Suggested Books:**

1. Cost & Management Accounting- Jain & Narang
2. Management Accounting- Khan & Jain

Unit I

Human Resource Management: Concept, Functions, roles, skills & competencies, HRD definition, Goals and Challenges. The changing environment of HRM – globalization, cultural environment, technological advances, workforce diversity, corporate downsizing, changing skill requirement, HRM support for improvement programs Work life balance, HR Role In Strategy Formulation & Gaining Competitive Advantage. HRM issues in Indian Organisations.

Unit II

Human Resource Planning: Process, Forecasting demand & supply, Skill inventories Human Resource Information System (HRIS) succession planning, Job analysis – Uses, Methods, Job description & Job specifications. HR accounting and Human Resource Development (HRD) audit concept. Recruitment, Selection & Orientation: internal & external sources, e- recruitment, selection process, orientation process.

Unit III

Training: Concept, Needs, Systematic approach to training, Methods of training. Management development: Concept & Methods. Performance management system: Concept, uses of performance appraisal, performance management methods, factors that distort appraisal, appraisal interview .Career planning: career anchors, career life stages. Compensation: Steps of determining compensation, job evaluation, components of pay structure, factors influencing compensation levels, wage differentials & incentives, profit sharing, gain sharing, employees' stock option plans. Brief introduction of social security, health, retirement & other benefits.

Unit IV

Industrial Relations: Introduction to Industrial Relations, Trade unions role, types, functions, problems, industrial dispute- concept, causes & machinery for settlement of disputes- grievance, concepts, causes & grievance redressal machinery, discipline concept, aspect of discipline & disciplinary procedure, Collective bargaining- concept, types, process, problems, essentials of effective collective bargaining .

Suggested Books:

1. De Cenzo, D.A. & Robbins: Fundamentals of Human Resource Management, New York: John Wiley & Sons.
2. Dessler, G: Human Resource Management, Pearson.
3. Monappa & Saiyaddin: Personnel Management, Tata McGraw Hill.
4. Rao, V.S.P.: Human Resource Management- Text and Cases, Excel Books.
5. R. Wayne Mondy & Rober M. Noe: Human Resource Management, Pearson

BBA-HC-3036 PERSONALITY AND PERSONAL SKILL DEVELOPMENT (CC-8)

Unit 1: PERSONALITY – Meaning, Elements/ Determinants, Types, Development of Personality, Concept of Self Esteem, Assertiveness, Interpersonal awareness (JOHARI) , Empathy, Drive Strength, Emotional intelligence, Time management, Stress management, Personal effectiveness, personal grooming, health & hygiene, body language gestures, Commitment Ethics, Growth Motivation.

Unit 2: TEAMS & GROUPS – Meaning of Groups, Features, Types, Theories of Group formation, Reasons of Group formation, Group Performance, Group Roles, Group Norms, Group Cohesion, Problems/ Difficulties of Informal Groups ; Meaning of Teams, Characteristics, Importance, Types, Building Effective Team.

Unit 3: CAREER DEVELOPMENT AND PLANNING – Meaning of Career, Meaning of Career Planning, Need/Importance of Career Planning, Steps in the Career Planning process.

Unit 4: BUSINESS ETIQUETTES & MANNERS – Meaning of Business Etiquettes, Advantages/ Benefits. Etiquette of the written word, Telephone Etiquettes, Business Meetings, Types, Handling business meetings, Sales and Customer Orientation.

Suggested Book:

Organisational Behaviour – S.S.Khanka, Publisher S.Chand.

BBA- HG-3046 OPERATIONS MANAGEMENT AND CONTROL

(GE-3)

Unit 1: Production management- definition, scope importance ,functions, system concept of production, types of production system.

Unit 2: Product design and analysis- concept, steps of product design, process planning and design, value analysis, standardization and simplification.

Capacity planning and investment decisions-determination of plant capacity ,capacity planning strategies, equipment selection.

Unit 3: Facility location- factors affecting plant location, facility location problems- single facility location problem, multi facility location problem.

Plant layout and material handling- classification of layout, Group technology ,material handling system.

Unit 4: Material Management and inventory control-Integrated Material Management, components of integrated Material Management, inventory control, models of inventory, purchasing management, store management -ABC analysis, XYZ analysis, VED analysis.

Production planning and control- objectives, importance, production planning and control procedure.

Scheduling -single machine scheduling ,flow shop scheduling- Johnson's model, extension of junction rule, job shop scheduling.

Unit 5: Work study- method study, time study ,work sampling

Quality control -objectives, importance, classification of quality control techniques, control charts, Six Sigma.

• **Suggested books:**

1. Production and operation management-R.Panneerselvam
2. Operations Management and Control- Dr C.B Gupta

Theory marks=50

Unit 1: Word Processing: Introduction to word processing, Creating and saving a documents, paragraph formatting techniques. working with tables, Spreadsheet: concept of worksheets and workbooks, creating charts and graphics in MS Excel, PowerPoint presentation: Creating graphs, tables, charts, use of animation and multimedia

Unit 2: Database management System:- Definition of Database, Traditional File Approach vs. DBMS approach, Characteristics of the Data Base Approach, DBMS user, Role of a DBA, Advantage and disadvantage of using DBMS, DBMS architecture. ER model as a tool for conceptual design entities, attributes and relationships, weak and strong entities, conversion of ER model into relational schema. ANSI SQL –92 Standards: DDL, DML.

Unit 3: System development life cycle:- System models and types of models, System analysis, feasibility analysis, cost benefit analysis, payback period.

Unit 4: Tally: Basic definition of Tally, Features of Tally, Advantage and disadvantage of Tally. Tally accounting, manual accounting, and financial accounting.

Practical marks=30

Tally.ERP9 Install.
GST in Tally.ERP9.
Interest calculation.
Bill Of Material.
Prepare profit and loss account, Balance sheet

• **Suggested Books:**

- | | |
|--|-----------------|
| 1. Computer Application in Business | R.Paraeswaram |
| 2. Introduction to database management system | C.J. Date |
| 3. Tally ERP9 Training Guide - 4th revised & updated edition | Asok K. Nadhani |

Semester-IV

BBA-HC-4016 ORGANISATIONAL BEHAVIOUR AND INDUSTRIAL PSYCHOLOGY

(CC-9)

Unit 1: Introduction: Meaning and concept of OB, Key elements of OB, Nature and Scope of OB, Importance of studying OB, Contributing disciplines to OB, Models of OB.

Unit 2: Individual Behavior: Personality- Concept, Determinants, Types, and Theories: Type theory, Trait theory, Psychoanalytical theory, Social learning theory, Self theory. Development of Personality: Erikson's Eight Life Stages, Influence of Personality in an Organization.

Perception- Meaning, Perceptual process, Factors affecting perception, Improvement of Perception, Application of perception in OB, Difference between perception and sensation.

Learning- Meaning, Determinants of learning, Learning Theories: Classical Conditioning, Operant Learning, Cognitive Theory, Social Learning Theory. Meaning of Reinforcement: Schedules of Reinforcement, Punishment, Effect of Learning on Behaviour.

Attitudes and Values: Concept and Meaning of Attitude, Features, Sources of Attitudes, Types of attitudes at work place, modification of attitudes. Concept and meaning of values, types, factors affecting values.

Unit 3: Interpersonal Behaviour: Concept, Types, Skills for Cooperative Interpersonal Behaviour. Concept of TA: Levels of Self Awareness, Ego States, Life positions, Transaction-Types, Benefits of TA.

Unit 4: Group Behaviour: Meaning of Group, Types of Groups, Reasons for formation of groups, Theories of Group formation, Stages of Group formation and development, Concept of Group Dynamics, Group Behaviour- concept of group norms, group cohesion, group role, role identity, role ambiguity, role conflict, role expectations, Inter-Group Behaviour.

Group Decision making- Meaning, Process, Techniques, Advantages and Disadvantages.

Teams- Concept, Types, Teams Vs Groups, Building and managing effective teams.

Unit 5: Organizational Issues: Organizational Conflicts- Meaning and definition, Sources, Types, Advantages and Disadvantages, Process/ Stages, Conflict Management.

Organizational Culture- Meaning and definition, types, functions, Factors influencing organization culture.

Organizational Change- Concept, Kinds, Resistance to changes, Causes, Overcoming resistance to Change.

Organizational Climate- Concept, Features, Elements.

Unit 6: Industrial Psychology: Meaning, Importance, Scope, Objectives, Characteristics/ Features, History of Industrial Psychology.

• **Suggested Books:**

1. Organizational Behavior by L.M.Prasad
2. Organizational Behaviour by Rakesh Gupta
3. Organizational Behaviour by S.S.Khanka

Unit I

Nature of Financial Management: Finance and related disciplines; Scope of Financial Management; Profit Maximization, Wealth Maximization - Traditional and Modern Approach; Functions of finance – Finance Decision, Investment Decision, Dividend Decision; Objectives of Financial Management; Organization of finance function; Concept of Time Value of Money, present value, future value, and annuity.

Unit II

Long-term investment decisions: Capital Budgeting - Principles and Techniques; Nature and meaning of capital budgeting; Estimation of relevant cash flows and terminal value; Evaluation techniques - Accounting Rate of Return, Net Present Value, Internal Rate of Return & MIRR, Net Terminal Value, Profitability Index Method.

Concept and Measurement of Cost of Capital: Explicit and Implicit costs; Measurement of cost of capital; Cost of debt; Cost of perpetual debt; Cost of Equity Share; Cost of Preference Share; Cost of Retained Earning; Computation of over-all cost of capital based on Historical and Market weights.

Unit III

Capital Structures: Approaches to Capital Structure Theories - Net Income approach, Net Operating Income approach, Modigliani-Miller (MM) approach, Traditional approach, Capital Structure and Financial Distress, Trade-Off Theory.

Dividend Policy Decision - Dividend and Capital; The irrelevance of dividends: General, MM hypothesis; Relevance of dividends: Walter's model, Gordon's model;

Leverage Analysis: Operating and Financial Leverage; EBIT -EPS analysis; Combined leverage.

Unit IV

Working Capital Management: Management of Cash - Preparation of Cash Budgets (Receipts and Payment Method only); Cash management technique, Receivables Management – Objectives; Credit Policy, Cash Discount, Debtors Outstanding and Ageing Analysis; Costs - Collection Cost, Capital Cost, Default Cost, Delinquency Cost, Inventory Management (Very Briefly) - ABC Analysis; Minimum Level; Maximum Level; Reorder Level; Safety Stock; EOQ, Determination of Working Capital.

Readings

1. M.Y. Khan & P.K. Jain: Financial Management Text Problem and Cases, Tata McGraw Hill Publishing Co. Ltd.
2. R. P. Rustogi: Financial Management: Theory Concepts and Practices, Taxmann Publication.
3. I.M. Pandey: Financial Management: Theory and Practices, Vikas Publishing House
4. R.A. Brealey, S.C. Myers, F. Allen & P. Mohanty: Principles of Corporate Finance, McGraw Hill Higher Education
5. J.V. Horne & J.M. Wachowicz: Fundamentals of Financial Management Prentice Hall

BBA-HC-4036 PRINCIPLES OF MARKETING**(CC-11)**

Unit I: Introduction: Nature, Scope and Importance of Marketing, Evolution of Marketing; Core marketing concepts; Company orientation - Production concept, Product concept, Selling concept, Marketing concept, Holistic marketing concept. Marketing Environment: Demographic, economic, political, legal, socio cultural, Technological environment (Indian context); Portfolio approach – Boston Consultative Group (BCG) matrix

Unit II: Segmentation, Targeting and Positioning: Levels of Market Segmentation, Basis for Segmenting Consumer Markets, Difference between Segmentation, Targeting and Positioning;

Unit III: Product & Pricing Decisions: Concept of Product Life Cycle (PLC), PLC marketing strategies, Product Classification, Product Line Decision, Product Mix Decision, Branding Decisions, Packaging & Labelling, New Product Development. Pricing Decisions: Determinants of Price, Pricing Methods (Non-mathematical treatment), Adapting Price (Geographical Pricing, Promotional Pricing and Differential Pricing).

Unit IV: Promotion Mix: Factors determining promotion mix, Promotional Tools – basics of Advertisement, Sales Promotion, Public Relations & Publicity and Personal Selling; Place (Marketing Channels): Channel functions, Channel Levels, Types of Intermediaries: Types of Retailers, Types of Wholesalers. Marketing of Services - Unique Characteristics of Services, Marketing strategies for service firms – 7Ps.

Readings:

1. Kotler, P. & Keller, K. L.: Marketing Management, Pearson.
2. Kotler, P., Armstrong, G., Agnihotri, P. Y., & Ul Haq, E.: Principles of Marketing: A South Asian Perspective, Pearson.
3. Ramaswamy, V.S. & Namakumari, S.: Marketing Management: Global Perspective-Indian Context, Macmillan Publishers India Limited.
4. Zikmund, W.G. & D' Amico, M.: Marketing, Ohio: South-Western College Publishing.

Unit I: Nature and Scope of Marketing Research – Role of Marketing Research in decision making. Applications of Marketing Research – marketing research; The Research process – Steps in the research process; the research proposal; Problem Formulation: Management decision problem Vs. Marketing Research problem.

Unit II: Research Design: Exploratory, Descriptive, Causal. Secondary Data Research: Advantages & Disadvantages of Secondary Data, Criteria for evaluating secondary Sources, secondary sources of data in Indian Context, Syndicated Research (in India)

Unit III: Primary Data Collection: Survey Vs. Observations. Comparison of self administered, Telephone, mail, emails techniques. Qualitative Research Tools: Depth Interviews focus groups and projective techniques; Measurement & Scaling: Primary scales of Measurement-Nominal, Ordinal, Interval & Ratio. Scaling techniques paired Comparison, rank order, constant sum, semantic differential, itemized ratings, Likert Scale; Questionnaire-form & design.

Unit IV: Sampling: Sampling techniques, determination of sample size; Data Analysis:

Readings:

1. Zikmund, Babin & Carr: Business Research Methods, South-Western.
2. Cooper & Schindler: Business Research Methods McGraw-Hill Education,
3. Churchill: Marketing Research: Methodological Foundations, Cengage Learning.
4. Aaker, Kumar, Day - Marketing Research. Wiley.
5. Naresh Malhotra – Marketing Research, Pearson.

THIRD YEAR

Semester-V

BBA-HC-5016 LEGAL ASPECTS OF BUSINESS

(CC-12)

Unit I:

The Indian Contract Act 1872: Meaning and Essentials of contract; Kinds of contract-
Based on: validity, formation & performance, law relating to offer and acceptance,
Consideration, competency to contract, free consent, Void agreements, performance of
Contracts, discharge of contracts, breach of contracts and quasi contract, Special
Contracts: contract of indemnity and guarantee, bailment and pledge, and agency.

Unit II:

Sale of Goods Act 1930: Sale and agreement to sell, implied conditions and warranties,
Sale by non-owners, rights of unpaid seller.

Negotiable Instruments Act 1881:

Meaning of negotiable instruments, type of negotiable instruments, promissory
Note, bill of exchange, Cheque.

Unit III:

The Companies Act 2013:

Meaning and types, Incorporation, Memorandum & Articles of association,
Prospectus, Issue of shares and bonus shares, rights issue, sweat equity, role of
Directors, share qualification, company meetings.

The Limited Liability Partnership Act 2008:

Meaning and nature of limited partnership, formation, partners & their relations, extent
and limitation of liability.

Unit IV:

Consumer Protection Act 1986:

Objectives and machinery for consumer protection, defects and deficiency removal, rights
of consumers.

The Right to Information Act 2005:

Salient features and coverage of the act, definition of terms information, right, record,
public authority; obligations of public authorities, requesting information and functions of
PIO.

Readings:

1. M.C.Kucchal: Business Law/Mercantile Law, Vikas Publishing.House (P) Ltd.
2. M.C.Kucchal,& Vivek Kucchal: Business Legislation for Management, Vikas
Publishing House (P) Ltd.
3. Dr. G. K. Kapoor & Sanjay Dhamija: Company Law and Practice-A comprehensive
textbook on Companies Act 2013, latest edition, Taxmann.
4. Avtar Singh: Principle of Mercantile Law, Eastern Book Company
5. Gulshan Kapoor: Business Law, New Age International Pvt Ltd Publishers.
6. Maheshwari & Maheshwari: Principle of Mercantile Law, National Publishing Trust
7. Rohini Aggarwal: Mercantile & Commercial Law, Taxmann.

BBA- SE-5024 SUMMER PROJECT

(SEC-2)

(Duration 1st July to 15th August)

BBA- HE-5036

(DSE-1)

BBA- HE-5046

(DSE-2)

A Student can choose any two papers from any one of the 3 groups of Discipline Specific Electives (Finance, Marketing or Human Resource) the detailed syllabus for which are given after syllabus for sixth semester.

Semester-VI

BBA-HC-6016 BUSINESS POLICY AND STRATEGY

(CC-13)

Unit I: Nature & importance of business policy & strategy: Introduction to the strategic management process and related concepts; Characteristics of corporate, business & functional level strategic management decisions.

Company's vision and mission: need for a mission statement, criteria for evaluating a mission statement- Goal, Process & Input formulation of the mission statement-Drucker's Performance Area, Bennis's Core Problem; formulation of mission statement.

Unit II: Environmental Analysis & Diagnosis: Analysis of company's external environment Environmental impact on organizations policy and strategy, organisations dependence on the environment, analysis of remote environment, analysis of specific environment- Michael E. Porter's 5 Forces model; Internal analysis: Importance of organisation's capabilities, competitive advantage and core competence, Michael E. Porter's Value Chain Analysis.

Unit III: Formulation of competitive strategies: Michael E. Porter's generic competitive Strategies, implementing competitive strategies- offensive & defensive moves. Formulating Corporate Strategies: Introduction to strategies of growth, stability and Renewal, Types of growth strategies – concentrated growth, product development, Integration, diversification, international expansion (multi domestic approach, Franchising, licensing and joint ventures), Types of renewal strategies – retrenchment and turnaround. Strategic fundamentals of merger & acquisitions.

Unit IV: Strategic Framework: Strategic analysis & choice, Strategic gap analyses, Portfolio analysis – BCG, GE, product market evolution matrix, experience curve, directional policy matrix, life cycle portfolio matrix, grand strategy selection matrix; Behavioural considerations affecting choice of strategy; Culture and Strategic Leadership: Implementing & operationalizing strategic choice, Impact of structure, culture & leadership, functional strategies & their link with business level strategies, Balanced Score Card; Introduction to Strategic control & evaluation, Strategic Surveillance.

Readings:

1. J.A. Pearce & R.B. Robinson : Strategic Management formulation implementation and control, TMH
2. Arthur A. Thompson Jr. & A.J Strickland III : Crafting and executing strategy, TMH

Supplementary Readings

1. Gerry Johnson & Kevan Scholes, Exploring corporate strategies, PHI
2. Upendra Kachru: Strategic Management, Excel books
3. Arthur A. Thompson Jr. and A.J. Strickland: Strategic Management –Concepts and Cases, McGraw-Hill Companies
4. Lawrence R. Jauch & William F. Glueck: Business Policy and Strategic Management (Mcgraw Hill Series in Management).

BBA-HC-6026 TAXATION LAWS

(CC-14)

Unit 1: Law relating to Income Tax : Basic concepts and definitions, Previous year, Assessment year, Assesses, Person, Agricultural Income, Casual Income, Exempted Incomes, Residential Status and Tax Liability.

Unit 2: Heads of Income: Income from Salaries, Income from House Property, Profits and Gains of Business or Profession, Capital Gains, Income from Other Sources. (Simple Problems)

Unit 3: Computation of Gross Total Income and Total Income, deductions from Gross Total Income of individuals.

Unit 4: Concept of Incidence, Impact and Shifting of Tax ; Tax planning, tax avoidance and tax evasions.

Unit 5: Goods and Services Tax (GST) : Basic concepts, Levy of GST.

• **Suggested Books:**

1. Direct Taxes – B.B.Dam, Sujit Sikidar, R.Barman, B.Bora.
2. Students' Guide to GST & Customs Law (Taxmann) – Dr. Vinod K. Singhanian
3. Students' Guide to Income Tax (Taxmann) – Dr Vinod K. Singhanian, Dr.Monica Singhanian.

BBA- HE-6036

(DSE-3)

BBA- HE-6046

(DSE-4)

A Student can choose any two papers from the same Discipline Specific Elective group from which he/she has chosen the two DSE papers in semester-V. The detailed syllabus is given below:-

DSE Group I : FINANCE

INTERNATIONAL FINANCE

UNIT-I

Introduction: concept of International trade, International Business, International Finance and differences among them. Theories of International trade, International trade financing in India, Balance of payments (of India)

International Monetary System: Different types of Exchange rate mechanisms- the gold standard, the gold exchange standard, The Bretton Woods System, Current monetary system, European Monetary Union. IMF and World Bank.

UNIT-II

Foreign Exchange Management: Forex market – Wholesale and Domestic market, Quotations- direct, indirect and cross currency; various kinds of transactions and their Settlement dates, forward rates, Swaps, Quotes for various kinds of Merchant Transactions; Early delivery, extension or cancellation of Forward contracts
Exchange Rate determination and Forecasting: Purchasing power parity and Interest rate Parity, relationship between PPP and IRP, reasons for deviation from PPP and IRP; models of exchange rate forecasting- forward rate as an unbiased predictor, the Demand-Supply approach, the monetary approach, the Asset approach, the portfolio balance Approach, other models

UNIT-III

Foreign Exchange Exposures: Financial Accounting and Foreign Exchange- Alternative Currency Translation Methods, Statement of Financial Accounting, Standards No.8, Statement of Financial Accounting Standards No.-52, Transaction Exposure, Managing Accounting Exposure- Managing Transaction and Translation Exposure, Designing a Hedging Strategy, Measuring and managing Economic Exposure- Foreign Exchange Risk and Economic Exposure, Identifying Economic Exposure, Calculating Economic Exposure, Operational Measure of Exchange Risk.

Multinational Financial System- Value of the Multinational Financial System, Intercompany Fund- Flow Mechanisms: Cost and Benefits, Designing a Global Remittance Policy, Transfer Pricing and Tax Evasion. Issue of GDR, ADR Euro bonds and Foreign bonds.

UNIT-IV

International Investment Management: International Portfolio Investment- Issues in Foreign Investment Analysis, International Bond Investing, Strategies for Direct Investment, Bond Investment & Portfolio Investment, Optional International Asset Allocation. International project appraisal- IRR and APV methods; Managing Political Risk- Measuring Political Risk, Country Risk Analysis, Managing Political Risk, Post expropriation Policies.

Multinational Working Capital Management: Current Asset Management for the Multinational- International Cash Management, Accounts Receivables Management, Inventory Management.

Text Books:

1. PG Apte: International Finance, TataMcgraw Hill.
2. Alan C. Shapiro: Multinational Financial Management- Prentice Hall

References:

3. Maurice D. Levi: International Finance- The Markets and Financial Management of Multinational Business, Mcgraw Hill.

INVESTMENT BANKING AND FINANCIAL SERVICES

UNIT- 1

Introduction: An Overview of Indian Financial System, Investment Banking in India, Recent Developments and Challenges ahead, Institutional structure and Functions of Investment / Merchant Banking; SEBI guidelines for Merchant Bankers, Registration, Obligations and responsibilities of Lead Managers, Regulations regarding Continuance of Association of lead manager with an issue

UNIT II

Issue Management: Public Issue: classification of companies, eligibility, issue pricing, Promoter's contribution, minimum public offer, prospectus, allotment, preferential Allotment, private placement, Book Building process, designing and pricing, Green Shoe Option; Right Issue: promoter's contribution, minimum subscription, advertisements, Contents of offer document, Bought out Deals, Post issue work & obligations, Investor Protection, Broker, sub broker and underwriters

UNIT III

Leasing and Hire Purchase: Concepts of leasing, types of leasing – financial & operating Lease, direct lease and sales & lease back, advantages and limitations of leasing, Lease Rental determination; Finance lease evaluation problems (only Lessee's angle), Hire Purchase interest & Installment, difference between Hire Purchase & Leasing, Choice Criteria between Leasing and Hire Purchase mathematics of HP, Factoring, forfaiting and its arrangement, Housing Finance : Meaning and rise of housing finance in India, Fixing the amount of loan, repricing of a loan, floating vs. fixed rate, Practical problems on housing finance.

UNIT IV

Venture Capital: Concept, history and evolution of VC, the venture investment process, various steps in venture financing, incubation financing.

Insurance: concept, classification, principles of insurance, IRDA and different regulatory norms, operation of General Insurance, Health Insurance, Life Insurance.

Credit Ratings: Introduction, types of credit rating, advantages and disadvantages of credit ratings, Credit rating agencies and their methodology, International credit rating practices.

Securitization: concept, securitization as a funding mechanism, Traditional and nontraditional mortgages, Graduated-payment mortgages (GPMs), Pledged-Account Mortgages (PAMs), Centralized Mortgage obligations (CMOs), Securitization of non mortgage assets, Securitization in India.

REFERENCES

1. M.Y.Khan: Financial Services, Tata McGraw –Hill.
2. Machiraju: Indian Financial System, Vikas Publishing House.
3. J.C.Verma: A Manual of Merchant Banking, Bharath Publishing House.
4. K.Sriram: Hand Book of Leasing, Hire Purchase & Factoring, ICFAI, Hyderabad.
5. Ennew.C.Trevor Watkins & Mike Wright: Marketing of Financial Services, Heinemann Professional

INVESTMENT ANALYSIS AND PORTFOLIO MANAGEMENT

Unit I

Basics of risk and return: concept of returns, application of standard deviation, coefficient of variation, beta, alpha. Bonds : present value of a bond, yield to maturity, yield to call, yield to put, systematic risk, price risk, interest rate risk, default risk. Yield curve and theories regarding shape of yield curve. Unsystematic risk and non-risk factors that influence yields. Duration and modified duration, immunization of a bond portfolio. Fundamental analysis: EIC framework; Economic analysis: Leading lagging & coincident macro-economic indicators, Expected direction of movement of stock prices with macro-economic variables in the Indian context; Industry analysis: stages of life cycle, Porter's five forces model, SWOT analysis, financial analysis of an industry; Company Analysis.

Unit II

Share valuation: Dividend discount models- no growth, constant growth, two stage Growth model, multiple stages; Relative valuation models using P/E ratio, book value to market value. Technical analysis: meaning, assumptions, difference between technical and fundamental analysis; Price indicators- Dow theory, advances and declines, new highs and lows- circuit filters. Volume indicators- Dow Theory, small investor volumes. Other indicators- futures, institutional activity, Trends: resistance, support, consolidation, Momentum- Charts: line chart, bar chart, candle chart, point & figure chart. Patterns: head & shoulders, triangle, rectangle, flag, cup & saucer, double topped, double bottomed, Indicators: moving averages. Efficient market hypothesis; Concept of efficiency: Random walk, Three forms of EMH and implications for investment decisions. (No numericals in EMH and technical analysis)

Unit III

Portfolio analysis: portfolio risk and return, Markowitz portfolio model: risk and return for 2 and 3 asset portfolios, concept of efficient frontier & optimum portfolio. Market Model: concept of beta systematic and unsystematic risk. Investor risk and return preferences: Indifference curves and the efficient frontier, Traditional portfolio management for individuals: Objectives, constraints, time horizon, current wealth, tax considerations, liquidity requirements, and anticipated inflation, Asset allocation: Asset allocation pyramid, investor life cycle approach, Portfolio management services: Passive – Index funds, systematic investment plans. Active – market timing, style investing.

Unit IV

Capital asset pricing model (CAPM): Efficient frontier with a combination of risky and risk free assets. Assumptions of single period classical CAPM model. Characteristic line, Capital Market Line, Security market Line. Expected return, required return, overvalued and undervalued assets. Mutual Funds :Introduction, calculation of Net Asset Value (NAV) of a Fund, classification of mutual fund schemes by structure and objective, Advantages and disadvantages of investing through mutual funds. Performance Evaluation using Sharpe's Treynor's and Jensen's measures.

References:

1. Fischer, D.E. & Jordan, R.J.: Security Analysis & Portfolio Management, Pearson Education.
2. Sharpe, W.F., Alexander, G.J. & Bailey, J.: Investments, Prentice Hall of India.
3. Singh,R: Security Analysis & Portfolio Management . Excel Books.
4. Frank K Reilly & Keith C Brown: Investment Analysis and Portfolio Management, Cenage India Pvt. Ltd.

STRATEGIC CORPORATE FINANCE

UNIT-I

Introduction to strategic corporate finance: Strategy Vs Planning, significance of strategy in financial decisions, Different types of financial strategy for Shareholders Wealth Maximization, overall corporate value addition and Economic Value Addition.

Strategic Cost Management: Traditional costing Vs Strategic Costing, Relevant costs Vs Irrelevant costs, Different types of strategic costing and their relevance- Target Costing, Activity based Costing, Life Cycle Costing, Quality Costing, Zero Based Budgeting, Strategic cost reduction techniques and value chain analysis.

Alternative sources of financing – alternative sources of financing, Different approach to infrastructure projects financing- Public Private Partnership (PPP) and its relevance.

UNIT-II

Management Buy-outs: Establishing feasibility of the buy-out, Negotiating the main terms of the transaction with the vendor including price and structure, Developing the business plan and financial forecasts in conjunction with the buy-out team for submission to potential funders, negotiations with potential funders so that the most appropriate funding offers are selected.

Management Buy-ins: Management Buy-in/Buy-outs (“BIMBOs”), Vendor initiated buy-outs/buy-ins.

Valuing Real assets in the presence of risk: tracking portfolios and Real Asset valuation, Different Approaches of Valuing Real Assets, Capital Budgeting and Strategic policy

Real options: Financial and real options compared, various types of real options, the Black-Scholes model, Decision tree analysis, application of Real options, Drawbacks of Real options

UNIT-III

Financial Distress and restructuring: Meaning of Bankruptcy, Factors leading to Bankruptcy, symptoms and predictions of bankruptcy, reorganization of distressed firms, liquidation of firms. Company disposals: retirement sale or the sale of a noncore Subsidiary, planned exit, forceful retirement and other disposals. Exit strategy most appropriate exit route, valuation, timing of sale and tax planning opportunities, Identification of potential purchasers, approaching the potential purchaser, negotiate with potential acquirers and selection of a preferred purchaser, calculation of the various tax implications.

Fundraising: identification of different sources of development capital, determination of capital structure and factors affecting the capital structure, cost of capital and cost saving strategy, production of a business plan and financial forecasts to enable potential funders to assess the proposition. Due Diligence: financial due diligence for both purchasers and financial institutions, good quality “added value” due diligence advice.

UNIT-IV

Company Valuation: an overview of valuation, valuation principles and practices more, the impact of “what if” scenarios, the key financial and commercial factors Affecting the business. Value enhancement tools & techniques, the link between valuation and corporate finance.

Other strategic issues: managing credit ratings, and setting dividend and share Repurchase policy, problem of too much cash. The issues of stock liquidity and Illiquidity, Strategic risk management, the substitutability of capital structure and risk Management choices, such as process control efforts, financial, physical, and Operational hedging, value-based management.

Text Books: (1). Aswath Damodaran: Corporate finance theory and practice; John Willey & Sons, Inc (2). Jakhota: Strategic Financial Management (Vikas Publication)

BUSINESS ANALYSIS AND VALUATION

Unit I

Analysis of Corporate Financial Statements: Income statements and Balance sheets
Through ratio analysis and analyzing the Chairman's statement, Directors' report,
Management discussion & analysis, report on corporate governance, auditor's report to
Evaluate the financial soundness of the company.

Unit II

Cash Flows: Firm cash flows, Earnings, Tax effect, Reinvestment needs; Equity cash
Flows: Dividend, Forecasted Cash flows, terminal value estimation approaches. Equity
Discounted cash Flow Models-Dividend discount models, extensions of DDM; free cash
flow to equity model

Unit III

Introduction to Valuation: Approaches to valuation, Discounted Cash Flow, Relative
Valuation, Role of valuation; Discounted Cash flow Valuation: Estimating discount rates cost
of equity, cost of equity to cost of capital; Valuation of an asset with guaranteed cash
flows, introducing uncertainty into valuation (valuing an asset with default risk & equity
risk), valuing an asset with an infinite life.

Unit IV

Firm Valuation Models: Cost of capital approach, adjusted present value approach, EVA,
Capital structure and firm value. Relative valuation-popularity and potential pitfalls;
reconciling relative and discounted cash flow valuation Equity Multiples; Value
Multiples; Valuation of different kinds of companies.
Value of Synergy; operating and financial synergy, Cash and tax benefits, debt capacity,
Evidence on synergy, common errors in valuing synergy; Valuing Real options

Text Books:

1. Foster, George *Financial Statement Analysis*, 2nd ed., Pearson Education Pvt Ltd
2. Damodaran, A. (2008). *Damodaran on Valuation, Security Analysis for investment and Corporate Finance* (2nd ed.). Wiley India Pvt. Ltd.

References:

1. Chandra, P. (2011). *Corporate Valuation and Value Creation*, (1st ed). TMH
2. Weston, Chung, Hoag, *Mergers, Restructuring and Corporate Control*, Prentice Hall of India

DSE Group II: MARKETING

CONSUMER BEHAVIOUR

Unit I

Consumer Behaviour: Nature, scope & application: Importance of consumer behaviour in marketing decisions, characteristics of consumer behaviour, role of consumer research, consumer behaviour- interdisciplinary approach. Introduction to 'Industrial Buying Behaviour' Market Segmentation: VALS 2 segmentation profile.

Unit II

Consumer Needs & Motivation: Characteristics of motivation, arousal of motives, Theories of needs & motivation: Maslow's hierarchy of needs, McLelland's APA theory, Murray's list of psychogenic needs, Bayton's classification of motives, self-concept & its Importance, types of involvement. Personality & Consumer Behaviour: Importance of personality, theories of personality- Freudian theory, Jungian theory, Neo-Freudian theory, Trait theory: Theory of self images; Role of self-consciousness. Consumer Perception: Concept of absolute threshold limit, differential threshold limit & Subliminal perception: Perceptual Process: selection, organisation & interpretation. Learning & Consumer Involvement: Importance of learning on consumer behaviour, learning theories: classical conditioning, instrumental conditioning, cognitive learning & Involvement theory. Consumer Attitudes: Formation of attitudes, functions performed by attitudes, models of attitudes: Tri-component model, multi-attribute model, attitude towards advertisement model: attribution theory.

Unit III

Group Dynamics & consumer reference groups: Different types of reference groups, factors affecting reference group influence, reference group influence on products & brands, application of reference groups. Family & Consumer Behaviour: Consumer socialisation process, consumer roles within a family, purchase influences and role played by children, family life cycle. Social Class & Consumer behaviour: Determinants of social class, measuring & characteristics of social class. Culture & Consumer Behaviour: Characteristics of culture, core values held by society & their influence on consumer behaviour, introduction to sub-cultural & cross-cultural influences. Opinion Leadership Process: Characteristics & needs of opinion leaders & opinion receivers, interpersonal flow of communication.

Unit IV

Diffusion of Innovation: Definition of innovation, product characteristics influencing diffusion, resistance to innovation, adoption process. Consumer Decision making process: Process- problem recognition, pre-purchase search influences, information evaluation, purchase decision (compensatory decision rule, conjunctive decision, rule, Lexicographic rule, affect referral, disjunctive rule), postpurchase evaluation; Situational Influences Models of Consumer Decision making: Nicosia Model, Howard-Sheth Model, Howard- Sheth Family Decision Making Model, Engel, Kollat& Blackwell Model, Sheth Newman Gross Model of Consumer Values.

NOTE: Cases & application to marketing will be taught with respect to each topic.

Readings

1. Leon G.Schiffman & Leslie L.Kanuk: Consumer Behaviour, Prentice Hall Publication, latest Edition
2. Solomon, M.R.: Consumer Behaviour – Buying, Having, and Being, Pearson Prentice Hall.
3. Blackwell, R.D., Miniard, P.W., & Engel, J. F.: Consumer Behaviour, Cengage Learning.
4. Hawkins, D.I., Best, R. J., Coney, K.A., & Mookerjee, A: Consumer Behaviour – Building Marketing Strategy, Tata McGraw Hill.
5. Kotler, P. & Keller, K. L.: Marketing Management (Global Edition) Pearson

MARKETING OF SERVICES

Unit I: The emergence of service economy: contributory factors, consumption pattern analysis, economic transformation unique aspects of services: goods, services, products, managerial challenges

Unit II: Marketing mix: concept of value and value drivers, extended framework Service marketing system: production, marketing, human resources, sequential analysis.

Unit III: Service system positioning: service delivery process, blueprinting Service buying behaviour; difference in perspective, risk analysis, decision process.

Unit IV: Service marketing strategy; segmentation, targeting and positioning, market innovation Competitive differentiation; competitive advantage and value chain analysis

Unit V: Service quality; concept, technical and functional quality, Service quality models and measurement Demand and supply imbalances management; challenges and strategies; Service culture; managing by values, recovery and empowerment; Relationship building: relationship marketing, bonding and life time value Service industries: insurance, banking, air transportation, courier, education etc.

Text Books:

1. Fisk, R. P., Grove, S. J., & John, J.: Interactive services marketing. New York. Houghton Mifflin.
2. Glynn, W. J., & Barnes, J. G.: Understanding services management - Integrating marketing, organizational behaviour, operations and human resources management, Prentice Hall.

References:

1. Gronroos, C.: Service Management and Marketing - A customer relationship management approach, New York: John Wiley.
2. Hoffman, K. D., & John, E. G. B.: Marketing of services: Concepts strategies and cases, Thomson-South Western.
3. Shanker, R. (2002). Services Marketing: The Indian perspective, Excel Books.

ADVERTISING AND BRAND MANAGEMENT

Unit I

Advertising need & importance: Definition & growth of modern advertising, advertising & the marketing mix, types & classification of advertisement, advertising spiral; Social & economic aspects of advertising; Marketing communication models: AIDA, hierarchy of effect, innovation adoption model, action first model, quick decision model; Planning framework of promotional strategy

Unit II

How advertising works: Exposure, salience, familiarity, low involvement, central route & Peripheral route & cognitive learning; Positioning strategies ; Associating feelings with a brand; Developing brand personality ; Creating copy strategies: Rational & emotional Approaches, selection of an endorser, creative strategy & style- brand image, execution, USP, common touch & entertainment, message design strategy, format & formulae for Presentation of appeals (slice of life, testimonials, etc.), different types of copy; Art & layout of an advertisement: Principles of design, layout stages, difference in designing of Television, audio & print advertisement

Unit III

Media planning & scheduling: Introduction to broadcast & non -broadcast media; Budgeting decision rule: percentage of sales method, objective to task method, competitive parity, & all you can afford; Key factors influencing media planning; Media decisions: media class, media vehicle & media option; Scheduling: flighting, pulsing, & continuous

Unit IV

Management of sales promotion: Importance & need for sales promotion, planning for consumer schemes & contests, different types of consumer schemes.

Unit V

Introduction to brands and brand management, Concept of a brand, brand evolution, Branding challenges and opportunities, Strategic brand management process.

Unit VI

Identifying and establishing brand positioning and values; Brand building, brand Positioning and values brand repositioning.

Unit VII

Designing and implementing brand strategies; Brand extension. Brand hierarchy Kapfrer. Brand equity, brand personality, brand image, managing brands overtime.

Integrating advertising and brand management

Note: Applied cases would be taken up in class.

Readings:

1. Aaker, Myers &Batra : Advertising Management , Prentice Hall.
2. Wells, Moriarity & Burnett : Advertising Principles & practices , Prentice Hall.
3. Kleppner's Advertising Procedure: W.Ronald Lane, Kane Whitehill king and J. Thomas Russell, Pearson Education.
4. George E.Belch& Michael A. Balch : Advertising and Promotion, TMH
5. S.H.H Kazmi and SatishK.Batra : Advertising and sales promotion, Excel books
6. Cowley. D: Understanding Brands, , Kogan Page Ltd
7. Jean Noel Kamperer: Strategic Brand Management, Kapferer Free Press
8. David Aaker: Brand Leadership, Simon & Schuster
9. Wright, Winter, Ziegler: Advertising, Atlantic Publishers & Dist.
10. Sandage, Fryburger,: Advertising Theory & Practice, Ratroll Longman Group

RETAIL MANAGEMENT

Unit I:

Introduction to Retailing, Definition, Characteristics, Evolution of Retailing in India, Retailing in India, Emerging Trends in Retailing, Factors Behind the change of Indian Retail Industry.

Unit II:

Retail Formats: Retail Sales by ownership, On the basis of Merchandise offered, nonstore Based retail mix & Non traditional selling.

Unit III:

Store Planning: Design & Layout, Location Planning and its importance, retailing image mix, Effective Retail Space Management, Floor Space Management.

Unit IV:

Retail Marketing: Advertising & Sales Promotion, Store Positioning, Retail Marketing. Mix, CRM, Advertising in Retailing.

Unit V:

Retail Merchandising: Buying function, Markups & Markdown in merchandise management, shrinkage in Retail merchandise management.

Unit VI:

Merchandise Pricing: Concept of Merchandise Pricing, Pricing Options, Pricing Strategies, Pricing Objectives, Types of Pricing.

Unit VII:

Retail Operation: Elements/Components of Retail Store Operation, Store Administration, Store Manager –Responsibilities, Inventory Management, Management of Receipts, Customer Service, Management of Retail Outlet/Store, Store Maintenance, Store Security.

Readings

1. Cullen & Newman: Retailing – Environment & Operations, Cengage Learning EMEA
2. Berman & Evarv: Retail Management, Perntice Hall.
3. Bajaj, Tuli & Srivastava: Retail Management- Oxford University Publications
4. Gibson G Vedamani: Retail Management: Functional principles & practices, Jaico Publishing House.
5. Harjit Singh: Retail Management, S. Chand Publication.

PERSONAL SELLING AND SALES FORCE MANAGEMENT

Unit I Introduction to Personal Selling; functions of a sales person, qualities of an effective Sales Person; Personal Selling situations.

Unit II Theories of Selling: AIDAS, Right Set of circumstances, Buying formula theory.

Unit III The Selling Process: Preapproach – acquiring product knowledge, acquiring competition and market knowledge, Identifying and qualifying prospects – sources of prospecting, conditions for qualification, Opening a sale – methods of approaching, Sales presentation – presentation strategies and methods, Sales demonstration – planning effective demonstration, use of sales tools, Handling objection – types of objections, determining hidden objections, strategies for handling objections, Closing a sale – trial close, closing techniques, Post sales follow up.

Unit IV Introduction to sales force management: Objectives of Sales management, Role of a sales manager; Managing Sales force – Recruitment, Selection, Training, Compensation and evaluation of sales force; Sales Territory Coverages: Sales Territory Concept, Reasons for establishing sales territories, procedures for selling up sales territories.

Readings:

1. Still, Cundiff & Govani: Sales Management, Prentice Hall of India
2. Charles Futrell: Fundamentals of Selling, McGraw Hill

DSE Group III : HUMAN RESOURCE

HUMAN RESOURCE DEVELOPMENT : SYSTEMS AND STRATEGIES

UNIT - I:

Human Resource Development (HRD) : Concept, Origin and Need, Relationship between human resource management and human resource development; HRD as a Total System; Activity Areas of HRD : Training, Education and Development; Roles and competencies of HRD professionals.

UNIT - II:

HRD Process: Assessing need for HRD; Designing and developing effective HRD programs; Implementing HRD programs; Evaluating HRD programs.

UNIT- III:

HRD Interventions: Integrated Human Resource Development Systems, Staffing for HRD; Physical and Financial Resources for HRD. HRD and diversity management; HRD Climate; HRD Audit.

UNIT – IV:

HRD Applications: Coaching and mentoring, Career management and development; Employee counseling; Competency mapping, High Performance Work Systems, Balanced Score Card, Appreciative inquiry. Integrating HRD with technology.

UNIT – V:

Evaluating the HRD Effort; Data Gathering; Analysis and Feedback; Industrial relations and HRD. HRD Experience in Indian Organizations, International HRD experience, Future of HRD.

Readings:

1. Nadler, Leonard: Corporate human Resource Development, Van Nostrand Reinhold / ASTD, New York.
2. Rao T.V. and Pareek, Udai: Designing and Managing Human Resource Systems, Oxford and IBH Publication Ltd.
3. Rao T.V.: Reading in human Resource Development, Oxford IBH Publication .Ltd.
4. Viramani B.R. and Seth, Pramila: Evaluating Management Training and Development, Vision Books.
5. Rao T.V.: Human Resource Development, Sage publication.
6. Kapur, Sashi: Human resource Development and Training in Practice, Beacon Books.
7. Lynton, Rolf P. and Pareek, Udai: Training for Development, Vistaar publication.
8. Werner J. M., DeSimone, R.L.: Human resource development, South Western.
9. Mankin, D.: Human resource development, Oxford University Press India.
10. Haldar, U. K.: Human resource development, Oxford University Press India.
11. Rao, T.V.: Future of HRD, Macmillan Publishers India.

MANAGEMENT OF INDUSTRIAL RELATIONS :

Unit I -Concept of industrial relations, aspects of industrial relations, conflict and Cooperation, parties in industrial relations, workers employers and government, trade unions, objectives collective bargaining.

Unit II -Workers participation in management, levels of participation, mode of Participation Works Committee, Joint Management councils, Worker Director, Grievance Procedure, Quality Circles.

Unit III Trade Union Act 1926, Immunity granted to Registered Trade Unions, Recognition of Trade Unions . The Industrial Employment (Standing Orders) Act 1946, Scope, coverage, certification process, modification, interpretation, and enforcement. The Industrial Disputes Act 1947, forum for settlement of disputes, instruments of Economic coercion, strikes, lockouts and closure.

Unit IV Salient features, coverage of employees and employers, rules and benefits relating to The Payment of Wages Act 1936, The Payment of Gratuity Act 1972, The Minimum Wages Act 1948, and The Payment of Bonus Act 1965.

Unit V The Factories Act 1948, definition, approval, licensing and registration, health and welfare measures ,employment of women and young persons ,leave with wages and weekly holidays.

Unit VI The salient features ,coverage of employees and employers, and benefits under The Provident Fund and Miscellaneous Provisions Act 1952 and Employees Pension Scheme and Employees State Insurance Act 1948.

References:

1. S C Srivastava: Industrial Relations and Labour Laws, Vikas Publishing House.
2. T N Chhabra: Industrial Relations and Labour Laws, Dhanpat Rai Publishing House.

TALENT AND KNOWLEDGE MANAGEMENT

Unit I

Meaning and importance of talent management, Talent management Grid, Creating talent management system, Strategies of talent management.

Unit II

Competency model, Competency mapping, Role of leaders in talent management, Talent management and competitive advantage.

Unit III

Elements of knowledge management, Advantages of knowledge management, Knowledge management in learning organisations. Types of Knowledge: Tacit and Explicit .Managing knowledge workers.

Unit IV

Knowledge management process, Approaches to knowledge management: Knowledge management solutions, Knowledge creation, Knowledge sharing, Knowledge dissemination, Knowledge management life cycle, Nonaka's model of knowledge. Knowledge capturing techniques: Brainstorming, Protocol analysis, Consensus decision making, Repertory grid, Concept mapping.

Unit V

Knowledge management strategies: Aligning individual needs with organisation, Reward systems for knowledge management, Knowledge audit, Benchmarking, Balance score card, Gap analysis.

Readings

1. Lance A. Berger, Dorothy Berger: Talent management handbook, McGraw Hill New York.
2. Cappeli Peter: Talent on Demand –Managing Talent in an age of uncertainty, Harvard Business press.
3. Awad.E.M and Ghaziri.H.M: Knowledge management, Pearson education International.
4. Stuart Barnes: Knowledge management system theory and practice, Thomson learning.
5. Donald Hislop: Knowledge management in organisations, Oxford University press.
6. Sudhir Warier: Knowledge management, Vikas publishing house.
7. T. Raman: Knowledge management –a resource book, Excel books.

PERFORMANCE AND COMPENSATION MANAGEMENT

Unit I

Introduction- Concept, Philosophy, History from performance appraisal to performance development. Objectives of performance management system; Performance management and performance appraisal; Performance Management process: Performance planning, Process and Documentation of Performance appraisal, Appraisal Interview, Performance Feedback and Counselling.

Unit II

Performance management and reward systems. Performance Coaching ,Mentoring and Counselling, Competency development, Use of technology and e-PMS, International Aspects of PMS. Performance systems trends, Ethical Perspectives in performance appraisal.

Unit III

Introduction to Job Evaluation.Methods of Job Evaluation.Company Wage Policy: Wage Determination, Pay Grades, Wage Surveys, Wage Components. Modern trends in compensation - from wage and salary to cost to company concept, Comparable worth, broadbanding, competency based pay.

Unit IV

Incentives plans for production employees and for other professionals. Developing effective incentive plans, pay for performance,. Supplementary pay benefits, insurance benefits, retirement benefits, employee services benefits. Benefits & Incentive practices in indian industry.

Unit V

Wages in India: Minimum wage, fair wage and living wage. Methods of state regulation of wages. Wage differentials & national wage policy Regulating payment of wages, wage boards, Pay commissions, dearness allowances, linking wages with productivity,. Special compensation situations: International compensation-managing variations. Expatriate Pay.

Readings:

1. Milkovich & Newman , Compensation, McGraw Hill.
2. T.J. Bergman , Compensation Decision Making, Harcourt, Fort Worth, TX
3. Richard Henderson: Compensation management in a knowledge based world, Prentice Hall.
4. T.N.Chhabra & Savitha Rastogi Compensation management, Sun India Publications.
5. Gary Dessler , Human Resource Management, Prentice Hall.
6. Armstrong's Handbook of Performance Management: An Evidence-Based Guide to Delivering High Performance :Book by Michael Armstrong
7. Herman Aguinis: Performance Management, Prentice Hill.
8. Armstrong, M. & Baron, A: Performance management and development, Jaico Publishing House
9. Armstrong, M., Performance management: Key strategies and practical guidelines, Kogan Page, London.
10. Bagchi, S. N.: Performance management, Cengage Learning India.
11. Bhattacharyya, D.K.: Performance management systems and strategies, Pearson Education.
12. Robert B.: Performance management, McGraw-Hill Education India.

TRAINING AND MANAGEMENT DEVELOPMENT

Unit I - Organization vision & plans, assessment of training needs, setting training objectives, designing training programmes, Spiral model of training.

Unit II - Tasks of the training function: Building support, overall training capacity, Developing materials, strategic planning, networking, designing training programmes.

Unit III -Training methods: On the job training, job instruction training, apprenticeship, coaching, job rotation, syndicate method, knowledge based methods, lecture, conferences, programmed learning, simulation methods, case study, vestibule training, laboratory training, in-basket exercise, experiential methods, sensitivity training, e-training.

Unit IV -Management Development Programme Methods:-Understudy, Coaching, Action Learning, Role Play, Management Games, Seminars, University related programmes, special projects, behavioural modeling, job rotation, case study, multiple management, sensitivity training. Post training: Training evaluation, Training impact on individuals and organizations, Evaluating Programmes, Participants, Objectives.

Unit V- Organisational Development (OD): Definition Foundations of OD, Managing the OD Process, Action Research and OD. OD Interventions: Overview of OD Interventions, Team Interventions Inter-group and Third-Party Peacemaking Interventions. Comprehensive OD Interventions, Structural Interventions and the Applicability of OD, Training Experiences. Issues in Consultant –Client Relationships, System Ramifications, Power, Politics and OD

Readings:

1. Blanchard P.Nick & Thacker James: Effective Training, Systems, Strategies and Practices, Pearson.
2. French Wendell, Bell Cecil and Vohra Veena: Organisation Development, Behavioral Science Interventions for Organisation Improvement, Prentice Hall.
3. Lynton Rolf & Pareek Udai: Training & Development, Prentice Hall.
4. Bhatia S.K.: Training & Development, Deep & Deep Publishers.

Gauhati University
Syllabus for B.Sc.(Honors)
ZOOLOGY
Choice Based Credit System (CBCS)

Course effective from academic year 2019-20

Syllabus for B.Sc.(Honors) Zoology

Choice Based Credit System (CBCS)

Course effective from academic year 2019-20

This is approved in the Academic Council on 08//11/2019



Gauhati University

Guwahati::Assam

Mapping of Subjects 1st Semester

Type	Core	AEC	SEC	DSE	GEN
Credits	14 × 6 = 84	2 × 4 = 8	2 × 4 = 8	4 × 6 = 24	4 × 6 = 24
Honours Sem I	ZOO-HC-1016	ENG-AE-1014			XXX-HG-1XX6
	ZOO-HC-1026				ZOO-HG-1XX6
					XXX-HG-1XX6
					...
					...

Type	Core	AECC	SEC	DSE
Credits	12 × 6 = 72	2 × 4 = 8	4 × 4 = 16	6 × 6 = 36
Regular Sem I	ZOO-RC-1016	ENG-AE-1014		
	YYY-RC-1016			
	ZZZ-RC-1016			

2nd Semester

Type	Core	AEC	SEC	DSE	GEN
Credits	14 × 6 = 84	2 × 4 = 8	2 × 4 = 8	4 × 6 = 24	4 × 6 = 24
Honours Sem II	ZOO-HC-2016	ENV-AE-2014			XXX-HG-2XX6
	ZOO-HC-2026				ZOO-HG-2XX6
					XXX-HG-2XX6
					...
					...

Type	Core	AECC	SEC	DSE
Credits	12 × 6 = 72	2 × 4 = 8	4 × 4 = 16	6 × 6 = 36
Regular Sem II	ZOO-RC-2016	ENV-AE-2014		
	YYY-RC-2016			
	ZZZ-RC-2016			

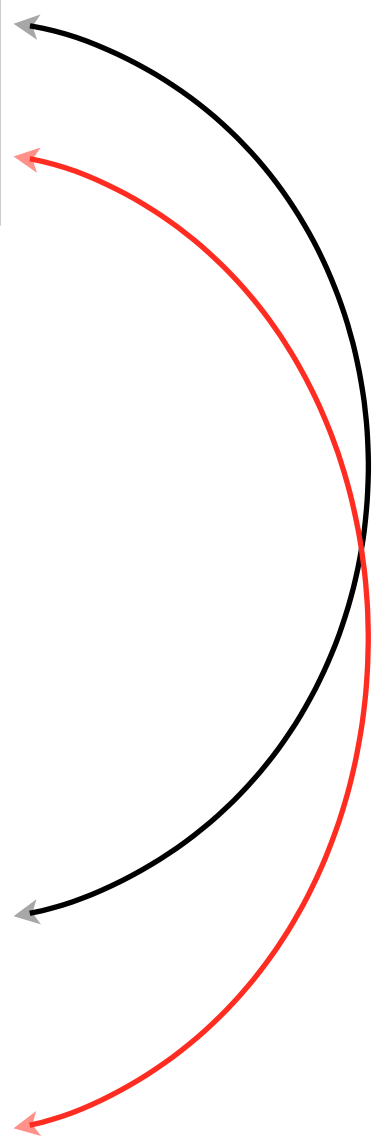
BSc Courses
3rd - 6th Semesters

Type		Core	AEC	SEC	DSE	GEN
Credits		14 × 6 = 84	2 × 4 = 8	2 × 4 = 8	4 × 6 = 24	4 × 6 = 24
Sem III	ZOO-HC-					
	ZOO-HC-			ZOO-SE-3XX4		ZOO-HC-3XX6
	ZOO-HC-					
Sem IV	ZOO-HC-					
	ZOO-HC-			ZOO-SE-4XX4		ZOO-HG-4XX6
	ZOO-HC-					
Sem V	ZOO-HC-				ZOO-HE-	
	ZOO-HC-				ZOO-HE-	
Sem VI	ZOO-HC-				ZOO-HE-	
	ZOO-HC-				ZOO-HE-	

Type		Core	AECC	SEC	DSE
Credits		12 × 6 = 72	2 × 4 = 8	4 × 4 = 16	6 × 6 = 36
Sem III	ZOO-RC-3016				
	YYY-RC-3016			ZOO-SE-3XX4	
	ZZZ-RC-3016				
Sem IV	ZOO-RC-4016				
	YYY-RC-4016			ZOO-SE-4XX4	
	ZZZ-RC-4016				
Sem V					ZOO-RE-5XX6
				ZOO-SE-5XX4	ZOO-RE-5XX6
					ZOO-RE-5XX6
Sem VI					ZOO-RE-6XX6
				ZOO-SE-6XX4	ZOO-RE-6XX6
					ZOO-RE-6XX6

UNIVERSITY

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ZOO-HC-1026: Principles of Ecology.....	
SemesterII	
ZOO-HC-2016: Non-chordates II:Coelomates	
ZOO-HC-2026: Cell Biology.....	
SemesterIII	
ZOO-HC-3016:DIVERSITY OF CHORDATES.....	
ZOO-HC-3026 Physiology: Controlling and Coordinating Systems	
ZOO-HC-3036:FUNDAMENTALS OF BIOCHEMISTRY	
SemesterIV.....	
ZOO-HC-4016:COMPARATIVE ANATOMY OF VERTEBRATE.....	
ZOO-HC-4026:PHYSIOLOGY: LIFE SUSTAINING.....	
ZOO-HC-4036:BIOCHEMISTRY OF METABOLIC PROCESS	

SemesterV

 ZOO-HC-5016:MOLECULAR BIOLOGY.....

 ZOO-HC-5026: PRINCIPLES OF GENETICS.....

SemesterVI.....

 ZOO-HC-6016:DEVELOPMENTAL BIOLOGY

 ZOO-HC-6026:EVOLUTIONARY BIOLOGY

ZOOLOGY-GENERAL ELECTIVE COURSE (GE)

 SEMESTER I-----

 ZOO-HG-1016: ANIMAL DIVERSITY

 SEMESTER II-----

 ZOO-HG-2016: COMPARATIVE ANATOMY AND DEVELOPMENTAL BIOLOGY OF
 VERTEBRATE

 SEMESTER III-----

 ZOO-HG-3016: PHYSIOLOGY AND BIOCHEMISTRY

 SEMESTER IV-----

 ZOO-HG-4016: GENETICS AND EVOLUTIONARY BIOLOGY

ZOOLOGY-Discipline Specific Electives(DSE)

 ZOO-HE-5016: COMPUTATIONAL BIOLOGY AND BIostatISTICS
.....

 ZOO-HE-5026: ANIMAL BIOTECHNOLOGY.....

 ZOO-HE-5036: ENDOCRINOLOGY

 ZOO-HE-5046: PARASITOLOGY

 ZOO-HE-6014 :BIOLOGY OF INSECTA.....

 ZOO-HE-6026: FISH AND FISHERIES.....

ZOO-HE-6036: REPRODUCTIVE BIOLOGY

ZOO-HE-6046: WILDLIFE CONSERVATION AND MANAGEMENT

ZOO-HE-6056 DISSERTATION-----

Skill Enhancement Courses

ZOO-SE-3014: ORNAMENTAL FISH AND FISHERIES.....

ZOO-SE-3024: APICULTURE
ZOO-SE-4014: Non-Mulberry Sericulture.....
ZOO-SE-4024:Wildlife Photography and Eco-tourism
ZOO-SE-4034 Research methodology
Ability Enhancement Compulsory Courses.....
ENG-AE-1014:ENGLISHCOMMUNICATION
ENV-AE-2014:ENVIRONMENTALSCIENCE.....

Preamble

The choice based credit system is naturally the next logical step in a credit based semester system. This makes the system the more learner-centric. A CBCS offers the student a diversity of courses to choose from and the autonomy to decide on the place, pace and the time of learning.

The Gauhati University has decided to introduce the CBCS system at the under graduate level from the session 2019-20. The CBCS syllabus for the B.Sc. (Honours) is prepared in the model of syllabus prepared by theUGC.

A student opting for honors course in ZOOLOGY must have and passed the BIOLOGY as a subject in the Senior Secondary level examination.

Course Structure	
Course	*Credits
	Theory+ Practical
I. Core Course (14 Papers) Core Course Practical / Tutorial* (14 Papers)	14×4= 56 14×2= 28
II. Elective Course (8 Papers) A.1. Discipline Specific Elective (4Papers) A.2. Discipline Specific Elective Practical/Tutorial*(4Papers)	4×4=16 4×2=8
B.1. Generic Elective/ Interdisciplinary (4 Papers) B.2. Generic Elective Practical/ Tutorial* (4 Papers)	4×4=16 4×2=8
III. Ability Enhancement Courses 1. Ability Enhancement Compulsory (2 Papers of 2 credit each) Environmental Studies English/MIL Communication 2. Ability Enhancement Elective(SkillBased) (Minimum2) (2 Papers of 2 credit each)	2×4=8 2×4=8
Total	148

***Core and DSE courses without practicals will have tutorial and have credit distribution of: 5credits for theory and 1credit for tutorial, total6credits,sameasthe papers with practical**

Structure of BSc Honours(ZOOLOGY) Programme

Seme ster	Type	Core	AECC	SEC	DSE	GEN
	Cred its	14 × 6 = 84	2 × 4 = 8	2 × 4 = 8	4 × 6 = 24	4 × 6 = 24
I	ZOO- HC- 1 016	ENG- AE- 10 14				XXX- HG- 1XX6
	ZOO- HC- 1 026					
II	ZOO- HC- 2 016	ENV- AE- 20 14				XXX- HG- 2XX6
	ZOO- HC- 2 026					
III	ZOO- HC- 3 016			ZOO- SE- 3YY4†		XXX- H G- 3XX6
	ZOO- HC- 3 026					
	ZOO- HC- 3 036					
IV	ZOO- HC- 4 016			ZOO- SE- 4YY4†		XXX- H G- 4XX6
	ZOO- HC- 4 026					
	ZOO- HC- 4 036					
V	ZOO- HC- 5 016				ZOO- HE- 5YY6‡	
	ZOO- HC- 5 026				ZOO- HE- 5YY6‡	
VI	ZOO- HC- 6 016				ZOO- HE- 6YY6‡	
	ZOO- HC- 6 016				ZOO- HE- 6YY6‡	

SCHEME FOR CHOICE BASED CREDIT SYSTEM IN B. Sc.

Honours (ZOOLOGY)

SEMESTER	COURSE CODE	COURSE NAME	Credits
I	ENG-AE-1014	English Communications	4
	ZOO-HC-1016	Non Chordates I: Protista to Pseudocoelomates	4+2=6
		NON Chordates-I Lab	
	ZOO-HC-1026	Principles of Ecology	4+2=6
		Principles of Ecology Lab	
	AAA-HG-1YY6	GE-1	4/5
		Generic Elective 1 Practical/Tutorial	2/1
Total Credits in Semester I			22
II	Ability Enhancement Compulsory Course-II**	Environmental Studies	4
	ZOO-HC-2016	Non Chordates-II: Coelomate	4+2=6
		NON Chordates-II Lab	
	ZOO-HC-2026	Cell Biology	4+2=6
		Cell Biology Lab	
	AAA-HG-2YY6*	GE-2	4/5
		Generic Elective 2 Practical/Tutorial	2/1
Total Credits in Semester II			22
III	ZOO-HC-3016	Diversity of Chordates	4+2=6
		Diversity of Chordates Lab	
	ZOO-HC-3026	Physiology: Controlling and Coordinating Systems	4+2=6
		Physiology Controlling and Coordinating Systems Lab	
	ZOO-HC-3036	Fundamental of Biochemistry	4+2=6
		Fundamental of Biochemistry Lab	
	ZOO-SE-3YY4†	SEC-1	4
	AAA-HG-3YY6*	GE-3	4/5

		Generic Elective Practical/Tutorial 3	2/1
Total Credits in Semester III			28
IV	ZOO-HC-4016	Comparative anatomy of Vertebrate	4+2=6
		Comparative Anatomy of Vertebrate Lab	
	ZOO-HC-4026	Physiology Life Sustaining systems	4+2=6
		Physiology Life Sustaining systems Lab	
	ZOO-HC-4036	Biochemistry of Metabolic process	4+2=6
		Biochemistry of Metabolic Process Lab	
	ZOO-SE-4YY4†	SEC -2	4
	AAA-HG-4YY 6*	GE-4	4/5
		Generic Elective Practical/tutorial	2/1
Total Credits in Semester IV			28
V	ZOO-HC-5016	Molecular Biology	4+2=6
		Molecular Biology Lab	
	ZOO-HC-5026	Principles of Genetics	4+2=6
		Principles of genetics Lab	
	ZOO-HE-5YY6‡	DSE-1	4+2=6
		DSE-1 Lab	
	ZOO-HE-5YY6‡	DSE-2	4+2=6
	DSE-2 Lab		
Total Credits in Semester V			24
VI	ZOO-HC-6016	Developmental Biology	4+2=6
		Developmental Biology Lab	
	ZOO-HC-6026	Evolutionary Biology	4+2=6
		Evolutionary Biology Lab	
	ZOO-HE-6YY6‡	DSE-3	4+2=6
		DSE-3 Lab	
	ZOO-HE-6YY6‡	DSE-4	4+2=6

	DSE-4 Lab	
Total Credits in Semester VI		24
Grand Total Credits		148

***Generic Electives (Other Discipline) - GE 1 to GE 4**

1. Botany (4) + Lab(4)
2. Chemistry (4)+ Lab (4)
3. Anthropology (4)+ Lab (4)
4. Geography (4)+ Lab (4)
5. Geology (4)+ Lab (4)
6. Biotechnology (4)+ Lab (4)
7. Computer Science (4)+Lab (4)
8. STATISTICS (4)+ Lab (2)
9. MATHEMATICS
10. MICROBIOLOGY (4)+ Lab (2)
11. PHYSICS (4)+ Lab (2)

***a)Generic Electives(GE) are to be taken preferably from Botany and Chemistry disciplines.**

b) Students can choose minimum of two GE papers from different disciplines.

‡ Discipline Specific Elective Papers: (Credit: 06 each) (4 papers to be selected)-

DSE for Semester V DSE-1 (Any One from the following)

1. **ZOO-HE-5016:** Computational Biology and Biostatistics (4) + Lab(2) (Compulsory)

DSE-2(Any One from the following)

2. **ZOO-HE-5026:** Animal biotechnology (4) + Lab(2)
3. **ZOO-HE-5036:** Endocrinology (4) + Lab(2)
4. **ZOO-HE-5046:** Parasitology (4) + Lab(2)

DSE for Semester VI

DSE-3(Any One from the following)

5. **ZOO-HE-6016:** Biology of Insect (4) + Lab(2)
6. **ZOO-HE-6026:** FISH and Fisheries (4) + Lab(2)

DSE-4 (Any One from the following)

7. **ZOO-HE-6046:** Reproductive Biology (4) + Lab(2)
8. **ZOO-HE-6056:**Wildlife Conservation and Management (4)+ Lab (2)
9. **ZOO-HE-6066:** Dissertation in any Zoology Specific Subject (6)

†Skill Enhancement Courses (04papers)(Credit:04each)

SEC for Semester III

Any One from the following

1. **ZOO-SE-3014:** Ornamental fish and Fischeies
2. **ZOO-SE-3024:** Apiculture

SEC for Semester IV

Any One from the following

3. **ZOO-SE-4014:** Non Mulberry sericulture
4. **ZOO-SE-4024:** Wildlife Photography and Ecotourism
5. **ZOO-SE-4034:** Research Methodology

****Ability Enhancement Compulsory Courses (02 papers) (Credit: 04 each)**

AECC for Semester I

1. **ENG-AE-1014: English Communications**

AECC for Semester II

2. **ENV-AE-2014: Environmental Science**
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CORE COURSE I
CODE: ZOO-HC-1016

NON-CHORDATES I: PROTISTS TO PSEUDOCOELOMATES

THEORY	(Credits 4)
Unit 1: Protista, Parazoa and Metazoa	19
General characteristics and Classification upto classes Study of <i>Euglena</i> , <i>Amoeba</i> and <i>Paramecium</i>	
Life cycle and pathogenicity of <i>Plasmodium vivax</i> and <i>Entamoeba histolytica</i>	
Locomotion and Reproduction in Protista	
Evolution of symmetry and segmentation of Metazoa	
Unit 2: Porifera	7
General characteristics and Classification upto classes Canal system and spicules in sponges	
Unit 3: Cnidaria	12
General characteristics and Classification upto classes Metagenesis in <i>Obelia</i>	
Polymorphism in Cnidaria Corals and coral reefs	
Unit 4: Ctenophora	4
General characteristics and Evolutionary significance	
Unit 5: Platyhelminthes	10
General characteristics and Classification up to classes	
Life cycle and pathogenicity of <i>Fasciola hepatica</i> and <i>Taeniasolium</i>	
Unit 6: Nemathelminthes	8
General characteristics and Classification up to classes	
Lifecycle, and pathogenicity of <i>Ascaris lumbricoides</i> and <i>Wuchereri abancrofti</i>	
Parasitic adaptations in helminthes	

Note: Classification to be followed from “Barnes, R.D. (1982). *Invertebrate Zoology*, V Edition”

NON-CHORDATES I: PROTISTS TO PSEUDOCOELOMATES

PRACTICALS

(Credits 2)

1. Study of whole mount of *Euglena*, *Amoeba* and *Paramecium*, Binary fission and Conjugation in *Paramecium*
2. Examination of pond water collected from different places for diversity in protista
3. Study of *Sycon* (T.S. and L.S.), *Hyalonema*, *Euplectella*, *Spongilla*
4. Study of *Obelia*, *Physalia*, *Millepora*, *Aurelia*, *Tubipora*, *Corallium*, *Alcyonium*, *Gorgonia*, *Metridium*, *Pennatulula*, *Fungia*, *Meandrina*, *Madrepora*
5. One specimen/slide of any ctenophore
6. Study of adult *Fasciola hepatica*, *Taenia solium* and their life cycles (Slides/micro- photographs)
7. Study of adult *Ascaris lumbricoides* and its life stages (Slides/micro-photographs)
8. To submit a Project Report on any related topic on life cycles.

Note: Classification to be followed from “Ruppert and Barnes (2006) *Invertebrate Zoology*, 8th edition, Holt Saunders International Edition”

SUGGESTED READINGS

- Ruppert and Barnes, R.D. (2006). *Invertebrate Zoology*, VIII Edition. Holt Saunders International Edition.
- Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.I. (2002). *The Invertebrates: A New Synthesis*, III Edition, Blackwell Science
- Barrington, E.J.W. (1979). *Invertebrate Structure and Functions*. II Edition, E.L.B.S. and Nelson

CORE COURSE II
CODE: ZOO-HC-1026
PRINCIPLES OF
ECOLOGY

THEORY (Credits 4)

Unit 1: Introduction to Ecology 6

History of ecology, Autecology and synecology, Levels of organization, Laws of limiting factors, Study of physical factors

Unit2:Population 24

Unitary and Modular populations
Unique and group attributes of population: Density, natality, mortality, life tables, fecundity tables, survivorship curves, age ratio, sex ratio, dispersal and dispersion Exponential and logistic growth, equation and patterns, r and K strategies Population regulation - density-dependent and independent factors

Population interactions, Gause's Principle with laboratory and field examples, Lotka-Volterra equation for competition and Predation, functional and numerical responses

Unit3:Community 12

Community characteristics: species richness, dominance, diversity, abundance, vertical stratification, Ecotone and edge effect; Ecological succession with one example

Theories pertaining to climax community

Unit4:Ecosystem 14

Types of ecosystems with one example in detail, Food chain: Detritus and grazing food chains, Linear and Y-shaped food chains, Food web, Energy flow through the ecosystem, Ecological pyramids and Ecological efficiencies

Nutrient and biogeochemical cycle with one example of Nitrogen cycle Human modified ecosystem

Unit 5:Applied Ecology 4

Ecology in Wildlife Conservation and Management

PRINCIPLES OF ECOLOGY

PRACTICALS

(Credits 2)

1. Study of life tables and plotting of survivorship curves of different types from the hypothetical/real data provided
2. Determination of population density in a natural/hypothetical community by quadrat method and calculation of Shannon-Weiner diversity index for the same community
3. Study of an aquatic ecosystem: Phytoplankton and zooplankton, Measurement of area, temperature, turbidity/penetration of light, determination of pH, and Dissolved Oxygen content (Winkler's method).
4. Report on a visit to National Park/Biodiversity Park/Wild life sanctuary

SUGGESTED READINGS

- Colinvaux, P.A. (1993). Ecology. II Edition. Wiley, John and Sons, Inc.
- Krebs, C. J. (2001). Ecology. VI Edition. Benjamin Cummings.
- Odum, E.P., (2008). Fundamentals of Ecology. Indian Edition. Brooks/Cole
- Robert Leo Smith Ecology and field biology Harper and Row publisher
- Ricklefs, R.E., (2000). Ecology. V Edition. Chiron Press

CORE COURSE III
CODE: ZOO-HC-2016
NON-CHORDATES II: COELOMATES

THEORY	(Credits 4)
Unit 1: Introduction to Coelomates	2
Evolution of coelom and metamerism	
Unit 2: Annelida	10
General characteristics and Classification upto classes Excretion in Annelida	
Unit 3: Arthropoda	17
General characteristics and Classification upto classes Vision and Respiration in Arthropoda Metamorphosis in Insects Social life in bees and termites	
Unit 4: Onychophora	4
General characteristics and Evolutionary significance	
Unit 5: Mollusca	
General characteristics and Classification upto classes Respiration in Mollusca Torsion and detorsion in Gastropoda Pearl formation in bivalves Evolutionary significance of trochophore larva	
Unit 6: Echinodermata	12
General characteristics and Classification upto classes Water-vascular system in Asteroidea Larval forms in Echinodermata Affinities with Chordates	

Note: Classification to be followed from “Ruppert and Barnes (2006)
Invertebrate Zoology, 8th edition, Holt Saunders International Edition”

NON-CHORDATES II: COELOMATES

PRACTICAL

(Credits 2)

1. Study of following specimens:
Annelids - *Aphrodite*, *Nereis*, *Heteronereis*, *Sabella*, *Serpula*, *Chaetopterus*, *Pheretima*, *Hirudinaria*
Arthropods - *Limulus*, *Palaemon*, *Daphnia*, *Balanus*, *Sacculina*, *Cancer*, *Eupagurus*, *Scolopendra*, *Julus*, *Bombyx*, *Periplaneta*, termites and honey bees
Onychophora - *Peripatus*
Molluscs - *Chiton*, *Dentalium*, *Pila*, *Doris*, *Helix*, *Unio*, *Ostrea*, *Pinctada*, *Sepia*, *Octopus*, *Nautilus*
Echinodermates - *Pentaceros*/*Asterias*, *Ophiura*, *Clypeaster*, *Echinus*, *Cucumaria* and *Antedon*
2. Study of digestive system, septal nephridia and pharyngeal nephridia of earthworm
3. T.S. through pharynx, gizzard, and typhlosolar intestine of earthworm
4. Mount of mouth parts and dissection of digestive system and nervous system of *Periplaneta**
5. To submit a Project Report on any related topic to larval forms (crustacean, mollusc and echinoderm)

Note: Classification to be followed from “Ruppert and Barnes (2006) *Invertebrate Zoology*, 8th edition, Holt Saunders International Edition”

SUGGESTED READINGS

- Ruppert and Barnes, R.D. (2006). *Invertebrate Zoology*, VIII Edition. Holt Saunders International Edition
- Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.I. (2002). *The Invertebrates: A New Synthesis*, III Edition, Blackwell Science
- Barrington, E.J.W. (1979). *Invertebrate Structure and Functions*. II Edition, E.L.B.S. and Nelson

CORE COURSE IV
CODE: ZOO-HC-2026
CELL BIOLOGY

THEORY	(Credits4)
Unit 1: Over view of Cells	3
Prokaryotic and Eukaryotic cells, Virus, Viroids, Mycoplasma, Prions	
Unit 2:Plasma Membrane	7
Various models of plasma membrane structure Transportacrossmembranes:ActiveandPassivetransport,Facilitatedtra nsport Cell junctions: Tight junctions, Desmosomes, Gapjunctions	
Unit 3:Endomembrane System	10
Structure and Functions: Endoplasmic Reticulum, Golgi Apparatus, Lysosomes	
Unit 4: Mitochondria and Peroxisomes	8
Mitochondria:Structure,Semi- autonomoussnature,Endosymbiotichypothesis Mitochondrial Respiratory Chain, Chemi-osmotichypothesis Peroxisomes	
Unit5:Cytoskeleton	8
Structure and Functions: Microtubules, Microfilaments and Intermediate filaments	
Unit6:Nucleus	12
Structure of Nucleus: Nuclearenvelope, Nuclear pore complex, Nucleolus Chromatin: Euchromatin and Hetrochromatin and packaging(nucleosome)	
Unit 7:Cell Division	8
Mitosis, Meiosis, Cell cycle and its regulation	
Unit 8:Cell Signaling	4
GPCR and Role of second messenger (cAMP)	

CELL BIOLOGY

PRACTICAL

(Credits 2)

1. Preparation of temporary stained squash of onion root tip to study various stages of mitosis
2. Study of various stages of meiosis.
3. Preparation of permanent slide to show the presence of Barrbody in human female blood cells/cheek cells.
4. Preparation of permanent slide to demonstrate:
 - i DNA by Feulgen reaction
 - ii Mucopolysaccharides by PAS reaction
 - iii Proteins by Mercurio bromophenol blue/FastGreen

SUGGESTED READINGS

- Karp, G. (2010). *Cell and Molecular Biology: Concepts and Experiments*. VI Edition. John Wiley and Sons.Inc.
- De Robertis, E.D.P. and De Robertis, E.M.F. (2006). *Cell and Molecular Biology*. VIII Edition. Lippincott Williams and Wilkins,Philadelphia.
- Cooper, G.M. and Hausman, R.E. (2009). *The Cell: A Molecular Approach*. V Edition. ASM Press and Sunderland, Washington, D.C.; Sinauer Associates, MA.
- Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. (2009). *The World of the Cell*. VII Edition. Pearson Benjamin Cummings Publishing, San Francisco.
- Bruce Albert, Bray Dennis, Levis Julian, Raff Martin, Roberts Keith and Watson James (2008). *Molecular Biology of the Cell*, V Edition, Garland publishing Inc., New York and London.

CORE COURSE V

DIVERSITY OF

CHORDATA

CODE: ZOO-HC-3016

THEORY	(Credits 4)
Unit 1: Introduction to Chordates	2
General characteristics and outline classification	
Unit2:Protochordata	8
General characteristics of Hemichordata, Urochordata and Cephalochordata; Study of larval forms in protochordates; Retrogressive metamorphosis in Urochordata	
Unit 3: Origin of Chordata	3
Dipleurula concept and the Echinoderm theory of origin of chordates Advanced features of vertebrates over Protochordata	
Unit4:Agnatha	2
General characteristics and classification of cyclostomes up to class	
Unit5:Pisces	8
General characteristics of Chondrichthyes and Osteichthyes, classification up to order Migration, Osmoregulation and Parental care in fishes	
Unit6:Amphibia	6
Origin of <i>Tetrapoda</i> (Evolution of terrestrial ectotherms); General characteristics and classification up to order; Parental care in Amphibians	
Unit7:Reptilia	7
General characteristics and classification up to order; Affinities of <i>Sphenodon</i> ; Poison apparatus and Biting mechanism in snakes	
Unit8:Aves	8
General characteristics and classification up to order <i>Archaeopteryx</i> -- a connecting link; Principles and aerodynamics of flight, Flight adaptations and Migration in birds	
Unit9:Mammals	8
General characters and classification up to order; Affinities of Prototheria; Adaptive radiation with reference to locomotory appendages	

Unit10:Zoogeography

8

Zoo geographical realms, Theories pertaining to distribution of animals, Plate tectonic and Continental drift theory, distribution of vertebrates in different realms

DIVERSITY OF CHORDATA

PRACTICAL

(Credits 2)

1. Protochordata

Balanoglossus, *Herdmania*, *Branchiostoma*, Colonial Urochordata
Sections of *Balanoglossus* through proboscis and branchio genital regions, Sections of *Amphioxus* through pharyngeal, intestinal and caudal regions. Permanent slide of *Herdmania* spicules

2. Agnatha

Petromyzon, *Myxine*

3. Fishes

Scoliodon, *Sphyrna*, *Pristis*, *Torpedo*, *Chimaera*, *Mystus*,
Heteropneustes, *Labeo*, *Exocoetus*, *Echeneis*, *Anguilla*, *Hippocampus*,
Tetrodon/Diodon, *Anabas*, Flat fish

4. Amphibia

Ichthyophis/Ureotyphlus, *Necturus*, *Bufo*, *Hyla*, *Alytes*, *Salamandra*

5. Reptilia

Chelone, *Trionyx*, *Hemidactylus*, *Varanus*,
Uromastix, *Chamaeleon*, *Ophiosaurus*, *Draco*,
Bungarus, *Vipera*, *Naja*, *Hydrophis*, *Zamenis*, *Crocodylus* Key for
Identification of poisonous and non-poisonous snakes

6. Aves

Study of six common birds from different orders. Types of beaks and claws

7. Mammalia

Sorex, Bat (Insectivorous and Frugivorous), *Funambulus*, *Loris*,
Herpestes, *Erinaceous*.

Mount of weberian ossicles of fish

Power point presentation on study of any two animals from two different classes by students (may be included if dissections not given permission)

Classification from Young, J. Z. (2004) to be followed

SUGGESTED READINGS

18

- Young, J.Z. (2004). *The Life of Vertebrates*. III Edition. Oxford university press.
- Pough H. *Vertebrate life*, VIII Edition, Pearson International.

- Darlington P.J. *The Geographical Distribution of Animals*, R.E. Krieger Pub Co.
- Hall B.K. and Hallgrímsson B. (2008). *Strickberger's Evolution*.
IV Edition. Jones and Bartlett Publishers Inc.

CORE COURSE VI
ANIMAL PHYSIOLOGY: CONTROLLING AND COORDINATING
SYSTEMS
CODE: ZOO-HC-3026

THEORY	(Credits 4)
Unit 1: Tissues	6
Structure, location, classification and functions of epithelial tissue, connective tissue, muscular tissue and nervous tissue	
Unit 2: Bone and Cartilage	4
Structure and types of bones and cartilages, Ossification, bone growth and resorption	
Unit 3: Nervous System	10
Structure of neuron, resting membrane potential, Origin of action potential and its propagation across the myelinated and unmyelinated nerve fibers; Types of synapse, Synaptic transmission and, Neuromuscular junction; Reflex action and its types - reflex arc; Physiology of hearing and vision.	
Unit 4: Muscle	12
Histology of different types of muscle; Ultra structure of skeletal muscle; Molecular and chemical basis of muscle contraction; Characteristics of muscle twitch; Motor unit, summation and tetanus	
Unit 5: Reproductive System	10
Histology of testis and ovary; Physiology of male and female reproduction; Puberty, Methods of contraception in male and female	
Unit 6: Endocrine System	18
Histology of endocrine glands - pineal, pituitary, thyroid, parathyroid, pancreas, adrenal; hormones secreted by them and their mechanism of action; Classification of hormones; Regulation of their secretion; Mode of hormone action, Signal transduction pathways for steroid and non-steroidal hormones; Hypothalamus (neuroendocrine gland)- principal nuclei involved in neuro endocrine control of anterior pituitary and endocrines system; Placental hormones	

ANIMAL PHYSIOLOGY: CONTROLLING AND COORDINATING SYSTEMS

PRACTICALS

(Credits 2)

- *1. Demonstration of the unconditioned reflex action (Deep tendon reflex such as knee jerk reflex)
2. Preparation of temporary mounts: Squamous epithelium, Striated muscle fibres and nerve cells
3. Study of permanent slides of Mammalian skin, Cartilage, Bone, Spinal cord, Nerve cell, Pituitary, Pancreas, Testis, Ovary, Adrenal, Thyroid and Parathyroid
4. Microtomy: Preparation of permanent slide of any five mammalian (Goat/ rat/ mice) tissues

(*Subject to UGC guidelines)

SUGGESTED BOOKS

- Guyton, A.C. & Hall, J.E. (2006). Textbook of Medical Physiology. XI Edition. Harcourt Asia PTE Ltd. /W.B. Saunders Company.
- Tortora, G.J. & Grabowski, S. (2006). Principles of Anatomy & Physiology. XI Edition John Wiley & sons
- Victor P. Eroschenko. (2008). diFiore's Atlas of Histology with Functional correlations. XII Edition. Lippincott W. & Wilkins.

CORE COURSE VII
FUNDAMENTALS OF BIOCHEMISTRY

CODE: ZOO-HC-3036

THEORY	(CREDITS 4)
Unit1:Carbohydrates	8
Structure and Biological importance: Monosaccharides, Disaccharides, Polysaccharides and Glycoconjugates	
Unit2:Lipids	8
Structure and Significance: Physiologically important saturated and unsaturated fatty acids, Tri-acylglycerols, Phospholipids, Glycolipids, Steroids	
Unit3:Proteins	14
Amino acids: Structure, Classification and General properties of α -amino acids; Physiological importance of essential and non-essential α -amino acids	
Proteins: Bonds stabilizing protein structure; Levels of organization in proteins; Denaturation; Introduction to simple and conjugate proteins	
Immunoglobulins: Basic Structure, Classes and Function, Antigenic Determinants	
Unit 4:NucleicAcids	12
Structure:Purines and pyrimidines,Nucleosides,Nucleotides,Nucleicacids CotCurves: Base pairing, Denaturation and Renaturation of DNA Types of DNA and RNA, Complementarity of DNA, Hpyo- Hyperchromaticity of DNA	
Unit5:Enzymes	18
Nomenclature and classification; Cofactors; Specificity of enzyme action; Isozymes; Mechanism of enzyme action; Enzyme kinetics; Factors affecting rate of enzyme-catalyzed reactions; Derivation of Michaelis-Menten equation, Concept of K_m and V_{max} , Lineweaver-Burk plot; Multi-substrate reactions; Enzyme inhibition; Allosteric enzymes and their kinetics; Regulation of enzyme action	

FUNDAMENTALS OF BIOCHEMISTRY

PRACTICAL

(CREDITS2)

1. Qualitative tests of functional groups in carbohydrates, proteins and lipids.
2. Paper chromatography of amino acids.
3. Action of salivary amylase under optimum conditions.
4. Effect of pH, temperature on the action of salivary amylase.
5. Demonstration of proteins separation by SDS-PAGE.

SUGGESTED READING

- Cox, M.M and Nelson, D.L. (2008). *Lehninger's Principles of Biochemistry*, V Edition, W.H. Freeman and Co., New York.
- Berg, J.M., Tymoczko, J.L. and Stryer, L. (2007). *Biochemistry*, VI Edition, W.H. Freeman and Co., New York.
- Murray, R.K., Bender, D.A., Botham, K.M., Kennelly, P.J., Rodwell, V.W. and Well, P.A. (2009). *Harper's Illustrated Biochemistry*, XXVIII Edition, International Edition, The McGraw-Hill Companies Inc.
- Hames, B.D. and Hooper, N.M. (2000). *Instant Notes in Biochemistry*, II Edition, BIOS Scientific Publishers Ltd., U.K.
- Watson, J.D., Baker, T.A., Bell, S.P., Gann, A., Levine, M. and Losick, R. (2008). *Molecular Biology of the Gene*, VI Edition, Cold Spring Harbor Lab. Press, Pearson Pub.

**CORE COURSE VIII COMPARATIVE
ANATOMY OF VERTEBRATES**

CODE: ZOO-HC-4016

THEORY	(CREDITS 4)
Unit 1: Integumentary System	8
Structure, functions and derivatives of integument	
Unit 2: Skeletal System	8
Overview of axial and appendicular skeleton, Jaw suspensorium, Visceral arches	
Unit 3: Digestive System	8
Alimentary canal and associated glands, dentition	
Unit 4: Respiratory System	8
Skin, gills, lungs and air sacs; Accessory respiratory organs	
Unit 5: Circulatory System	8
General plan of circulation, evolution of heart and aortic arches	
Unit 6: Urinogenital System	6
Succession of kidney, Evolution of urinogenital ducts, Types of mammalian uteri	
Unit 7: Nervous System	8
Comparative account of brain Autonomic nervous system, Spinal cord, Cranial nerves in mammals	
Unit 8: Sense Organs	6
Classification of receptors Brief account of visual and auditory receptors in man	

COMPARATIVE ANATOMY OF VERTEBRATES

PRACTICAL

(CREDITS 2)

1. Study of placoid, cycloid and ctenoid scales through permanent slides/photographs
2. Disarticulated skeleton of Frog, Fowl, Rabbit
3. Carapace and plastron of turtle/tortoise
4. Mammalian skulls: One herbivorous and one carnivorous animal
5. Study of structure of any two organs (heart, lung, kidney, eye and ear) from video recording (may be included if dissection not permitted)
6. Project on skeletal modifications in vertebrates (may be included if dissection not permitted)

SUGGESTED READINGS

- Kardong, K.V. (2005) *Vertebrates' Comparative Anatomy, Function and Evolution*. IV Edition. McGraw-Hill Higher Education
- Kent, G.C. and Carr R.K. (2000). *Comparative Anatomy of the Vertebrates*. IX Edition. The McGraw-Hill Companies
- Hilderbrand, M and Gaslow G.E. *Analysis of Vertebrate Structure*, John Wiley and Sons
- Walter, H.E. and Sayles, L.P.; *Biology of Vertebrates*, Khosla Publishing House

CORE COURSE IX
ANIMAL PHYSIOLOGY: LIFE SUSTAINING SYSTEMS
CODE: ZOO-HC-4026

THEORY **(Credits 4)**

Unit 1: Physiology of Digestion **14**

Structural organization and functions of gastrointestinal tract and associated glands; Mechanical and chemical digestion of food; Absorptions of carbohydrates, lipids, proteins, water, minerals and vitamins; Hormonal control of secretion of enzymes in Gastrointestinal tract.

Unit 2: Physiology of Respiration **12**

Histology of trachea and lung; Mechanism of respiration, Pulmonary ventilation; Respiratory volumes and capacities; Transport of oxygen and carbon dioxide in blood; Respiratory pigments, Dissociation curves and the factors influencing it; Carbon monoxide poisoning; Control of respiration

Unit 3: Renal Physiology **8**

Structure of kidney and its functional unit; Mechanism of urine formation; Regulation of water balance; Regulation of acid-base balance

Unit 4: Blood **14**

Components of blood and their functions; Structure and functions of haemoglobin

Haemostasis: Blood clotting system,
Kallikrein-Kininogen system, Complement system & Fibrinolytic system, Haemopoiesis

Blood groups: Rh factor, ABO and MN

Unit 5: Physiology of Heart **12**

Structure of mammalian heart; Coronary circulation; Structure and working of conducting myocardial fibers. Origin and conduction of cardiac impulses Cardiac cycle; Cardiac output and its regulation, Frank-Starling Law of the heart, nervous and chemical regulation of heart rate. Electrocardiogram, Blood pressure and its regulation

ANIMAL PHYSIOLOGY: LIFE SUSTAINING SYSTEMS

PRACTICALS

(CREDITS 2)

1. Determination of ABO Blood group
2. Enumeration of red blood cells and white blood cells using haemocytometer
3. Estimation of haemoglobin using Sahli's haemoglobinometer
4. Preparation of haemin crystals
5. Recording of blood pressure using a sphygmomanometer
6. Examination of sections of mammalian oesophagus, stomach, duodenum, ileum, rectum, liver, trachea, lung, kidney

(*Subject to UGC guidelines)

SUGGESTED READINGS

- Guyton, A.C. & Hall, J.E. (2006). Textbook of Medical Physiology. X Edition. Harcourt Asia PTE Ltd. W.B. Saunders Company.
- Tortora, G.J. & Grabowski, S. (2006). Principles of Anatomy & Physiology. XI Edition John Wiley & sons,
- Victor P. Eroschenko. (2008). diFiore's Atlas of Histology with Functional correlations. XII Edition. Lippincott W. & Wilkins.
- Vander A, Sherman J. and Luciano D. (2014). Vander's Human Physiology: The Mechanism of Body Function. XIII Edition, McGrawHills

**CORE COURSE X BIOCHEMISTRY OF
METABOLIC PROCESSES**

CODE: ZOO-HC-4036

THEORY	(CREDITS 4)
Unit 1: Overview of Metabolism	10
Catabolism vs Anabolism, Stages of catabolism, Compartmentalization of metabolic pathways, Shuttle systems and membrane transporters; ATP as "Energy Currency of cell"; coupled reactions; Use of reducing equivalents and cofactors; Intermediary metabolism and regulatory mechanisms	
Unit 2: Carbohydrate Metabolism	16
Sequence of reactions and regulation of glycolysis, Citric acid cycle, Phosphate pentose pathway, Gluconeogenesis, Glycogenolysis and Glycogenesis	
Unit 3: Lipid Metabolism	14
β -oxidation and omega-oxidation of saturated fatty acids with even and odd number of carbon atoms; Biosynthesis of palmitic acid; Ketogenesis	
Unit 4: Protein Metabolism	10
Catabolism of amino acids: Transamination, Deamination, Urea cycle; Fate of C-skeleton of Glucogenic and Ketogenic amino acids	
Unit 5: Oxidative Phosphorylation	10
Redox systems; Review of mitochondrial respiratory chain, Inhibitors and un-couplers of Electron Transport System	

BIOCHEMISTRY OF METABOLIC PROCESS

PRACTICALS

(CREDITS 2)

1. Estimation of total protein in given solutions by Lowry's method.
2. Detection of SGOT and SGPT in serum/tissue
3. To study the enzymatic activity of Trypsin and Lipase.
4. Study of biological oxidation (SDH) [goat liver]
5. To perform the Acid and Alkaline phosphatase assay from serum/tissue.

SUGGESTED READINGS

- Cox, M.M and Nelson, D.L. (2008). *Lehninger Principles of Biochemistry*, V Edition, W.H. Freeman and Co., New York.
- Berg, J.M., Tymoczko, J.L. and Stryer, L. (2007). *Biochemistry*, VI Edition, W.H. Freeman and Co., New York.
- Murray, R.K., Bender, D.A., Botham, K.M., Kennelly, P.J., Rodwell, V.W. and Well, P.A. (2009). *Harper's Illustrated Biochemistry*, XXVIII Edition, International Edition, The McGraw-Hill Companies Inc.
- Hames, B.D. and Hooper, N.M. (2000). *Instant Notes in Biochemistry*, II Edition, BIOS Scientific Publishers Ltd., U.K.

CORE COURSE XI

MOLECULAR

BIOLOGY

CODE: ZOO-HC-5016

THEORY

(CREDITS 4)

Unit 1:NucleicAcids

4

Salient features of DNA and RNA Watson and Crick model of DNA

Unit 2:DNAReplication

12

DNA Replication in prokaryotes and eukaryotes, mechanism of DNA replication, Semi-conservative, bidirectional and semi-discontinuous replication, RNA priming, Replication of circular and linear *ds*-DNA, replication of telomeres

Unit3:Transcription

10

RNA polymerase and transcription Unit, mechanism of transcription in prokaryotes and eukaryotes, synthesis of rRNA and mRNA, transcription factors

Unit4:Translation

12

Geneticcode, DegeneracyofthegeneticcodeandWobbleHypothesis; Process of protein synthesis in prokaryotes: Ribosome structure and assembly in prokaryotes, fidelity of protein synthesis, aminoacyl tRNA synthetases and charging of tRNA; Proteins involved in initiation, elongation and termination of polypeptidechain; Inhibitors of proteinsynthesis; Differencebetweenprokaryotic and eukaryotic translation

Unit 5: Post Transcriptional Modifications and Processing of Eukaryotic RNA

6

Structure of globin mRNA; Split genes: concept of introns and exons, splicing mechanism, alternative splicing, exon shuffling, and RNA editing, Processing of tRNA

Unit 6:GeneRegulation

10

Transcription regulation in prokaryotes: Principles of transcriptional regulation with examples from *lac* operon and *trp* operon; Transcription regulation in eukaryotes: enhance silencer elements; Activators, repressors, rs, elements; Gene silencing, Genetic imprinting

Unit 7: DNA Repair Mechanisms

3

Pyrimidine dimerization and mismatch repair

Unit 8: Regulatory RNAs

3

Ribo-switches, RNA interference, miRNA,
siRNA

MOLECULAR BIOLOGY

PRACTICAL

(CREDITS 2)

1. Study of Polytene chromosomes from Chironomous / Drosophilalarvae
2. Preparation of liquid culture medium(LB)andraisecultureof*E.coli*
3. Estimation of the growth kinetics of *E. coli* by turbidity method
4. Quantitative estimation DNA using colorimeter (Diphenylamine reagent)
5. Quantitative estimation of RNA using Orcinolreaction
6. Study and interpretation of electron micrographs/ photographshowing
 - (a) DNA replication
 - (b) Transcription
 - (c) Splitgenes

SUGGESTED READINGS

- Becker, W.M., Kleinsmith, L.J., Hardin, J. and Bertoni, G.P. (2009). *The World of the Cell*. VII Edition. Pearson Benjamin Cummings Publishing, San Francisco.
- Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, Peter Walter: *Molecular Biology of the Cell*, IV Edition.
- Cooper G.M. and Robert E. Hausman R.E. *The Cell: A Molecular Approach*, V Edition, ASM Press and Sinauer Associates.
- De Robertis, E.D.P. and De Robertis, E.M.F. (2006). *Cell and Molecular Biology*. VIII Edition. Lippincott Williams and Wilkins, Philadelphia.
- Karp, G. (2010) *Cell and Molecular Biology: Concepts and Experiments*. VI Edition. John Wiley and Sons. Inc.
- Lewin B. (2008). *Gene XI*, Jones and Bartlett
- McLennan A., Bates A., Turner, P. and White M. (2015). *Molecular Biology* IV Edition. GS, Taylor and Francis Group, New York and London.

CORE COURSE XII
PRINCIPLES OF
GENETICS

CODE: ZOO-HC-5026

THEORY	(CREDITS 4)
Unit 1: Mendelian Genetics and its Extension	8
Principles of inheritance, Incomplete dominance and co-dominance, Multiple alleles, Lethal alleles, Epistasis, Pleiotropy, Sex-linked, sex- influenced and sex-limited characters inheritance.	
Unit 2: Linkage, Crossing Over and Chromosomal Mapping	12
Linkage and crossing over, Cytological basis of crossing over, Molecular mechanisms of crossing over including models of recombination, Recombination frequency as a measure of linkage intensity, Two factor and three factor crosses, Interference and coincidence, Somatic cell hybridization.	
Unit3:Mutations	10
Typesofgenemutations(Classification),Typesofchromosomalaberrations (Classification, figures and with one suitable example of each), Molecular basisofmutationsinrelationtoUVlightandchemicalmutagens;Detection of mutations: CLB method, attached X method.	
Unit 4:SexDetermination	4
Chromosomal mechanisms of sex determination in Drosophila and Man	
Unit 5:Extra-chromosomalInheritance	6
Criteria for extra-chromosomal inheritance, Antibiotic resistance in <i>Chlamydomonas</i> , Mitochondrial mutations in <i>Saccharomyces</i> , Infective heredity in <i>Paramecium</i> and Maternal effects	
Unit 6:PolygenicInheritance	3
Polygenic inheritance with suitable examples; simple numericals based on it.	
Unit 7: Recombination in BacteriaandViruses	9
Conjugation, Transformation, Transduction, Complementation test in Bacteriophage	
Unit 8: TransposableGeneticElements	8
Transposons in bacteria, Ac-Ds elements ³³ in maize and P elements in <i>Drosophila</i> , Transposons in humans	

PRINCIPLES OF GENETICS

PRACTICALS

(CREDITS 2)

1. To study the Mendelian laws and gene interactions.
2. Chi-square analyses using seeds/beads/*Drosophila*.
3. Linkage maps based on data from conjugation ,transformation and transduction.
4. Linkage maps based on data from *Drosophila* crosses.
5. Study of human karyotype (normal and abnormal).
6. Pedigree analysis of some human inherited traits.

SUGGESTED READINGS

- Gardner, E.J., Simmons, M.J., Snustad, D.P. (2008). *Principles of Genetics*. VIII Edition. WileyIndia
- Snustad, D.P., Simmons, M.J. (2009). *Principles of Genetics*. V Edition. John Wiley and SonsInc
- Klug, W.S., Cummings, M.R., Spencer, C.A. (2012). *Concepts of Genetics*. X Edition. BenjaminCummings
- Russell, P. J. (2009). *Genetics- A Molecular Approach*.III Edition. BenjaminCummings
- Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C. and Carroll,S.B. *Introduction to Genetic Analysis*.IX Edition. W. H. Freeman and Co
- Fletcher H. and Hickey I. (2015). *Genetics*. IV Edition. GS, Taylor and Francis Group, New York andLondon.

**CORE COURSE XIII
DEVELOPMENTAL
BIOLOGY**

CODE: ZOO-HC-6016

THEORY

(CREDITS 4)

Unit1:Introduction

4

Historical perspective and basic concepts: Phases of development, Cell-Cell interaction, Pattern formation, Differentiation and growth, Differential gene expression, Cytoplasmic determinants and asymmetric cell division

Unit 2: Early Embryonic Development

28

Gametogenesis, Spermatogenesis, Oogenesis; Types of eggs, Egg membranes; Fertilization (External and Internal): Changes in gametes, Blocks to polyspermy; Planes and patterns of cleavage; Types of Blastula; Fate maps (including Techniques); Early development of frog and chick up to gastrulation; Embryonic induction and organizers

Unit 3: Late Embryonic Development

8

Fate of Germ Layers; Extra-embryonic membranes in birds; Implantation of embryo in humans, Placenta (Structure, types and functions of placenta)

Unit 4: PostEmbryonicDevelopment

12

Metamorphosis: Changes, hormonal regulations in amphibians and insects; Regeneration: Modes of regeneration, epimorphosis, morphallaxis and compensatory regeneration (with one example each); Ageing: Concepts and Theories

Unit 5: Implications ofDevelopmentalBiology

8

Teratogenesis: Teratogenic agents and their effects on embryonic development; *In vitro* fertilization, Stem cell (ESC), Amniocentesis

DEVELOPMENTAL BIOLOGY

PRACTICALS

(CREDITS 2)

1. Study of whole mounts and sections of developmental stages of frog through permanent slides: Cleavage stages, blastula, gastrula, neurula, tail-bud stage, tadpole (external and internal gillstages)
2. Study of whole mounts of developmental stages of chick through permanent slides: Primitive streak (13 and 18 hours), 21, 24, 28, 33, 36, 48, 72, and 96 hours of incubation (Hamilton and Hamburgerstages)
3. Study of the developmental stages and life cycle of *Drosophila* from stock culture
4. Study of different sections of placenta (photomicrograph/slides)
5. Project report on *Drosophila* culture/chick embryodevelopment

SUGGESTED READINGS

- Gilbert, S. F. (2010). Developmental Biology, IX Edition, Sinauer Associates, Inc., Publishers, Sunderland, Massachusetts, USA
- Balinsky B. I. and Fabian B. C. (1981). An Introduction to Embryology, V Edition, International Thompson Computer Press
- Carlson, R. F. Patten's Foundations of Embryology
- Kalthoff (2008). Analysis of Biological Development, II Edition, McGraw-Hill Publishers
- Lewis Wolpert (2002). Principles of Development, II Edition, Oxford University Press

CORE COURSE XIV

EVOLUTIONARY

BIOLOGY

CODE: ZOO-HC-6026

THEORY	(CREDITS 4)
Unit1: Life's Beginnings: Chemogeny, RNA world, Biogeny, Origin of photosynthesis, Evolution of eukaryotes	7
Unit2: Historical review of evolutionary concept: Lamarckism, Darwinism, Neo-Darwinism	4
Unit3: Evidences of Evolution: Fossil record (types of fossils, transitional forms, geological time scale, evolution of horse, Molecular (universality of genetic code and protein synthesising machinery, three domains of life, neutral theory of molecular evolution, molecular clock ,example of globin gene family, rRNA/cyt c	10
Unit4: Sources of variations: Heritable variations and their role in evolution	8
Unit5: Population genetics: Hardy-Weinberg Law (statement and derivation of equation, application of law to human Population); Evolutionary forces upsetting H-W equilibrium; Natural selection (concept of fitness, selection coefficient, derivation of one unit of selection for a dominant allele, genetic load, mechanism of working, types of selection, density-dependent selection, heterozygous superiority, kin selection, adaptive resemblances, sexual selection. Genetic Drift (mechanism, founder's effect, bottleneck phenomenon); Role of Migration and Mutation in changing allele frequencies	13
Unit6: Product of evolution: Micro evolutionary changes (inter-population variations, clines, races, Species concept, Isolating mechanisms, modes of speciation—allopatric, sympatric, Adaptive radiation / macroevolution (exemplified by Galapagos finches	7
Unit7: Extinctions, Background and mass extinctions (causes and effects), detailed example of K-T extinction	2
Unit8: Origin and evolution of man, Unique hominin characteristics contrasted with primate characteristics, primate phylogeny from <i>Dryopithecus</i> leading to <i>Homo</i>	6

sapiens, molecular analysis of human origin

Unit9:

Phylogenetic trees, Multiple sequence alignment, construction of phylogenetic trees, interpretation of trees

2

EVOLUTIONARY BIOLOGY

PRACTICALS

(CREDITS2)

1. Study of fossils from models/pictures
2. Study of homology and analogy from suitable specimens
3. Study and verification of Hardy-Weinberg Law by chi square analysis
4. Graphical representation and interpretation of data of height/weight of a sample of 100 humans in relation to their age and sex.
5. Construction of phylogenetic trees with the help of bioinformatics tools (Clustal X, Phylip, NJ) and its interpretation.

SUGGESTED READINGS

- Ridley, M (2004) Evolution III Edition Blackwell publishing
- Hall, B.K. and Hallgrimson, B (2008). Evolution IV Edition. Jones and Barlett Publishers.
- Campbell, N.A. and Reece J.B (2011). Biology. IX Edition. Pearson, Benjamin, Cummings.
- Douglas, J. Futuyma (1997). Evolutionary Biology. Sinauer Associates.
- Snustad. S Principles of Genetics.
- Pevsner, J (2009). Bioinformatics and Functional Genomics. II Edition Wiley- Blackwell

DISCIPLINE CENTRIC ELECTIVE COURSES
CODE: ZOO-HE-5016
COMPUTATIONAL BIOLOGY and BIOSTATICS

THEORY **(Credits 4)**

Unit 1: Introduction to Bioinformatics **5**

Importance, Goal, Scope; Genomics, Transcriptomics, Systems Biology, Functional Genomics, Metabolomics, Molecular Phylogeny; Applications and Limitations of Bioinformatics

Unit 2: Biological Databases **10**

Introduction to biological databases; Primary, secondary and composite databases; Nucleic acid databases (GenBank, DDBJ, EMBL and NDB); Protein databases (PIR, SWISS-PROT, TrEMBL, PDB); Metabolic pathway database (KEGG, EcoCyc, and MetaCyc); Small molecule databases (PubChem, Drug Bank, ZINC, CSD)

Unit 3: Data Generation and Data Retrieval **14**

Generation of data (Gene sequencing, Protein sequencing, Mass spectrometry, Microarray), Sequence submission tools (BankIt, Sequin, Webin); Sequence file format (flat file, FASTA, GCG, EMBL, Clustal, Phylip, Swiss-Prot); Sequence annotation; Data retrieval systems (SRS, Entrez)

Unit 3: Basic Concepts of Sequence Alignment **14**

Scoring Matrices (PAM, BLOSUM), Methods of Alignment (Dot matrix, Dynamic Programming, BLAST and FASTA); Local and global alignment, pair wise and multiple sequence alignments; Similarity, identity and homology of sequences.

Unit 4: Applications of Bioinformatics **7**

Structural Bioinformatics (3-D protein, PDB), Functional genomics (genome-wide and high throughput approaches to gene and protein function), Drug discovery method (Basic concepts)

Unit 5: Biostatistics **10**

Introduction, calculation of standard deviation, standard error, Coefficient of Variance, Chi-square test, Z test, t-Test

COMPUTATIONAL BIOLOGY

PRACTICAL

(Credits 2)

1. Accessing biological databases
2. Retrieval of nucleotide and protein sequences from the databases.
3. To perform pair-wise alignment of sequences (BLAST) and interpret the output
4. Predict the structure of protein from its amino acid sequence.
5. To perform a “two-sample t- test” for a given set of data
6. To learn graphical representations of statistical data with the help of computers (e.g. MS Excel).

SUGGESTED READINGS

- Ghosh Z and Mallick B. (2008). *Bioinformatics: Principles and Applications*, Oxford University Press.
- Pevsner J. (2009). *Bioinformatics and Functional Genomics*, II Edition, Wiley Blackwell.
- Zvelebil, Marketa and Baum O. Jeremy (2008). *Understanding Bioinformatics*, Garland Science, Taylor and Francis Group, USA.
- Zar, Jerrold H. (1999). *Biostatistical Analysis*, IV Edition, Pearson Education Inc and Dorling Kindersley Publishing Inc. USA
- Antonisamy, B., Christopher S. and Samuel, P. P. (2010). *Biostatistics: Principles and Practice*. Tata McGraw Hill Education Private Limited, India.
- Pagana, M. and Gavreau, K. (2000). *Principles of Biostatistics*, Duxbury Press, USA

CODE: ZOO-HC-5026

ANIMAL BIOTECHNOLOGY

THEORY

(Credits
4)

Unit 1. Introduction	8
Concept and scope of biotechnology	
Unit 2. Molecular Techniques in Gene manipulation	24
Cloning vectors: Plasmids, Cosmids, Phagemids, Lambda Bacteriophage, M13, BAC, YAC, MAC and Expression vectors (characteristics).	
Restriction enzymes: Nomenclature, detailed study of Type II.	
Transformation techniques: Calcium chloride method and electroporation.	
Construction of genomic and cDNA libraries and screening by colony and plaque hybridization	
Southern, Northern and Western blotting	
DNA sequencing: Sanger method	
Polymerase Chain Reaction, DNA Finger Printing and DNA micro array	
Unit 3. Genetically Modified Organisms	18
Production of cloned and transgenic animals: Nuclear Transplantation, Retroviral Method, DNA microinjection	
Applications of transgenic animals: Production of pharmaceuticals, production of donor organs, knock out mice.	
Production of transgenic plants: <i>Agrobacterium</i> mediated transformation.	
Applications of transgenic plants: insect and herbicide resistant plants.	
Unit 4. Culture Techniques and Applications	10
Animal cell culture, Expressing cloned genes in mammalian cells, Molecular diagnosis of genetic diseases (Cystic fibrosis, Sickle cell anemia)	
Recombinant DNA in medicines: Recombinant insulin and human growth hormone, Gene therapy	

ANIMAL BIOTECHNOLOGY

PRACTICAL

(Credits 2)

1. Genomic DNA isolation from *E. coli*
2. Plasmid DNA isolation (pUC 18/19) from *E. coli*

3. Restriction digestion of plasmid DNA.
4. Construction of circular and linear restriction map from the data provided.
5. Calculation of transformation efficiency from the data provided..
6. To study following techniques through photographs
 - a. Southern Blotting
 - b. Northern Blotting
 - c. Western Blotting
 - d. DNA Sequencing (Sanger's Method)
 - e. PCR
 - f. DNA fingerprinting
7. Project report on animal cell culture

SUGGESTED READINGS

- Brown, T.A. (1998). *Molecular Biology Labfax II: Gene Cloning and DNA Analysis*. II Edition, Academic Press, California, USA.
- Glick, B.R. and Pasternak, J.J. (2009). *Molecular Biotechnology- Principles and Applications of Recombinant DNA*. IV Edition, ASM press, Washington, USA.
- Griffiths, A.J.F., J.H. Miller, Suzuki, D.T., Lewontin, R.C. and Gelbart, W.M. (2009). *An Introduction to Genetic Analysis*. IX Edition. Freeman and Co., N.Y., USA.
- Snustad, D.P. and Simmons, M.J. (2009). *Principles of Genetics*. V Edition, John Wiley and Sons Inc.
- Watson, J.D., Myers, R.M., Caudy, A. and Witkowski, J.K. (2007). *Recombinant DNA- Genes and Genomes- A Short Course*. III Edition, Freeman and Co., N.Y., USA.
- Beauchamp, T.I. and Childress, J.F. (2008). *Principles of Biomedical Ethics*. VI Edition, Oxford University Press.

CODE: ZOO-HE-5036

ENDOCRINOLOGY

THEORY

(Credits 4)

Unit 1: Introduction to Endocrinology

12

History of endocrinology, Classification, Characteristic and Transport of Hormones, Neuro secretions and Neuro hormones

Unit 2: Epiphysis, Hypothalamo-hypophysial Axis

15

Structure of pineal gland, Secretions and their functions in biological rhythm sand reproduction.

Structure of hypothalamus, Hypothalamic nuclei and their functions, Regulation of neuroendocrine glands, Feed back mechanisms

Structure of pituitary gland, Hormones and their functions, Hypothalamo- hypophysial portal system, Disorders of pituitary gland.

Unit3:Peripheral Endocrine Glands

18

Structure, Hormones, Functions and Regulation of Thyroid gland, Parathyroid, Adrenal, Pancreas, Ovary and Testis

Hormones in homeostasis, Disorders of endocrine glands

Unit4: Regulation of Hormone Action

15

Hormone action at Cellular level: Hormone receptors, transduction and regulation Hormone action at Molecular level: Molecular mediators, Genetic control of hormone action

ENDOCRINOLOGY

PRACTICAL

(Credits 2)

1. Dissect and display of Endocrine glands in laboratory bred rat*
2. Study of the permanent slides of all the endocrine glands
3. Demonstration of Castration/ovariectomy in laboratory bred rat*
4. Designing of primers of any hormone

SUGGESTED READINGS

- General Endocrinology C. Donnell Turner Pub- Saunders Toppan
- Endocrinology: An Integrated Approach; Stephen Nussey and Saffron Whitehead.
- Oxford: BIOS Scientific Publishers; 2001.
- Hadley, M.E. and Levine J.E. 2007. Endocrinology, 6th Edition. Pearson Prentice-Hall, Pearson Education Inc., New Jersey.
- Vertebrate Endocrinology by David O. Norris,

CODE: ZOO-HE-5046

PARASITOLOGY

THEORY

(CREDITS 4)

Unit I: Introduction to Parasitology

3

Brief introduction of Parasitism, Parasite, Parasitoid and Vectors (mechanical and biological vector) Host parasite relationship

Unit II: Parasitic Protists

15

Study of Morphology, Life Cycle, Prevalence, Epidemiology, Pathogenicity, Diagnosis, Prophylaxis and Treatment of *Entamoeba histolytica*, *Giardia intestinalis*, *Trypanosoma magambiense*, *Leishmania donovani*, *Plasmodium vivax*

Unit III: Parasitic Platyhelminthes

15

Study of Morphology, Life Cycle, Prevalence, Epidemiology, Pathogenicity, Diagnosis, Prophylaxis and Treatment of *Fasciolopsis buski*, *Schistosoma haematobium*, *Taenia solium* and *Hymenolepis nana*

Unit IV: Parasitic Nematodes

15

Study of Morphology, Life Cycle, Prevalence, Epidemiology, Pathogenicity, Diagnosis, Prophylaxis and Treatment of *Ascaris lumbricoides*, *Ancylostomaduodenale*, *Wuchereriabancrofti* and *Trichinella spiralis*. Study of structure, life cycle and importance of *Meloidogyne* (root knot nematode), *Pratylenchus* (lesion nematode)

Unit IV: Parasitic Arthropoda

10

Biology, importance and control of ticks, mites, *Pediculus humanus* (head and body louse), *Xenopsyllacheopsis* and *Cimex lectularius*

Unit V: Parasitic Vertebrates

2

A brief account of parasitic vertebrates; Cookicutter Shark, Candiru, Hood Mockingbird and Vampire bat

PARASITOLOGY

PRACTICAL

(Credits 2)

- Study of life stages of *Entamoeba histolytica*, *Giardia intestinalis*, *Trypanosoma gambiense*, *Leishmania donovani* and *Plasmodium vivax* through permanent slides/microphotographs
- Study of adult and life stages of *Fasciolopsis buski*, *Schistosoma mahaematobium*, *Taenia solium* and *Hymenolepis nana* through permanent slides/microphotographs
- Study of adult and life stages of *Ascaris lumbricoides*, *Ancylostomoduodenale*, *Wuchereria bancrofti* and *Trichinella spiralis* through permanent slides/microphotographs
- Study of plant parasitic root knot nematode, *Meloidogyne* from the soil sample
- Study of *Pediculus humanus* (Head louse and Body louse), *Xenopsyllacheopsis* and *Cimex lectularius* through permanent slides/photographs
- Study of monogenea from the gills of fresh/marine fish [Gills can be procured from fish market as by product of the industry]
- Study of nematode/cestode parasites from the intestines of Poultry bird [Intestine can be procured from poultry/market as a byproduct]

Submission of a brief report on parasitic

vertebrates SUGGESTED READINGS

- Arora, D. R. and Arora, B. (2001) *Medical Parasitology*. II Edition. CBS Publications and Distributors
- E.R. Noble and G.A. Noble (1982) *Parasitology: The biology of animal parasites*. V Edition, Lea & Febiger
- Ahmed, N., Dawson, M., Smith, C. and Wood, Ed. (2007) *Biology of Disease*. Taylor and Francis Group
- Parija, S. C. *Textbook of medical parasitology, protozoology & helminthology (Text and colour Atlas)*, II Edition, All India Publishers & Distributors, Medical Books Publishers, Chennai, Delhi
- Rattan Lal Chhpujani and Rajesh Bhatia. *Medical Parasitology*, III Edition, Jaypee Brothers Medical Publishers (P) Ltd., New Delhi

□ Meyer, Olsen & Schmidt's Essentials of Parasitology,
Murray, D. Dailey, W.C. Brown Publishers

K. D. Chatterjee (2009). Parasitology: Protozoology and Helminthology. XIII Edition, CBS *Publishers & Distributors* (P)Lt

CODE: ZOO-HE-6016
BIOLOGY OF INSECTA

THEORY	(Credits 4)
Unit I: Introduction	4
General Features of Insects	
Distribution and Success of Insects on the Earth	
Unit II: Insect Taxonomy	4
Basis of insect classification; Classification of insects up to orders	
Unit III: General Morphology of Insects	8
External Features; Head – Eyes, Types of antennae, Mouth parts w.r.t. feeding habits	
Thorax: Wings and wing articulation, Types of Legs adapted to diverse habitat Abdominal appendages and genitalia	
Unit IV: Physiology of Insects	28
Structure and physiology of Insect body systems - Integumentary, digestive, excretory, circulatory, respiratory, endocrine, reproductive, and nervous system	
Sensory receptors	
Growth and metamorphosis	
Unit IV: Insect Society	6
Group of social insects and their social life	
Social organization and social behaviour (w.r.t. any one example)	
Unit V: Insect Plant Interaction	4
Theory of co-evolution, role of allelochemicals in host-plant interaction	
Host-plant selection by phytophagous insects, Insects as plant pests	
Unit VI: Insects as Vectors	6
Insects as mechanical and Biological vectors, Brief discussion on houseflies and mosquitoes as important insect vectors	

BIOLOGY OF INSECTA

PRACTICAL

(CREDITS 2)

1. Study of one specimen from each insect order
2. Study of different kinds of antennae, legs and mouth parts of insects
3. Study of head and sclerites of any one insect
4. Study of insect wings and their venation.
5. Study of insect spiracles
6. Methodology of collection, preservation and identification of insects.
7. Morphological studies of various castes of *Apis*, *Camponotus* and *Odontotermes*
8. Study of any three insect pests and their damages
9. Study of any three beneficial insects and their products

Field study of insects and submission of a project report on the insect diversity

SUGGESTED READINGS

- A general text book of entomology, Imms, A. D., Chapman & Hall, UK
- The Insects: Structure and function, Chapman, R. F., Cambridge University Press, UK
- Principles of Insect Morphology, Snodgrass, R. E., Cornell Univ. Press, USA
- Introduction to the study of insects, Borror, D. J., Triplehorn, C. A., and Johnson, N. F., M Saunders College Publication, USA
- The Insect Societies, Wilson, E. O., Harvard Univ. Press, UK
- Host Selection by Phytophagous insects, Bernays, E. A., and Chapman, R. F., Chapman and Hall, New York, USA
- Physiological system in Insects, Klowden, M. J., Academic Press, USA
- The Insects, An outline of Entomology, Gullan, P. J., and Cranston, P. S., Wiley Blackwell, UK

Insect Physiology and Biochemistry, Nation, J. L., CRC Press, USA

CODE: ZOO-HE-6026

FISH AND FISHERIES

THEORY (Credits 4)

UNIT 1: Introduction and Classification: 6

General description of fish; Account of systematic classification of fishes (upto classes); Classification based on feeding habit, habitat and manner of reproduction.

UNIT 2: Morphology and Physiology: 18

Types of fins and their modifications; Locomotion in fishes; Hydrodynamics; Types of Scales, Use of scales in Classification and determination of age of fish; Gills and gas exchange; Swim Bladder: Types and role in Respiration, buoyancy; Osmoregulation in Elasmobranchs; Reproductive strategies (special reference to Indian fishes); Electric organs; Bioluminescence; Mechanoreceptors; Schooling; Parental care; Migration

UNIT3: Fisheries 12

Inland Fisheries; Marine Fisheries; Environmental factors influencing the seasonal variations in fish catches in the Arabian Sea and the Bay of Bengal; Fishing crafts and Gears; Depletion of fisheries resources; Application of remote sensing and GIS in fisheries; Fisheries law and regulations

Unit4: Aquaculture 20

Sustainable Aquaculture; Extensive, semi-intensive and intensive culture of fish; Pen and cage culture; Polyculture; Composite fish culture; Brood stock management; Induced breeding of fish; Management of finfish hatcheries; Preparation and maintenance of fish aquarium; Preparation of compound diets for fish; Role of water quality in aquaculture; Fish diseases: Bacterial, viral and parasitic; Preservation and processing of harvested fish, Fishery by-products

UNIT 5: Fish in research 53 4

Transgenic fish, Zebra fish as a model organism in research

FISH AND FISHERIES

PRACTICAL

(Credits 2)

1. Morphometric and meristic characters of fishes
2. Study of *Petromyzon*, *Myxine*, *Pristis*, *Chimaera*, *Exocoetus*, *Hippocampus*, *Gambusia*, *Labeo*, *Heteropneustes*, *Anabas*
3. Study of different types of scales (through permanent slides/photographs).
4. Study of crafts and gears used in Fisheries
5. Water quality criteria for Aquaculture: Assessment of pH, conductivity, Total solids, Total dissolved solids
6. Study of air breathing organs in *Channa*, *Heteropneustes*, *Anabas* and *Clarias*
7. Demonstration of induced breeding in Fishes (video)
8. Demonstration of parental care in fishes (video)
9. Project Report on a visit to any fish farm/pisciculture unit/Zebra fish rearing Lab.

SUGGESTED READINGS

- Q Bone and R Moore, Biology of Fishes, Talyor and Francis Group, CRC Press, U.K.
- D. H. Evans and J. D. Claiborne, The Physiology of Fishes, Taylor and Francis Group, CRC Press, UK von der Emde, R. J. Mogdans and B. G. Kapoor. The Senses of Fish: Adaptations for the Reception of Natural Stimuli, Springer, Netherlands
- C.B.L. Srivastava, Fish Biology, Narendra Publishing House
- J.R. Norman, A history of Fishes, Hill and Wang Publishers
- S.S. Khanna and H.R. Singh, A text book of Fish Biology and Fisheries, Narendra Publishing House

CODE: ZOO-HE-6036

REPRODUCTIVE BIOLOGY

THEORY

(CREDITS 4)

Unit 1: Reproductive Endocrinology

Gonadal hormones and mechanism of hormone action, steroids, glycoprotein hormones, and prostaglandins, hypothalamo – hypophyseal – gonadal axis, regulation of gonadotropin secretion in male and female; Reproductive System: Development and differentiation of gonads, genital ducts, external genitalia, mechanism of sex differentiation.

Unit 2: Functional anatomy of male reproduction

Outline and histological of male reproductive system in rat and human; Testis: Cellular functions, germ cell, stem cell renewal; Spermatogenesis: kinetics and hormonal regulation; Androgen synthesis and metabolism; Epididymal function and sperm maturation; Accessory glands functions; Sperm transportation in male tract

Unit 3: Functional anatomy of female reproduction

Outline and histological of female reproductive system in rat and human; Ovary: folliculogenesis, ovulation, corpus luteum formation and regression; Steroidogenesis and secretion of ovarian hormones; Reproductive cycles (rat and human) and their regulation, changes in the female tract; Ovum transport in the fallopian tubes; Sperm transport in the female tract, fertilization; Hormonal control of implantation; Hormonal regulation of gestation, pregnancy diagnosis, foeto – maternal relationship; Mechanism of parturition and its hormonal regulation; Lactation and its regulation

Unit 4: Reproductive Health

Infertility in male and female: causes, diagnosis and management; Assisted Reproductive Technology: sex selection, sperm banks, frozen embryos, in vitro fertilization, ET, EFT, IUT, ZIFT, GIFT, ICSI, PROST; Modern contraceptive technologies; Demographic terminology used in family planning

REPRODUCTIVE BIOLOGY

PRACTICAL

(CREDITS 2)

1. Study of animal house: set up and maintenance of animal house, breeding techniques, care of normal and experimental animals.
2. Examination of vaginal smear rats from live animals.
3. Examination of histological sections from photomicrographs/ permanent slides of rat/human: testis, epididymis and accessory glands of male reproductive systems; Sections of ovary, fallopian tube, uterus (proliferative and secretory stages), cervix and vagina.
4. Sperm count and sperm motility in rat
5. Study of modern contraceptive devices

SUGGESTED READINGS

- Austin, C.R. and Short, R.V. reproduction in Mammals. Cambridge University Press.
- Degroot, L.J. and Jameson, J.L. (eds). Endocrinology. W.B. Saunders and Company.
- Knobil, E. et al. (eds). The Physiology of Reproduction. Raven Press Ltd.
- Hatcher, R.A. et al. The Essentials of Contraceptive Technology. Population Information Programme.

CODE: ZOO-HE-6046

WILD LIFE CONSERVATION AND MANAGEMENT

THEORY

(CREDITS 4)

Unit 1: Introduction to Wild Life

Values of wildlife-positive and negative; Conservation ethics; Importance of conservation; Causes of depletion; World conservation strategies.

Unit 2: Evaluation and management of wild life

Habitat analysis, Physical parameters : Topography, Geology, Soil and water; Biological Parameters: food, cover, forage, browse and cover estimation; Standard evaluation procedures: remote sensing and GIS.

Unit 3: Management of habitats

Setting back succession; Grazing logging; Mechanical treatment; Advancing the successional process; Cover construction; Preservation of general genetic diversity; Restoration of degraded habitats

Unit 4: Population estimation

Population density, Natality, Birth rate, Mortality, fertility schedules and sex ratio computation; Faecal analysis of ungulates and carnivores: Faecal samples, slide preparation, Hair identification, Pug marks and census method.

Unit 5: Management planning of wild life in protected areas

Estimation of carrying capacity; Ecotourism/wildlife tourism in forests; Concept of climax persistence; Ecology of perturbation.

Unit 7: Management of excess population

Bio-telemetry; Care of injured and diseased animal; Quarantine; Common diseases of wild animal

Unit 8: Protected areas

National parks & sanctuaries, Community reserve; Important features of protected areas in India; Tiger conservation - Tiger reserves in India; Management challenges in Tiger reserve.

WILD LIFE CONSERVATION AND MANAGEMENT

PRACTICALS

(CREDITS 2)

1. Identification of flora, mammalian fauna, avian fauna, herpeto-fauna
2. Demonstration of basic equipment needed in wildlife studies use, care and maintenance (Compass, Binoculars, Spotting scope, Range Finders, Global Positioning System, Various types of Cameras and lenses)
3. Familiarization and study of animal evidences in the field; Identification of animals through pugmarks, hoofmarks, scats, pellet groups, nest, antlers etc.
4. Demonstration of different field techniques for flora and fauna
5. PCQ, Tentree method, Circular, Square & rectangular plots, Parker's 2 Step and other methods for ground cover assessment, Tree canopy cover assessment, Shrub cover assessment.
6. Trail/transect monitoring for abundance and diversity estimation of mammals and bird (direct and indirect evidences)

SUGGESTED READINGS

- Caughley, G., and Sinclair, A.R.E. (1994). *Wildlife Ecology and Management*. Blackwell Science.
- Woodroffe R., Thirgood, S. and Rabinowitz, A. (2005). *People and Wildlife, Conflict or Co-existence?* Cambridge University.
- Bookhout, T.A. (1996). *Research and Management Techniques for Wildlife and Habitats*, 5 th edition. The Wildlife Society, Allen Press.
- Sutherland, W.J. (2000). *The Conservation Handbook: Research, Management and Policy*. Blackwell Sciences
- Hunter M.L., Gibbs, J.B. and Sterling, E.J. (2008). *Problem-Solving in Conservation Biology and Wildlife Management: Exercises for Class, Field, and Laboratory*. Blackwell Publishing.

ZOO-HE-6056

DISSERTATION

Dissertation of Zoology Specific subject

□ .

GENERIC ELECTIVE COURSES

CODE: ZOO-HG-1016

ANIMAL DIVERSITY

THEORY

(CREDITS 4)

Unit 1: Kingdom Protista

4

General characters and classification up to classes; Locomotory Organelles and locomotion in Protozoa

Unit 2: Phylum Porifera

3

General characters and classification up to classes; Canal System in *Sycon*

Unit 3: Phylum Cnidaria

3

General characters and classification up to classes; Polymorphism in Hydrozoa

Unit 4: Phylum Platyhelminthes

3

General characters and classification up to classes; Life history of *Taenia solium*

Unit 5: Phylum Nematelminthes

5

General characters and classification up to classes; Life history of *Ascaris lumbricoides* and its parasitic adaptations

Unit 6: Phylum Annelida

3

General characters and classification up to classes; Metamerism in Annelida

Unit 7: Phylum Arthropoda

5

General characters and classification up to classes; Vision in Arthropoda, Metamorphosis in Insects

Unit 8: Phylum Mollusca	4
General characters and classification up to classes; Torsion in gastropods	
Unit 9: Phylum Echinodermata	4
General characters and classification up to classes; Water-vascular system in Asterozoa	
Unit 10: Protochordates	2
General features and Phylogeny of Protochordata	
Unit 11: Agnatha	2
General features of Agnatha and classification of cyclostomes up to classes	
Unit 12: Pisces	4
General features and Classification up to orders; Osmoregulation in Fishes	

Unit13: Amphibia	4
General features and Classification up to orders; Parental care	
Unit14: Reptiles	4
General features and Classification up to orders; Poisonous and non-poisonous snakes, Biting mechanism in snakes	
Unit15: Aves	5
General features and Classification up to orders; Flight adaptations in birds	
Unit17: Mammals	5
Classification up to orders; Origin of mammals	

Note: Classification of Unit 1-9 to be followed from “Barnes, R.D. (1982). *Invertebrate Zoology*, V Edition”

ANIMAL DIVERSITY

PRACTICAL

(CREDITS2)

1. Study of the following specimens:

Amoeba, Euglena, Plasmodium, Paramecium, Sycon, Hyalonema, and Euplectella, Obelia, Physalia, Aurelia, Tubipora, Metridium, Taeniasolium, Male and female Ascarislumbricoides, Aphrodite, Nereis, Pheretima, Hirudinaria, Palaemon, Cancer, Limulus, Palamnaeus, Scolopendra, Julus, Periplaneta, Apis, Chiton, Dentalium, Pila, Unio, Loligo, Sepia, Octopus, Pentaceros, Ophiura, Echinus, Cucumaria and Antedon, Balanoglossus, Herdmania, Branchiostoma, Petromyzon, Sphyrna, Pristis, Torpedo, Labeo, Exocoetus, Anguilla, Ichthyophis/Ureotyphlus, Salamandra, Bufo, Hyla, Chelone, Hemidactylus, Chamaeleon, Draco, Vipera, Naja, Crocodylus, Gavialis, Any six common birds from different orders, Sorex, Bat, Funambulus, Loris

2. Study of the following permanent slides:

T.S. and L.S. of *Sycon*, Study of life history stages of *Taenia*, T.S. of Male and female *Ascaris*

3. Key for Identification of poisonous and non-poisonous snakes

An “**animal album**” containing photographs, cut outs, with appropriate write up about the above mentioned taxa. Different taxa/ topics may be given to different sets of students for this purpose.

SUGGESTED READINGS

- Ruppert and Barnes, R.D. (2006). *Invertebrate Zoology*, VIII Edition. Holt Saunders International Edition.
- Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.I. (2002). *The Invertebrates: A New Synthesis*, III Edition, Blackwell Science
- Young, J. Z. (2004). *The Life of Vertebrates*. III Edition. Oxford university press.
- Pough H. *Vertebrate life*, VIII Edition, Pearson International.
- Hall B.K. and Hallgrimsson B. (2008). *Strickberger's Evolution*. IV Edition. Jones and Bartlett Publishers Inc.

**COMPARATIVE ANATOMY AND DEVELOPMENTAL BIOLOGY OF
VERTEBRATES**
CODE: ZOO-HG-2016

THEORY	(CREDITS 4)
Unit 1: Integumentary System	4
Derivatives of integument w.r.t. glands and digital tips	
Unit 2: Skeletal System	3
Evolution of visceral arches	
Unit 3: Digestive System	4
Brief account of alimentary canal and digestive glands	
Unit 4: Respiratory System	5
Brief account of Gills, lungs, air sacs and swim bladder	
Unit 5: Circulatory System	4
Evolution of heart and aortic arches	
Unit 6: Urinogenital System	4
Succession of kidney, Evolution of urinogenital ducts	
Unit 7: Nervous System	3
Comparative account of brain	
Unit 8: Sense Organs	3
Types of receptors	
Unit 9: Early Embryonic Development	12
Gametogenesis: Spermatogenesis and oogenesis w.r.t. mammals, vitellogenesis in birds; Fertilization: external (amphibians), internal (mammals), blocks to polyspermy; Early development of frog and humans (structure of mature egg and its membranes, patterns of cleavage, fate map, up to formation of gastrula); types of morphogenetic movements; Fate of germ layers; Neurulation in frog embryo.	
Unit 10: Late Embryonic Development	10
Implantation of embryo in humans, Formation of human placenta and functions, other types of placenta on the basis of histology; Metamorphic events in frog life cycle and its hormonal regulation.	
Unit 11: Control of Development	8

Fundamental processes in development (brief idea) – Gene activation, determination, induction, Differentiation, morphogenesis, intercellular communication, cell movements and cell death

COMPARATIVE ANATOMY AND DEVELOPMENTAL BIOLOGY OF VERTEBRATES

PRACTICAL

(CREDITS 2)

1. Osteology:

- a) Disarticulated skeleton of fowl and rabbit
- b) Carapace and plastron of turtle/tortoise
- c) Mammalian skulls: One herbivorous and one carnivorous animal.

2. Frog - Study of developmental stages - whole mounts and sections through permanent slides – cleavage stages, blastula, gastrula, neurula, tail bud stage, tadpole external and internal gill stages.

3. Study of the different types of placenta- histological sections through permanent slides or photomicrographs.

4. Examination of gametes - frog/rat - sperm and ova through permanent slides or photomicrographs.

SUGGESTED READINGS

- Kardong, K.V. (2005) *Vertebrates' Comparative Anatomy, Function and Evolution*. IV Edition. McGraw-Hill Higher Education.
- Kent, G.C. and Carr R.K. (2000). *Comparative Anatomy of the Vertebrates*. IX Edition. The McGraw-Hill Companies.
- Hilderbrand, M and Gaslow G.E. *Analysis of Vertebrate Structure*, John Wiley and Sons.
- Walter, H.E. and Sayles, L.P; *Biology of Vertebrates*, Khosla Publishing House.
- Gilbert, S. F. (2006). *Developmental Biology*, VIII Edition, Sinauer Associates, Inc., Publishers, Sunderland, Massachusetts, USA.
- Balinsky, B.I. (2008). *An introduction to Embryology*, International Thomson Computer Press.
- Carlson, Bruce M (1996). *Patten's Foundations of Embryology*, McGraw Hill, Inc.

CORE COURSE III
PHYSIOLOGY AND BIOCHEMISTRY
CODE: ZOO-HG-3016

THEORY

(CREDITS 4)

Unit 1: Nerve and muscle	8
Structure of a neuron, Resting membrane potential, Graded potential, Origin of Action potential and its propagation in myelinated and non-myelinated nerve fibres, Ultra-structure of skeletal muscle, Molecular and chemical basis of muscle contraction	
Unit 2: Digestion	5
Physiology of digestion in the alimentary canal; Absorption of carbohydrates, proteins, lipids	
Unit 3: Respiration	5
Pulmonary ventilation, Respiratory volumes and capacities, Transport of Oxygen and carbon dioxide in blood	
Unit 4: Excretion	5
Structure of nephron, Mechanism of Urine formation, Counter-current Mechanism	
Unit 5: Cardiovascular system	6
Composition of blood, Hemostasis, Structure of Heart, Origin and conduction of the cardiac impulse, Cardiac cycle	
Unit 6: Reproduction and Endocrine Glands	7
Physiology of male reproduction: hormonal control of spermatogenesis; Physiology of female reproduction: hormonal control of menstrual cycle Structure and function of pituitary, thyroid, Parathyroid, pancreas and adrenal	
Unit 7: Carbohydrate Metabolism	8
Glycolysis, Krebs Cycle, Pentose phosphate pathway, Gluconeogenesis, Glycogen metabolism, Review of electron transport chain	
Unit 8: Lipid Metabolism	5
Biosynthesis and β oxidation of palmitic acid	
Unit 9: Protein metabolism	5
Transamination, Deamination and Urea Cycle	
Unit 10: Enzymes	6
Introduction, Mechanism of action, Enzyme Kinetics, Inhibition and Regulation	

PHYSIOLOGY AND BIOCHEMISTRY

PRACTICAL

(CREDITS2)

1. Preparation of hemin crystals
2. Study of permanent histological sections of mammalian pituitary, thyroid, pancreas, adrenal gland
3. Study of permanent slides of spinal cord, duodenum, liver, lung, kidney, bone, cartilage
4. Qualitative tests to identify functional groups of carbohydrates in given solutions (Glucose, Fructose, Sucrose, Lactose)
2. Estimation of total protein in given solutions by Lowry's method.
3. Study of activity of salivary amylase under optimum conditions

SUGGESTED READINGS

- Tortora, G.J. and Derrickson, B.H. (2009). *Principles of Anatomy and Physiology*, XII Edition, John Wiley & Sons, Inc.
- Widmaier, E.P., Raff, H. and Strang, K.T. (2008) *Vander's Human Physiology*, XI Edition., McGrawHill
- Guyton, A.C. and Hall, J.E. (2011). *Textbook of Medical Physiology*, XII Edition, Harcourt Asia Pvt. Ltd/ W.B. Saunders Company
- Berg, J. M., Tymoczko, J. L. and Stryer, L. (2006). *Biochemistry*. VI Edition. W.H Freeman and Co.
- Nelson, D. L., Cox, M. M. and Lehninger, A.L. (2009). *Principles of Biochemistry*. IV Edition. W.H. Freeman and Co.
- Murray, R.K., Granner, D.K., Mayes, P.A. and Rodwell, V.W. (2009). *Harper's Illustrated Biochemistry*. XXVIII Edition. Lange Medical Books/McGraw3Hill.

GENETICS AND EVOLUTIONARY BIOLOGY

CODE: ZOO-HG-4016

THEORY

(CREDITS 4)

Unit 1: Introduction to Genetics **3**

Mendel's work on transmission of traits, Genetic Variation, Molecular basis of Genetic Information

Unit 2: Mendelian Genetics and its Extension **8**

Principles of Inheritance, Chromosome theory of inheritance, Incomplete dominance and co-dominance, Multiple alleles, Lethal alleles, Epistasis, Pleiotropy, sex linked inheritance, extra-chromosomal inheritance

Unit 3: Linkage, Crossing Over and Chromosomal Mapping **9**

Linkage and crossing over, Recombination frequency as a measure of linkage intensity, two factor and three factor crosses, Interference and coincidence, Somatic cell genetics - an alternative approach to gene mapping

Unit 4: Mutations **7**

Chromosomal Mutations: Deletion, Duplication, Inversion, Translocation, Aneuploidy and Polyploidy; Gene mutations: Induced versus Spontaneous mutations, Back versus Suppressor mutations,

Unit 5: Sex Determination **4**

Chromosomal mechanisms, dosage compensation

Unit 6: History of Life **2**

Major Events in History of Life

Unit 7: Introduction to Evolutionary Theories **5**

Lamarckism, Darwinism, Neo-Darwinism

Unit 8: Direct Evidences of Evolution **5**

Types of fossils, Incompleteness of fossil record, Dating of fossils, Phylogeny of horse

Unit 9: Processes of Evolutionary Change **9**

Organic variations; Isolating Mechanisms; Natural selection (Example: Industrial melanism); Types of natural selection (Directional, Stabilizing, Disruptive), Artificial selection

Unit 10: Species Concept **6**

Biological species concept (Advantages and Limitations); Modes of speciation (Allopatric, Sympatric)

Unit11:Macro-evolution

5

Macro-evolutionary Principles (example: Darwin's Finches)

Unit 12: Extinction

6

Mass extinction (Causes, Names of five major extinctions, K-T extinction in detail), Role of extinction in evolution

GENETICS AND EVOLUTIONARY BIOLOGY

PRACTICAL

(CREDITS 2)

1. Study of Mendelian Inheritance and gene interactions (Non Mendelian Inheritance) using suitable examples. Verify the results using Chi-square test.
2. Study of Linkage, recombination, gene mapping using the data.
3. Study of Human Karyotypes (normal and abnormal).
4. Study of fossil evidences from plaster cast models and pictures
5. Study of homology and analogy from suitable specimens/pictures
6. Charts:
 - a) Phylogeny of horse with diagrams/ cut outs of limbs and teeth of horse ancestors
 - b) Darwin's Finches with diagrams/ cut outs of beaks of different species
7. Visit to Natural History Museum and submission of report

SUGGESTED READINGS

- Gardner, E.J., Simmons, M.J., Snustad, D.P. (2008). *Principles of Genetics*. VIII Edition. WileyIndia.
- Snustad, D.P., Simmons, M.J. (2009). *Principles of Genetics*. V Edition. John Wiley and SonsInc.
- Klug, W.S., Cummings, M.R., Spencer, C.A. (2012). *Concepts of Genetics*. X Edition. BenjaminCummings.
- Russell, P. J. (2009). *Genetics- A Molecular Approach*. III Edition. Benjamin Cummings.
- Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C. and Carroll, S.B. *Introduction to Genetic Analysis*. IX Edition. W. H. Freeman andCo.
- Ridley, M. (2004). *Evolution*. III Edition. BlackwellPublishing
- Barton, N. H., Briggs, D. E. G., Eisen, J. A., Goldstein, D. B. and Patel, N. H.(2007). *Evolution*. Spring, Harbour Laboratory Press.
- Hall, B. K. and Hall grimsson, B. (2008). *Evolution*. IV Edition. Jones and Bartlett Publishers
- Campbell, N. A. and Reece J. B. (2011). *Biology*. IX Edition, Pearson, Benjamin, Cummings.
- Douglas, J. Futuyma (1997). *Evolutionary Biology*. Sinauer Associates.

SKILL ENHANCEMENT COURSES

CODE: ZOO-SE-3014

Credit-4

Ornamental Fish & Fisheries

1. Ornamental Fish Diversity of North East India.
2. Aquarium plant diversity in the wetland of Assam.
3. Construction and management of Home Aquarium.
4. Natural feed of Ornamental Fish
5. Strategies for maintenance of natural colour of Ornamental Fish
6. Natural Breeding of Tricogaster species
7. Health management of Ornamental Fish
8. Feed formulation of Ornamental Fish
9. Development of Biological filtration in Aquarium
10. Pure culture of planktons

Practical's

11. Identification of Ornamental Fish
12. Culture of Indigenous ornamental fish in Aquarium
13. Estimation of Physico-chemical characteristics of Aquarium water
14. Biological filter for removal of Ammonia from Aquarium
15. Culture of Planktons

APICULTURE

CODE: ZOO-SE-3024

(CREDITS4)

Unit 1: Biology of Bees

History, Classification and Biology of Honey
Bees Social Organization of Bee Colony

Unit 2: Rearing of Bees

Artificial Bee rearing(Apiary),Beehives–Newton and
Langstroth Bee Pasturage
Selection of Bee Species for
Apiculture Bee Keeping Equipment
Methods of Extraction of Honey (Indigenous and Modern)

Unit 3: Diseases and Enemies

Bee Diseases and Enemies

Control and Preventive
measures

Unit 4: Bee Economy

Products of Apiculture Industry and its Uses (Honey, Bees Wax, Propolis), Pollen etc

Unit 5: Entrepreneurship in Apiculture

Bee Keeping Industry—Recent Efforts, Modern Methods in employing artificial Beehives for cross pollination in horticultural gardens

SUGGESTED READINGS

- Prost, P. J. (1962). *Apiculture*. Oxford and IBH, New Delhi.
- Bisht D.S., *Apiculture*, ICAR Publication.
- Singh S., *Bee keeping in India*, Indian council of Agricultural Research, New Delhi.

CODE: ZOO-SE-4014

SEC 2 NON-

MULBERRY

SERICULTURE

(CREDITS 4)

Unit 1: Introduction

Sericulture: Definition, history and present status of Mulberry and Non-Mulberry Sericulture; Silk route Varieties of Silk; Types and distribution of non-mulberry or wild or vanya sericigenous insects in N-E India

Unit 2: Biology of Non-mulberry Silkworm:

Life cycle of silkworm- Eri and Muga
Structure of silk gland and Nature of Silk

Unit 3: Rearing of Silkworms (Eri and Muga Silkworm):

Food plants of Eri and Muga Silkworm

Rearing Operation:

Rearing house/Site and rearing appliances
Disinfectants: Formalin, bleaching powder
Rearing technology: Early age and Late age rearing
Environmental conditions in rearing- Temperature, Humidity, Light and Air
Types of mountages
Harvesting and storage of cocoons
Spinning and Reeling of silk

Unit 4: Pests and Diseases:

Pests of eri and muga silkworm
Pathogenesis of eri and muga silkworm diseases: Protozoan, viral, fungal and bacterial
Prevention and control measures of pests and diseases

Unit 5: Entrepreneurship in Non-Mulberry Sericulture:

Varieties of Non-Mulberry Silk products and economics in India

Prospectus of Non-Mulberry Sericulture in India: Non-Mulberry Sericulture industry in different states, employment generation and potential

Visit to various sericulture Govt. /Private Farm/ Centers.

SUGGESTED READINGS

- Jolly, M. S., S. K. Sen, T.N. Sonwalkar and G.K. Prashad 1979. *Non-Mulberry Sericulture. In: Manual of Sericulture*, Rome, **FAO**, 4 (29)
- Chowdhury, S.N. 1981. *Muga Silk Industry*. Directorate of Sericulture, Govt. of Assam, Guwahati-781005, Assam.
- Chowdhury, S.N. 1982. *Eri Silk Industry*. Directorate of Sericulture, Govt. of Assam, Guwahati-781005, Assam.
- Chowdhury, S.N. 1992. *Silk and Sericulture*. Directorate of Sericulture and Weaving, Govt. of Assam, Guwahati-781005, Assam.

**Wildlife Photography and
Ecotourism**

**CREDITS 4
Credit-1**

Unit-I Tools and Technique of Photography

- Introduction to Photography
- Still && Video Photography
- To develop expertise in Photography
- Field trips for photography in different periods (Light and Dark), seasons and places (Wetlands, Wildlife sanctuaries, National parks, Industrial sites)
- Methods of documentation

Practical

- Submission of Photography
- Preparation of Poster and Calendar

Unit-2 Eco-tourism

- Introduction of Eco-tourism
- Scope of Eco-tourism with special reference to North East region of India
- Management of Eco-tourism & hospitality
- Development of Eco-tourism with innovative Eco-restoration ideas.

Practical

- Field visit to Wildlife sanctuaries, Eco-park, Historical and religious places, Cultural museum etc.
- Preparation of report and seminar presentation

CODE: ZOO-SE-4034
RESEARCH METHODOLOGY
Credit:4

Unit 1:

Foundations of Research:

Meaning, Objectives, Motivation: Research Methods vs Methodology, Types of Research: Analytical vs Descriptive, Quantitative vs Qualitative, Basic vs Applied

Unit 2:

Research Design Need for research design:

Features of good design, Important concepts related to good design- Observation and Facts, Prediction and Explanation, Development of Models. Developing a research plan: Problem identification, Experimentation, Determining experimental and sample designs

Unit 3:

Data Collection, Analysis and Report Writing

Observation and Collection of Data-Methods of data collection- Sampling Methods, Data Processing and Analysis Strategies, Technical Reports and Thesis writing, Preparation of Tables and Bibliography. Data Presentation using digital technology

Unit 4:

Ethical Issues

Intellectual property Rights, Commercialization, Copy Right, Royalty, Patent law, Plagiarism, Citation, Acknowledgement

SUGGESTED READINGS

- Anthony, M, Graziano, A.M. and Raulin, M.L. 2009. Research Methods: A Process of Inquiry, Allyn and Bacon.
- Walliman, N. 2011. Research Methods- The Basics. Taylor and Francis, London, New York.
- Wadhera, B.L.: Law Relating to Patents, Trade Marks, Copyright Designs and Geographical Indications, 2002, Universal Law publishing
- C.R.Kothari: Research Methodology, New Age International, 2009
- Coley, S.M. and Scheinberg, C.A. 1990, "Proposal writing". Stage Publications.

Choice Based Credit System (CBCS)

UNIVERSITY OF GAUHATI

DEPARTMENT OF STATISTICS

UNDERGRADUATE PROGRAMME

(Courses effective from Academic Year 2019 - 20)



SYLLABUS OF COURSES TO BE OFFERED

Core Courses, Elective Courses & Ability Enhancement Courses

Declaration of Conformity

I / We certify that the syllabus for the stream **B.Sc. (Honours)** in the subject **Statistics** is as per guidelines laid down in the UG-CBCS Regulations of GU and the Sequence and Nomenclature of the Core Papers are maintained as per model syllabus published by the UGC, which is also a mandate of the UG-CBCS Regulations of GU.

Signature of the Head of the Department/Chairperson of UG-CCS

Department of **Statistics**, Gauhati University

Date 17-05-2019

Course Structure for B.Sc. in Statistics (Honours) under CBCS

May 2019

Semester	Type	Core	AECC	SEC	DSE	GE
	Credits	14×6 = 84	2×4 = 8	2×4 = 8	4×6 = 24	4×6 = 24
I	STA – HC – 1016	ENG – AE – 1014				STA – HG – 1016
	STA – HC – 1026					
II	STA – HC – 2016	ENV – AE – 2014				STA – HG – 2016
	STA – HC – 2026					
III	STA – HC – 3016			STA - SE – 3YY4		STA – HG – 3016
	STA – HC – 3026					
	STA – HC – 3036					
IV	STA – HC – 4016			STA - SE – 4YY4		STA – HG – 4016
	STA – HC – 4026					
	STA – HC – 4036					
V	STT – HC – 5016				STA - HE – 5YY6	
	STA – HC – 5026					
VI	STA – HC – 6016				STA - HE – 6YY6	
	STA – HC – 6026					

Total Credit: 148

Legends

HC: Core Papers for **Honours**

SE: Skill Enhancement Papers

HE: Discipline Specific Elective Papers for **Honours**

HG: Generic Elective Papers for **Honours**

AE: Ability Enhancement Compulsory Course

RC: Core Papers for **Regular**

RE: Discipline Specific Elective Papers for **Regular**

RG: Generic Elective for Regular

YY: Serial No. of Paper: Two-digit numerical number (within the Semester)

Directives & Advisory

- A student majoring (honours) in Statistics MAY take **HG** papers from any available discipline in the college, except Statistics.
- It is also advisable that a student majoring (honours) in Statistics take at least one **HG** paper from Mathematics.
- A student majoring (honours) in Statistics MAY choose any four papers out of eight papers mentioned in **HE**.
- A student majoring (honours) in Statistics MAY choose any two papers out of four papers mentioned in **SE**.
- The Generic Elective Papers prepared HERE for other disciplines/Departments.
- Red FONTS stands for Regular Courses

List of Papers

Core Papers

Total Lectures for each Theory papers: 60

Credits: 6 (Theory: 04, Practical/Lab: 02)

Semeste	Paper Code	Course name	Paper code for DSE for Regular
I	STA–HC–1016	Descriptive Statistics	
	STA–HC–1026	Calculus	
II	STA–HC–2016	Probability and Probability Distributions	
	STA–HC–2026	Algebra	
III	STA–HC–3016	Sampling Distributions	
	STA–HC–3026	Survey Sampling & Indian Official Statistics	STA-RE-5046
	STA–HC–3036	Mathematical Analysis	
IV	STA–HC–4016	Statistical Inference	
	STA–HC–4026	Linear Models	
	STA–HC–4036	Statistical Quality Control	
V	STA–HC–5016	Stochastic Processes and Queuing Theory	
	STA–HC–5026	Statistical Computing Using C/C++ Programming	
VI	STA–HC–6016	Design of Experiments	STA-RE-6036
	STA–HC-- 6026	Multivariate Analysis and Nonparametric Methods	

Discipline Specific Elective (DSE) Papers for Honours

Total Lectures for each Theory papers: 60

Credits: 6 (Theory: 04, Practical/Lab: 02)

(Any **TWO** papers **MUST** be chosen from given **FOUR** options papers in each Semester)

Semester	Paper Code	Course name	Paper code for DSE for Regular
V	STA – HE – 5016	Operations Research	STA – RE – 5016
	STA – HE – 5026	Time Series Analysis	STA – RE – 5026
	STA – HE – 5036	Survival Analysis and Biostatistics	STA – RE – 5036
	STA – HE – 5046	Financial Statistics	
VI	STA – HE – 6016	Econometrics	STA – RE – 6016
	STA – HE – 6026	Demography and Vital Statistics	STA – RE – 6026
	STA – HE – 6036	Actuarial Statistics	STA – RE – 6046
	STA – HE – 6046	Project Work	

Skill Based (SEC) Papers for Honours

Total Lectures for each Theory papers: 30

Credits: 4 (Theory: 02, Practical/Lab: 02)

(Any **ONE** paper **MUST** be chosen from given **TWO** options papers in each Semester)

Semester	Paper Code	Course name	Paper code for SEC for Regular
III	STA – SE – 3014	Statistical-Data Analysis Using Software Packages	STA – SE – 3014
	STA – SE – 3024	Data Base Management Systems	STA – SE – 4014
IV	STA – SE – 4014	Statistical Data Analysis Using R	STA – SE – 5014
	STA – SE – 4024	Statistical Techniques for Research Methods	STA – SE – 6014

Generic Elective (GE) Papers for Honours

Total Lectures for each Theory papers: 60

Credits: 6 (Theory: 04, Practical/Lab: 02)

Semester	Paper Code	Course name	Paper code for Regular Core (RC) for Regular
I	STA – HG – 1016	Statistical Methods	STA – RC – 1016
II	STA – HG – 2016	Introductory Probability	STA – RC – 2016
III	STA – HG – 3016	Basics of Statistical Inference	STA – RC – 3016
IV	STA – HG – 4016	Applied Statistics	STA – RC – 4016

Regular Core (RC) Papers for Regular

Total Lectures for each Theory papers: 60

Credits: 6 (Theory: 04, Practical/Lab: 02)

Semester	Paper Code	Course name
I	STA – RC – 1016	Statistical Methods
II	STA – RC – 2016	Introductory Probability
III	STA – RC – 3016	Basics of Statistical Inference
IV	STA – RC – 4016	Applied Statistics

Discipline Specific Elective (DSE) Papers for Regular

Total Lectures for each Theory papers: 60

Credits: 6 (Theory: 04, Practical/Lab: 02)

Semester	Paper Code	Course name
V	STA – RE – 5016	Operations Research
	STA – RE – 5026	Time Series Analysis
	STA – RE – 5036	Survival Analysis and Biostatistics
	STA – RE – 5046	Survey Sampling & Indian Official Statistics
VI	STA – RE – 6016	Econometrics
	STA – RE – 6026	Demography and Vital Statistics
	STA – RE – 6036	Design of Experiments
	STA – RE – 6046	Actuarial Statistics

Skill Based (SEC) Papers for Regular

Total Lectures for each Theory papers: 30

Credits: 4 (Theory: 02, Practical/Lab: 02)

Semester	Paper Code	Course name
III	STA – SE – 3014	Statistical-Data Analysis Using Software Packages
IV	STA – SE – 4014	Data Base Management Systems
V	STA – SE – 5014	Statistical Data Analysis Using R
VI	STA – SE – 6014	Statistical Techniques for Research Methods

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STA-HC-1016

Descriptive Statistics

Total Lectures: 60 Credits: 6 (Theory: 04, Practical/Lab: 02)

1.1 Theory

1.1.1 Unit I: *Statistical Methods*: (Lectures: 10)

Definition and scope of Statistics, concepts of statistical population and sample. Data: quantitative and qualitative, attributes, variables, scales of measurement- nominal, ordinal, interval and ratio. Presentation: tabular and graphical, including histogram and ogives, box plot, consistency and independence of data with special reference to attributes.

1.1.2 Unit 2: *Measures of Central Tendency*: (Lectures: 20)

Mathematical and positional. Measures of Dispersion: range, quartile deviation, mean deviation, standard deviation, coefficient of variation, Moments, absolute moments, factorial moments, skewness and kurtosis, Sheppard's corrections.

Collection and Scrutiny of Data: Primary data-designing a questionnaire and a schedule; checking their consistency; Secondary data-their major sources including some government publications. Complete enumeration, controlled experiments, observational studies and sample surveys. Scrutiny of data for internal consistency and detection of errors of recording. Ideas of cross-validation.

1.1.3 Unit 3: *Bivariate data*: (Lectures: 15)

Definition, scatter diagram, simple, partial and multiple correlation (3 variables only), rank correlation. Simple linear regression, principle of least squares and fitting of polynomials and exponential curves.

1.1.4 Unit 4: *Index Numbers*: (Lectures: 15)

Definition, construction of index numbers and problems thereof for weighted and unweighted index numbers including Laspeyre's, Paasche's, Edgeworth-Marshall and Fisher's. Chain index numbers, conversion of fixed based to chain based index numbers and vice-versa. Consumer price index numbers.

1.2 Practical/Lab

List of Practical

1. Graphical representation of data.
2. Problems based on measures of central tendency.
3. Problems based on measures of dispersion.
4. Problems based on combined mean and variance and coefficient of variation.
5. Problems based on moments, skewness and kurtosis.
6. Fitting of polynomials, exponential curves.

7. Karl Pearson correlation coefficient.
8. Correlation coefficient for a bivariate frequency distribution.
9. Lines of regression, angle between lines and estimated values of variables.
10. Spearman rank correlation with and without ties.
11. Partial and multiple Correlations.
12. Planes of regression and variances of residuals for given simple correlations.
13. Planes of regression and variances of residuals for raw data.
14. Calculate price and quantity index numbers using simple and weighted average of price relatives.
15. To calculate the Chain Base index numbers.
16. To calculate consumer price index number.

SUGGESTED READING:

1. Goon A.M., Gupta M.K. and Dasgupta B. (2002): Fundamentals of Statistics, Vol. I & II, 8th Edn. The World Press, Kolkata.
2. Miller, Irwin and Miller, Marylees (2006): John E. Freund's Mathematical Statistics with Applications, (7th Edn.), Pearson Education, Asia.
3. Mood, A.M. Graybill, F.A. and Boes, D.C. (2007): Introduction to the Theory of Statistics, 3rd Edn., (Reprint), Tata McGraw-Hill Pub. Co.Ltd.

STA-HC-1026

Calculus

Total Lectures: 60 Credits: 6 (Theory: 04, Tutorial: 02)

2.1 Theory

2.1.1 Unit 1: *Differential Calculus*: (Lectures: 18)

Limits of function, continuous functions, properties of continuous functions, partial differentiation and total differentiation. Indeterminate forms: L - Hospital's rule, Leibnitz rule for successive differentiation. Euler's theorem on homogeneous functions. Maxima and minima of functions of one and two variables, constrained optimization techniques (with Lagrange multiplier) along with some problems. Jacobian.

2.1.2 Unit 2: *Integral Calculus*: (Lectures: 12)

Review of integration and definite integral. Differentiation under integral sign, double integral, change of order of integration, transformation of variables. Beta and Gamma functions: properties and relationship between them.

2.1.3 Unit 3: *Differential Equations*: (Lectures: 25)

Exact differential equations, Integrating factors, change of variables, Total differential equations, Differential equations of first order and first degree, Differential equations of first order but not of first degree, Equations solvable for x , y , q , Equations of the first degree in x and y , Clairaut's equations. Higher Order Differential Equations: Linear differential equations of order n , Homogeneous and non-homogeneous linear differential equations of order n with constant coefficients, Different forms of particular integrals.

2.1.4 Unit 4: *Partial Differential Equations*: (Lectures: 5)

Formation and solution of a partial differential equations. Equations easily integrable. Linear partial differential equations of first order.

2.2 Tutorial

SUGGESTED READINGS:

1. Gorakh Prasad: Differential Calculus, Pothishala Pvt. Ltd., Allahabad (14th Edition - 1997).
2. Gorakh Prasad: Integral Calculus, Pothishala Pvt. Ltd., Allahabad (14th Edition -2000).
3. Zafar Ahsan: Differential Equations and their Applications, Prentice-Hall of India Pvt. Ltd., New Delhi (2nd Edition -2004).
4. Piskunov, N: Differential and Integral Calculus, Peace Publishers, Moscow.

STA-HC-2016

Probability and Probability Distributions

Total Lectures: 60 Credits: 6 (Theory: 04, Practical/Lab: 02)

3.1 Theory

3.1.1 Unit 1: *Probability*: (Lectures: 12)

Introduction, random experiments, sample space, events and algebra of events. Definitions of Probability – classical, statistical, and axiomatic. Conditional Probability, laws of addition and multiplication, independent events, theorem of total probability, Bayes' theorem and its applications.

3.1.2 Unit 2: *Random variables*: (Lectures: 18)

Discrete and continuous random variables, p.m.f., p.d.f. and c.d.f., illustrations and properties of random variables, univariate transformations with illustrations. Two dimensional random variables: discrete and continuous type, joint, marginal and conditional p.m.f, p.d.f., and c.d.f., independence of variables, bivariate transformations with illustrations.

3.1.3 Unit 3: *Mathematical Expectation and Generating Functions*: (Lectures: 12)

Expectation of single and bivariate random variables and its properties. Moments and Cumulants, moment generating function, cumulant generating function and characteristic function. Conditional expectations.

3.1.4 Unit 4: *Mathematical Expectation and Generating Functions*: (Lectures: 18)

Standard probability distributions: Binomial, Poisson, geometric, negative binomial, hypergeometric, uniform, normal, exponential, Cauchy, beta and gamma along with their properties and limiting/approximation cases, Log normal, Laplace, Weibull.

3.2 Practical/Lab

List of Practical

1. Fitting of binomial distributions for n and $p = q = \frac{1}{2}$.
2. Fitting of binomial distributions for given n and p .
3. Fitting of binomial distributions after computing mean and variance.
4. Fitting of Poisson distributions for given value of λ .
5. Fitting of Poisson distributions after computing mean.
6. Fitting of negative binomial.
7. Fitting of suitable distribution.
8. Application problems based on binomial distribution.
9. Application problems based on Poisson distribution.
10. Application problems based on negative binomial distribution.
11. Problems based on area property of normal distribution.
12. To find the ordinate for a given area for normal distribution.
13. Application based problems using normal distribution.

14. Fitting of normal distribution when parameters are given.
15. Fitting of normal distribution when parameters are not given.

SUGGESTED READING:

1. Hogg, R.V., Tanis, E.A. and Rao J.M. (2009): Probability and Statistical Inference, Seventh Ed, Pearson Education, New Delhi.
2. Miller, Irwin and Miller, Marylees (2006): John E. Freund's Mathematical Statistics with Applications, (7th Edn.), Pearson Education, Asia.
3. Myer, P.L. (1970): Introductory Probability and Statistical Applications, Oxford & IBH Publishing, New Delhi

STA-HC-2026

Algebra

Total Lectures: 60 Credits: 6 (Theory: 04, Practical/Lab: 02)

4.1 Theory

4.1.1 Unit 1: *Theory of equations*: (Lectures: 15)

Statement of the fundamental theorem of algebra and its consequences. Relation between roots and coefficients or any polynomial equations. Solutions of cubic and biquadratic equations when some conditions on roots of equations are given. Evaluation of the symmetric polynomials and roots of cubic and biquadratic equations. Vector spaces, Subspaces, sum of subspaces, Span of a set, Linear dependence and independence, dimension and basis, dimension theorem.

4.1.2 Unit 2: *Algebra of matrices*: (Lectures: 17)

A review, theorems related to triangular, symmetric and skew symmetric matrices, idempotent matrices, Hermitian and skew Hermitian matrices, orthogonal matrices, singular and non-singular matrices and their properties. Trace of a matrix, unitary, involutory and nilpotent matrices. Adjoint and inverse of a matrix and related properties.

4.1.3 Unit 3: *Determinants of Matrices*: (Lectures: 18)

Definition, properties and applications of determinants for 3rd and higher orders, evaluation of determinants of order 3 and more using transformations. Symmetric and Skew symmetric determinants, Circulant determinants and Vandermonde determinants for n^{th} order, Jacobi's Theorem, product of determinants. Use of determinants in solution to the system of linear equations, row reduction and echelon forms, the matrix equations $AX=B$, solution sets of linear equations, linear independence, Applications of linear equations, inverse of a matrix.

4.1.4 Unit 4: *Matrices*: (Lectures: 10)

Rank of a matrix, row-rank, column-rank, standard theorems on ranks, rank of the sum and the product of two matrices. Partitioning of matrices and simple properties. Characteristic roots and Characteristic vector, Properties of characteristic roots, Cayley Hamilton theorem, Quadratic forms, Linear orthogonal transformation and their diagonalization.

3.2 Practical/Lab

List of Practical

Practical will done from the Unit 1 to Unit 4.

SUGGESTED READINGS:

1. Lay David C.: Linear Algebra and its Applications, Addison Wesley, 2000.
2. Schaum's Outlines : Linear Algebra, Tata McGraw-Hill Edition, 3rd Edition, 2006.
3. Krishnamurthy, V., Mainra, V.P. and Arora J.L.: An Introduction to Linear Algebra (II, III, IV, V).
4. Jain, P.K. and Khalil Ahmad: Metric Spaces, Narosa Publishing House, New Delhi, 1973
5. Biswas, S. (1997): A Textbook of Matrix Algebra, New Age International, 1997.
6. Gupta, S.C.: An Introduction to Matrices (Reprint). Sultan Chand & Sons, 2008.

7. Artin, M.: Algebra. Prentice Hall of India, 1994.
8. Datta, K.B.: Matrix and Linear Algebra. Prentice Hall of India Pvt. Ltd., 2002.
9. Hadley, G.: Linear Algebra, Narosa Publishing House (Reprint), 2002.
10. Searle, S.R.: Matrix Algebra Useful for Statistics. John Wiley & Sons., 1982.

STA-HC-3016

Sampling Distributions

Total Lectures: 60 Credits: 6 (Theory: 04, Practical/Lab: 02)

5.1 Theory

5.1.1 Unit 1: *Order Statistics*: (Lectures: 8)

Introduction, distribution of the r th order statistic, smallest and largest order statistics. Joint distribution of r th and s th order statistics, distribution of sample median and sample range.

5.1.2 Unit 2: *Sampling Distributions*: (Lectures: 20)

Definitions of random sample, parameter and statistic, sampling distribution of a statistic, sampling distribution of sample mean, standard errors of sample mean, sample variance and sample proportion. Null and alternative hypotheses, level of significance, Type I and Type II errors, their probabilities and critical region. Large sample tests, testing single proportion, difference of two proportions, single mean, difference of two means, standard deviation and difference of standard deviations by classical and p -value approaches.

5.1.3 Unit 3: *Exact sampling distributions*: (Lectures: 12)

Definition and derivation of p.d.f. of χ^2 with n degrees of freedom (d.f.) using m.g.f., nature of p.d.f. curve for different degrees of freedom, mean, variance, m.g.f., cumulant generating function, mode, additive property and limiting form of χ^2 distribution. Tests of significance and confidence intervals based on χ^2 distribution.

5.1.4 Unit 4: *Sampling distribution*: (Lectures: 20)

Student's and Fishers t -distribution, Derivation of its p.d.f., nature of probability curve with different degrees of freedom, mean, variance, moments and limiting form of t distribution.

Snedecore's F -distribution: Derivation of p.d.f., nature of p.d.f. curve with different degrees of freedom, mean, variance and mode. Distribution of $1/F(n_1, n_2)$. Relationship between t , F and χ^2 distributions. Test of significance and confidence Intervals based on t and F distributions.

5.2 Practical/Lab

List of Practical

1. Testing of significance and confidence intervals for single proportion and difference of two proportions
2. Testing of significance and confidence intervals for single mean and difference of two means and paired tests.
3. Testing of significance and confidence intervals for difference of two standard deviations.
4. Exact Sample Tests based on Chi-Square Distribution.

5. Testing if the population variance has a specific value and its confidence intervals.
6. Testing of goodness of fit.
7. Testing of independence of attributes.
8. Testing based on 2 X 2 contingency table without and with Yates' corrections.
9. Testing of significance and confidence intervals of an observed sample correlation coefficient.
10. Testing and confidence intervals of equality of two population variances

SUGGESTED READING:

1. Goon, A.M., Gupta, M.K. and Dasgupta, B. (2003): *An Outline of Statistical Theory*, Vol. I, 4th Edn. World Press, Kolkata.
2. Rohatgi V. K. and Saleh, A.K. Md. E. (2009): *An Introduction to Probability and Statistics*. 2nd Edn. (Reprint) John Wiley and Sons.
3. Hogg, R.V. and Tanis, E.A. (2009): *A Brief Course in Mathematical Statistics*. Pearson Education.
4. Johnson, R.A. and Bhattacharya, G.K. (2001): *Statistics-Principles and Methods*, 4th Edn. John Wiley and Sons.
5. Mood, A.M., Graybill, F.A. and Boes, D.C. (2007): *Introduction to the Theory of Statistics*, 3rd Edn. (Reprint). Tata McGraw-Hill Pub. Co. Ltd.

STA-HC-3026

Survey Sampling and Indian Official Statistics

Total Lectures: 60 Credits: 6 (Theory: 04, Practical/Lab: 02)

6.1 Theory

6.1.1 Unit 1: *Survey Sampling*: (Lectures: 8)

Concept of population and sample, complete enumeration versus sampling, sampling and non-sampling errors. Types of sampling: non-probability and probability sampling, basic principle of sample survey, simple random sampling with and without replacement, definition and procedure of selecting a sample, estimates of: population mean, total and proportion.

6.1.2 Unit 2: *Stratified random sampling*: (Lectures: 26)

Technique, estimates of population mean and total, variances of these estimates, proportional and optimum allocations and their comparison with SRS. Practical difficulties in allocation, estimation of gain in precision. Systematic Sampling: Technique, estimates of population mean and total, variances of these estimates ($N=n \times k$). Comparison of systematic sampling with SRS and stratified sampling in the presence of linear trend and corrections, introduction to PPS sampling and two stage sampling.

6.1.3 Unit 3: *Ratio and Regression Method of Sampling*: (Lectures: 20)

Introduction to Ratio and regression methods of estimation, first approximation to the population mean and total (for SRS of large size). Cluster sampling (equal clusters only) estimation of population mean and its variance, Concept of sub sampling.

6.1.4 Unit 4: *Official Statistics*: (Lectures: 6)

Present official statistical system in India, Methods of collection of official statistics, their reliability and limitations. Role of Ministry of Statistics & Program Implementation (MoSPI), Central Statistical Office (CSO), National Sample Survey Office (NSSO), and National Statistical Commission. Government of India's Principal publications containing data on the topics such as population, industry and finance.

6.2 Practical/Lab

List of Practical

1. To select a SRS with and without replacement.
2. For a population of size 5, estimate population mean, population mean square and population variance. Enumerate all possible samples of size 2 by WR and WOR and establish all properties relative to SRS.
3. For SRSWOR, estimate mean, standard error, the sample size
4. Stratified Sampling: allocation of sample to strata by proportional and Neyman's methods
Compare the efficiencies of above two methods relative to SRS
5. Estimation of gain in precision in stratified sampling.
6. Comparison of systematic sampling with stratified sampling and SRS in the presence of a

linear trend.

7. Ratio and Regression estimation: Calculate the population mean or total of the population. Calculate mean squares. Compare the efficiencies of ratio and regression estimators relative to SRS.
8. Cluster sampling: estimation of mean or total, variance of the estimate, estimate of intra-class correlation coefficient, efficiency as compared to SRS.

SUGGESTED READING

1. Cochran, W.G. (1984): Sampling Techniques (3rd Ed.), Wiley Eastern.
2. Sukhatme, P.V., Sukhatme, B.V. Sukhatme, S. Asok,C.(1984). Sampling Theories of Survey With Application, IOWA State University Press and Indian Society of Agricultural Statistics
3. Murthy, M.N. (1977): Sampling Theory & Statistical Methods, Statistical Pub. Society, Calcutta.
4. Des Raj and Chandhok, P. (1998): Sample Survey Theory, Narosa Publishing House.
5. Goon, A.M., Gupta, M.K. and Dasgupta, B. (2001): Fundamentals of Statistics (Vol.2), World Press.
6. Guide to current Indian Official Statistics, Central Statistical Office, GOI, New Delhi.
7. <http://mospi.nic.in/>

STA-HC-3036

Mathematical Analysis

Total Lectures: 60 Credits: 6 (Theory: 04, Practical/Lab: 02)

7.1 Theory

7.1.1 Unit 1: *Real Analysis*: (Lectures: 12)

Representation of real numbers as points on the line. Bounded and unbounded sets, neighborhoods and limit points, Supremum and infimum, derived sets, open and closed sets, sequences and their convergence, limits of some special sequences such as r^n , $\left(1 + \frac{1}{n}\right)^n$, and $\frac{1}{n^n}$ and Cauchy's general principle of convergence, Cauchy's first theorem on limits, monotonic sequences, limit superior and limit inferior of a bounded sequence.

7.1.2 Unit 2: *Infinite Series*: (Lectures: 12)

Infinite series, positive term series and their convergence; Comparison test, D'Alembert's ratio test, Cauchy's n^{th} root test, Raabe's test (For all the tests, statement only is required, without proof and applications). Absolute convergence of series, Leibnitz's test for the convergence of alternating series, Conditional convergence. Indeterminate form, L' Hospital's rule.

7.1.3 Unit 3: *Limits, Continuity and Differentiability*: (Lectures: 16)

Review of limit, continuity and differentiability, uniform Continuity and boundedness of a function. Rolle's and Lagrange's Mean Value theorems. Taylor's theorem with Lagrange's and Cauchy's form of remainder (without proof). Taylor's and Maclaurin's series expansions of $\sin(x)$, $\cos(x)$, e^x , $(1+x)^n$, $\log(1+x)$.

7.1.4 Unit 4: *Numerical Analysis*: (Lectures: 20)

Factorial, finite differences and interpolation. Operators, E and divided difference. Newton's forward, backward and divided differences interpolation formulae. Lagrange's interpolation formulae. Central differences, Gauss and Stirling interpolation formulae. Numerical integration. Trapezoidal rule, Simpson's one-third rule, three-eighths rule, Weddle's rule with error terms. Stirling's approximation to factorial n . Solution of difference equations of first order.

7.2 Practical/Lab

Practical to be done from topics contained in Unit 4 only.

SUGGESTED READINGS

1. Malik, S.C. and Savita Arora: Mathematical Analysis, Second Edition, Wiley Eastern Limited, New Age International Limited, New Delhi, 1994.
2. Somasundram, D. and Chaudhary, B.: A First Course in Mathematical Analysis, Narosa Publishing House, New Delhi, 1987.
3. Gupta, S.L. and Nisha Rani: Principles of Real Analysis, Vikas Publ. House Pvt. Ltd., New Delhi, 1995.
4. Appostol, T.M.: Mathematical Analysis, Second Edition, Narosa Publishing House, New Delhi, 1987.
5. Shanti Narayan: A course of Mathematical Analysis, 12th revised Edition, S. Chand & Co. (Pvt.) Ltd., New Delhi, 1987.
6. Singal, M.K. and Singal, A.R.: A First Course in Real Analysis, 24th Edition, R. Chand & Co., New Delhi, 2003.
7. Bartle, R. G. and Sherbert, D. R. (2002): Introduction to Real Analysis (3rd Edition), John Wiley and Sons (Asia) Pte. Ltd., Singapore.
8. Ghorpade, Sudhir R. and Limaye, Balmohan V. (2006): A Course in Calculus and Real Analysis, Undergraduate Texts in Mathematics, Springer (SIE), Indian reprint.
9. Jain, M. K., Iyengar, S. R. K. and Jain, R. K. (2003): Numerical methods for scientific and engineering computation, New age International Publisher, India.
10. Mukherjee, Kr. Kalyan (1990): Numerical Analysis. New Central Book Agency.
11. Sastry, S.S. (2000): Introductory Methods of Numerical Analysis, 3rd edition, Prentice Hall of India Pvt. Ltd., New Del.

STA-HC-4016

Statistical Inference

Total Lectures: 60 Credits: 6 (Theory: 04, Practical/Lab: 02)

8.1 Theory

8.1.1 Unit 1: *Estimation*: (Lectures: 20)

Concepts of estimation, unbiasedness, sufficiency, consistency and efficiency. Factorization theorem. Complete statistic, Minimum variance unbiased estimator (MVUE), Rao-Blackwell and Lehmann-Scheffe theorems (statement only). Cramer-Rao inequality and MVB estimators.

8.1.2 Unit 2: *Methods of Estimation*: (Lectures: 19)

Method of moments, method of maximum likelihood estimation, method of minimum Chi-square.

8.1.3 Unit 3: *Principles of test of significance*: (Lectures: 18)

Null and alternative hypotheses (simple and composite), Type-I and Type-II errors, critical region, level of significance, size and power, best critical region, most powerful test, uniformly most powerful test, Neyman Pearson Lemma (statement and applications to construct most powerful test). Likelihood ratio test, properties of likelihood ratio tests (without proof).

8.1.4 Unit 4: *Principles of test of significance*: (Lectures: 3)

Sequential Analysis: Introduction to Sequential probability ratio test (SPRT).

8.2 Practical/Lab

List of Practical

1. Unbiased estimators (including unbiased but absurd estimators)
2. Consistent estimators, efficient estimators and relative efficiency of estimators.
3. Cramer-Rao inequality and MVB estimators
4. Sufficient Estimators – Factorization Theorem, Rao-Blackwell theorem, Complete Sufficient estimators
5. Lehman-Scheffe theorem and UMVUE
6. Maximum Likelihood Estimation
7. Estimation by the method of moments, minimum Chi-square
8. Type I and Type II errors
9. Most powerful critical region (NP Lemma)
10. Uniformly most powerful critical region
11. Unbiased critical region
12. Power curves
13. Likelihood ratio tests for simple null hypothesis against simple alternative hypothesis
14. Likelihood ratio tests for simple null hypothesis against composite alternative hypothesis
15. Asymptotic properties of LR tests

SUGGESTED READINGS:

1. Goon, A.M., Gupta, M.K.: Das Gupta, B. (2005), Fundamentals of Statistics, Vol.I, World Press, Calcutta.
2. Rohatgi, V. K. and Saleh, A.K. Md. E. (2009): An Introduction to Probability and Statistics. 2nd Edn. (Reprint) John Wiley and Sons.
3. Miller, I. and Miller, M. (2002) : John E. Freund's Mathematical Statistics (6th addition, low price edition), Prentice Hall of India.
4. Dudewicz, E. J., and Mishra, S. N. (1988): Modern Mathematical Statistics. John Wiley & Sons.
5. Mood, A.M, Graybill, F.A. and Boes, D.C,: Introduction to the Theory of Statistics, McGraw Hill.
6. Bhat, B.R, Srivenkatramana, Tand Rao Madhava, K.S. (1997) Statistics: A Beginner's Text, Vol. I, New Age International (P) Ltd.
7. Snedecor, G.W and Cochran, W.G.(1967) Statistical Methods. Iowa State University Press.

STA-HC-4026

Linear Models

Total Lectures: 60 Credits: 6 (Theory: 04, Practical/Lab: 02)

9.1 Theory

9.1.1 Unit 1: *Gauss-Markov Set-up*: (Lectures: 12)

Theory of linear estimation, Estimability of linear parametric functions, Method of least squares, Gauss-Markov theorem, Estimation of error variance.

9.1.2 Unit 2: *Regression Analysis*: (Lectures: 15)

Simple regression analysis, Estimation and hypothesis testing in case of simple regression models.

9.1.3 Unit 3: *Analysis of Variance*: (Lectures: 18)

Definitions of fixed, random and mixed effect models, analysis of variance and covariance in one-way classified data for fixed effect models, analysis of variance and covariance in two-way classified data with one observation per cell for fixed effect models.

9.1.4 Unit 4: *Model Checking*: (Lectures: 15)

Prediction from a fitted model, Violation of assumptions of AOV and their remedies by transformation.

9.2 Practical/Lab

List of Practical

1. Estimability when X is a full rank matrix and not a full rank matrix
2. Distribution of Quadratic forms
3. Simple Linear Regression
4. Multiple Regression
5. Tests for Linear Hypothesis
6. Bias in regression estimates
7. Lack of fit
8. Orthogonal Polynomials
9. Analysis of Variance of a one way classified data
10. Analysis of Variance of a two way classified data with one observation per cell
11. Analysis of Covariance of a one way classified data
12. Analysis of Covariance of a two way classified data

SUGGESTED READINGS:

1. Weisberg, S. (2005). Applied Linear Regression (Third edition). Wiley.
2. Wu, C. F. J. And Hamada, M. (2009). Experiments, Analysis, and Parameter Design Optimization (Second edition), John Wiley.
3. Renchner, A. C. And Schaalje, G. B. (2008). Linear Models in Statistics (Second edition), John Wiley and Sons.

STA-HC-4036

Statistical Quality Control

Total Lectures: 60 Credits: 6 (Theory: 04, Practical/Lab: 02)

10.1 Theory

10.1.1 Unit 1: *Statistical Process Control*: (Lectures: 18)

Quality: Definition, dimensions of quality, historical perspective of quality control and improvements starting from World War II, historical perspective of Quality Gurus and Quality Hall of Fame. Quality system and standards: Introduction to ISO quality standards, Quality registration. Statistical Process Control - Seven tools of SPC, chance and assignable Causes of quality variation. Statistical Control Charts- Construction and Statistical basis of 3- σ Control charts, Rational Sub-grouping.

10.1.2 Unit 2: *Control Charts for Variables*: (Lectures: 18)

\bar{X} -bar & R -chart, \bar{X} -bar & s -chart. Control charts for attributes: np -chart, p -chart, c -chart and u -chart. Comparison between control charts for variables and control charts for attributes. Analysis of patterns on control chart, estimation of process capability.

10.1.3 Unit 3: *Acceptance Sampling Plan*: (Lectures: 20)

Principle of acceptance sampling plans. Single and Double sampling plan their OC, AQL, LTPD, AOQ, AOQL, ASN, ATI functions with graphical interpretation, use and interpretation of Dodge and Romig's sampling inspection plan tables.

10.1.4 Unit 4: *Six-Sigma*: (Lectures: 4)

Introduction to Six-Sigma: Overview of Six Sigma.

10.2 Practical/Lab

List of Practical

1. Construction and interpretation of statistical control charts \bar{X} -bar & R -chart
 - \bar{X} -bar & s -chart
 - np -chart
 - p -chart
 - c -chart
 - u -chart
2. Single sample inspection plan: Construction and interpretation of OC, AQL, LTPD, ASN, ATI, AOQ, AOQL curves
3. Calculation of process capability and comparison of 3-sigma control limits with specification limits.

SUGGESTED READING:

1. Montgomery, D. C. (2009): Introduction to Statistical Quality Control, 6th Edition, Wiley India Pvt. Ltd.
2. Goon A.M., Gupta M.K. and Dasgupta B. (2002): Fundamentals of Statistics, Vol. I & II, 8th Edn. The World Press, Kolkata.
3. Mukhopadhyay, P (2011): Applied Statistics, 2nd edition revised reprint, Books and Allied(P) Ltd.
4. Montgomery, D. C. and Runger, G.C. (2008): Applied Statistics and Probability for Engineers, 3rd Edition reprint, Wiley India Pvt. Ltd.
5. Ehrlich, B. Harris (2002): Transactional Six Sigma and Lean Servicing, 2nd Edition, St. Lucie Press.
6. Hoyle, David (1995): ISO Quality Systems Handbook, 2nd Edition, Butterworth Heinemann Publication.

STA-HC- 5016

Stochastic Processes and Queuing Theory

Total Lectures: 60 Credits: 6 (Theory: 04, Practical/Lab: 02)

11.1 Theory

11.1.1 Unit 1: *Probability Distributions*: (Lectures: 8)

Generating functions, Bivariate probability generating function. Stochastic Process: Introduction, Stationary Process.

11.1.2 Unit 2: *Markov Chains*: (Lectures: 18)

Definition of Markov Chain, transition probability matrix, order of Markov chain, Markov chain as graphs, higher transition probabilities. Generalization of independent Bernoulli trials, classification of states and chains.

11.1.3 Unit 3: *Poisson Process*: (Lectures: 18)

Postulates of Poisson process, properties of Poisson process, inter-arrival time.

11.1.4 Unit 4: *Queuing System*: (Lectures: 16)

General concept, steady state distribution, queuing model, M/M/1 with finite and infinite system capacity, waiting time distribution (without proof).

11.2 Practical/Lab

List of Practical

1. Calculation of transition probability matrix
2. Identification of characteristics of reducible and irreducible chains.
3. Identification of types of classes
4. Identification of ergodic transition probability matrix
5. Stationarity of Markov chain and graphical representation of Markov chain
6. Computation of probabilities in case of generalizations of independent Bernoulli trials.
7. Computation of inter-arrival time for a Poisson process.
8. Calculation of Probability and parameters for (M/M/1) model and change in behaviour of queue as N tends to infinity.
9. Calculation of generating function and expected duration for different amounts of stake.

SUGGESTED READING:

1. Medhi, J. (2009): Stochastic Processes, New Age International Publishers.
2. Basu, A.K. (2005): Introduction to Stochastic Processes, Narosa Publishing.
3. Bhat, B.R.(2000): Stochastic Models: Analysis and Applications, New Age International Publishers.
4. Taha, H. (1995): Operations Research: An Introduction, Prentice- Hall India.
5. Feller, William (1968): Introduction to probability Theory and Its Applications, Vol I, 3rd Edition, Wiley International.

STA-HC- 5026

Statistical Computing Using C/C++ Programming

Total Lectures: 60 Credits: 6 (Theory: 04, Practical/Lab: 02)

12.1 Theory

12.1.1 Unit 1: *C Programming*: (Lectures: 30)

History and importance of C. Components, basic structure programming, character set, C tokens, Keywords and Identifiers and execution of a C program. Data types: Basic data types, Enumerated data types, derived data types. Constants and variables: declaration and assignment of variables, Symbolic Constants, overflow and underflow of data.

Operators and Expressions: Arithmetic, relational, logical, assignment, increment/decrement, operators, precedence of operators in arithmetic, relational and logical expression. Implicit and explicit type conversions in expressions, library functions. Managing input and output operations: reading and printing formatted and unformatted data

12.1.2 Unit 2: *Decision making and Arrays*: (Lectures: 30)

Decision making and branching - if...else, nesting of if...else, else if ladder, switch, conditional (?) operator. Looping in C: for, nested for, while, do...while, jumps in and out of loops.

Arrays: Declaration and initialization of one-dim and two-dim arrays. Character arrays and strings: Declaring and initializing string variables, reading and writing strings from Terminal (using scanf and printf only).

12.2 Practical/Lab

List of Practical

1. Plot of a graph $y = f(x)$
2. Roots of a quadratic equation (with imaginary roots also)
3. Sorting of an array and hence finding median
4. Mean, Median and Mode of a Grouped Frequency Data
5. Variance and coefficient of variation of a Grouped Frequency Data
6. Preparing a frequency table
7. Value of $n!$ using recursion
8. Random number generation from uniform, exponential, normal (using CLT) and gamma distribution, calculate sample mean and variance and compare with population parameters.
9. Matrix addition, subtraction, multiplication Transpose and Trace
10. Fitting of Binomial, Poisson distribution and apply Chi-square test for goodness of fit
11. Chi-square contingency table
12. t-test for difference of means
13. Paired t-test
14. F-ratio test
15. Multiple and Partial correlation.

16. Compute ranks and then calculate rank correlation (without tied ranks)
17. Fitting of lines of regression

SUGGESTED READING:

1. Kernighan, B.W. and Ritchie, D. (1988): C Programming Language, 2nd Edition, Prentice Hall.
2. Balagurusamy, E. (2011): Programming in ANSI C, 6th Edition, Tata McGraw Hill.
3. Gottfried, B.S. (1998): Schaum's Outlines: Programming with C, 2nd Edition, Tata McGraw Hill.

STA-HC- 6016

Design of Experiments

Total Lectures: 60 Credits: 6 (Theory: 04, Practical/Lab: 02)

13.1 Theory

13.1.1 Unit 1: *Design of Experiments*: (Lectures: 25)

Role, historical perspective, terminology, experimental error, basic principles, uniformity trials, choice of size and shape of plots and blocks.

Basic designs: Completely Randomized Design (CRD), Randomized Block Design (RBD), Latin Square Design (LSD) – layout, model and statistical analysis, relative efficiency, analysis with missing observations, Greaco Latin Square Design.

13.1.2 Unit 2: *Design of Experiments*: (Lectures: 15)

Split Plot Design, Strip Plot Design, Incomplete Block Designs, Introduction to Balanced Incomplete Block Design (BIBD).

13.1.3 Unit 3: *Factorial Experiments*: (Lectures: 20)

Factorial experiments: advantages, notations and concepts, 2^2 , $2^3 \dots 2^n$ and 3^2 factorial experiments, design and analysis, Total and Partial confounding for 2^n ($n \leq 5$), idea of 3^2 experiment.

13.2 Practical/Lab

List of Practical

1. Analysis of a CRD
2. Analysis of an RBD
3. Analysis of an LSD
4. Analysis of an RBD with one missing observation
5. Analysis of an LSD with one missing observation
6. Analysis of 2^2 and 2^3 factorial in CRD and RBD
7. Analysis of a completely confounded two level factorial design in 2 blocks
8. Analysis of a completely confounded two level factorial design in 4 blocks
9. Analysis of a partially confounded two level factorial design.

SUGGESTED READINGS:

1. Cochran, W.G. and Cox, G.M. (1959): Experimental Design. Asia Publishing House.
2. Das, M.N. and Giri, N.C. (1986): Design and Analysis of Experiments. Wiley Eastern Ltd.
3. Goon, A.M., Gupta, M.K. and Dasgupta, B. (2005): Fundamentals of Statistics. Vol. II, 8th Edn. World Press, Kolkata.
4. Kempthorne, O. (1965): The Design and Analysis of Experiments. John Wiley.
5. Montgomery, D. C. (2008): Design and Analysis of Experiments, John Wiley.

STA-HC- 6026

Multivariate Analysis and Nonparametric Methods

Total Lectures: 60 Credits: 6 (Theory: 04, Practical/Lab: 02)

14.1 Theory

14.1.1 Unit 1: *Bivariate and Multivariate Distributions: (Lectures: 20)*

Bivariate Normal Distribution (BVN): p.d.f. of BVN, properties of BVN, marginal and conditional p.d.f. of BVN.

Multivariate Data: Random Vector: Probability mass/density functions, Distribution function, Mean vector & Dispersion matrix, Marginal & Conditional distributions.

14.1.2 Unit 2: *Multivariate Normal Distributions: (Lectures: 20)*

Multivariate Normal distribution and its properties. Sampling distribution for mean vector and variance- covariance matrix. Multiple and partial correlation coefficient and their properties, Basic idea of Principal Component Analysis, Hotelling T^2 – concept and applications.

14.1.3 Unit 3: *Non-parametric Tests: (Lectures: 20)*

Nonparametric Tests: Introduction and Concept, Test for randomness based on total number of runs, Empirical distribution function, Kolmogorov Smirnov test for one sample, Sign tests- one sample and two samples, Wilcoxon-Mann-Whitney test, Kruskal-Wallis test.

14.2 Practical/Lab

List of Practical

1. Multiple Correlation
2. Partial Correlation
3. Bivariate Normal Distribution,
4. Multivariate Normal Distribution
5. Principal Components Analysis
6. Test for randomness based on total number of runs,
7. Kolmogorov Smirnov test for one sample.
8. Sign test: one sample, two samples, large samples.
9. Wilcoxon-Mann-Whitney U-test,
10. Kruskal-Wallis test.

SUGGESTED READING:

1. Anderson, T.W. (2003): An Introduction to Multivariate Statistical Analysis, 3rdEdn., John Wiley
2. Muirhead, R.J. (1982): Aspects of Multivariate Statistical Theory, John Wiley.
3. Kshirsagar, A.M. (1972) :Multivariate Analysis, 1stEdn. Marcel Dekker.
4. Johnson, R.A. and Wichern, D.W. (2007): Applied Multivariate Analysis, 6thEdn., Pearson & Prentice Hall.
5. Mukhopadhyay, P. : Mathematical Statistics.
6. Gibbons, J. D. and Chakraborty, S (2003): Nonparametric Statistical Inference. 4th Edition. Marcel Dekker, CRC.

STA-HE- 5016

Operations Research

Total Lectures: 60 Credits: 6 (Theory: 04, Practical/Lab: 02)

15.1 Theory

15.1.1 Unit 1: *Operations Research: (Lectures: 20)*

Introduction to Operations Research, phases of O.R., model building, various types of O.R. problems. Linear Programming Problem, Mathematical formulation of the L.P.P, graphical solutions of a L.P.P. Simplex method for solving L.P.P.

15.1.2 Unit 2: *Transportation Problem: (Lectures: 15)*

Transportation Problem: Initial solution by North West corner rule, Least cost method and Vogel's approximation method (VAM).

15.1.3 Unit 3: *Game theory: (Lectures: 10)*

Game theory: Rectangular game, minimax-maximax principle.

15.1.4 Unit 4: *Inventory Management: (Lectures: 15)*

Inventory Management: ABC inventory system, characteristics of inventory system. EOQ Model and its variations, with and without shortages, Quantity Discount Model with price breaks.

15.2 Practical/Lab (Using TORA/WINQSB/LINGO)

List of Practical

1. Mathematical formulation of L.P.P and solving the problem using graphical method, Simplex technique and Charne's Big M method involving artificial variables.
2. Identifying Special cases by Graphical and Simplex method and interpretation
 - a. Degenerate solution
 - b. Unbounded solution
 - c. Alternate solution
 - d. Infeasible solution
3. Allocation problem using Transportation model
4. Networking problem
 - a. Minimal spanning tree problem
 - b. Shortest route problem
5. Problems based on game matrix
 - a. Graphical solution to $m \times 2 / 2 \times n$ rectangular game
 - b. Mixed strategy
6. Mathematical formulation of L.P.P and solving the problem using graphical method, Simplex technique and Charne's Big M method involving artificial variables.
7. Networking problem
 - a. minimal spanning tree problem
 - b. Shortest route problem
8. Problems based on game matrix
 - a. Graphical solution to $m \times 2 / 2 \times n$ rectangular game
 - b. Mixed strategy

9. To find optimal inventory policy for EOQ models and its variations
10. To solve all-units quantity discounts model

SUGGESTED READING:

1. Taha, H. A. (2007): Operations Research: An Introduction, 8th Edition, Prentice Hall of India.
2. KantiSwarup, Gupta, P.K. and Manmohan (2007): Operations Research, 13th Edition, Sultan Chand and Sons.
3. Hadley, G: (2002) : Linear Programming, Narosa Publications
4. Hillier, F.A and Lieberman, G.J. (2010): Introduction to Operations Research- Concepts and cases, 9th Edition, Tata McGraw Hill.

STA-HE- 5026

Time Series Analysis

Total Lectures: 60 Credits: 6 (Theory: 04, Practical/Lab: 02)

16.1 Theory

16.1.1 Unit 1: *Introduction to Time Series*: (Lectures: 15)

Introduction to times series data, application of time series from various fields, Components of a times series, Decomposition of time series. Trend: Estimation of trend by free hand curve method, method of semi averages, fitting a various mathematical curve, and growth curves.

16.1.2 Unit 2: *Introduction to Time Series*: (Lectures: 18)

Trend Cont.: Method of moving averages. Detrending. Effect of elimination of trend on other components of the time series. Seasonal Component: Estimation of seasonal component by Method of simple averages, Ratio to Trend.

16.1.3 Unit 3: *Moving averages*: (Lectures: 15)

Seasonal Component continued: Ratio to Moving Averages and Link Relative method, Deseasonalization.

16.1.4 Unit 4: *Forecasting and smoothing to Time Series*: (Lectures: 12)

Random Component: Variate component method. Forecasting: Exponential smoothing methods.

SUGGESTED READING:

1. Kendall M.G. (1976): Time Series, Charles Griffin.
2. Chatfield C. (1980): The Analysis of Time Series –An Introduction, Chapman & Hall.
3. Mukhopadhyay P. (2011): Applied Statistics, 2nd ed. Revised reprint, Books and Allied

PRACTICAL / LAB WORK

List of Practical

1. Fitting and plotting of modified exponential curve
2. Fitting and plotting of Gompertz curve
3. Fitting and plotting of logistic curve
4. Fitting of trend by Moving Average Method
5. Measurement of Seasonal indices Ratio-to-Trend method
6. Measurement of Seasonal indices Ratio-to-Moving Average method
7. Measurement of seasonal indices Link Relative method
8. Calculation of variance of random component by variate difference method
9. Forecasting by exponential smoothing
10. Forecasting by short term forecasting methods.

STA-HE- 5036

Survival Analysis and Biostatistics

Total Lectures: 60 Credits: 6 (Theory: 04, Practical/Lab: 02)

17.1 Theory

17.1.1 Unit 1: *Survival Analysis*: (Lectures: 18)

Survival Analysis: Functions of survival times, survival distributions and their applications- exponential, gamma, Weibull, Rayleigh, lognormal, death density function for a distribution having bath-tub shaped hazard function.

Censoring Schemes: Type I, Type II and progressive or random censoring with biological examples.

17.1.2 Unit 2: *Independent and dependent Risk*: (Lectures: 12)

Theory of independent and dependent risks. Bivariate normal dependent risk model.

17.1.3 Unit 3: *Epidemic Model*: (Lectures: 15)

Stochastic Epidemic Models: Simple epidemic models, general epidemic model definition and concept (without derivation). Duration of an epidemic.

17.1.4 Unit 4: *Statistical Genetics*: (Lectures: 15)

Statistical Genetics: Introduction, concepts-Genotype, Phenotype, Dominance, Recessiveness, Linkage and Recombination, Introduction to Clinical Trials.

SUGGESTED READING:

1. Lee, E.T. and Wang, J.W. (2003): Statistical Methods for Survival data Analysis, 3rd Edition, John Wiley and Sons.
2. Biswas, S. (2007): Applied Stochastic Processes: A Biostatistical and Population Oriented Approach, Reprinted 2nd Central Edition, New Central Book Agency.
3. Kleinbaum, D.G. (1996): Survival Analysis, Springer.
4. Chiang, C.L. (1968): Introduction to Stochastic Processes in Bio Statistics, John Wiley and Sons.
5. Indrayan, A. (2008): Medical Biostatistics, 2nd Edition Chapman and Hall/CRC.

PRACTICAL / LAB WORK

List of Practical

1. To estimate survival function
2. To determine death density function and hazard function
3. To identify type of censoring and to estimate survival time for type I censored data
4. To identify type of censoring and to estimate survival time for type II censored data
5. To identify type of censoring and to estimate survival time for progressively type I censored data
6. Estimation of mean survival time and variance of the estimator for type I censored data
7. Estimation of mean survival time and variance of the estimator for type II censored data
8. Estimation of mean survival time and variance of the estimator for progressively type I censored data
9. To estimate the survival function and variance of the estimator using Non-parametric methods with Actuarial methods
10. To estimate the survival function and variance of the estimator using Non-parametric methods with Kaplan-Meier method
11. To estimate Crude probability of death
12. To estimate Net-type I probability of death
13. To estimate Net-type II probability of death
14. To estimate partially crude probability of death
15. To estimate gene frequencies

STA-HE- 5046

Financial Statistics

Total Lectures: 60 Credits: 6 (Theory: 04, Practical/Lab: 02)

18.1 Theory

18.1.1 Unit 1: *Probability Review*: (Lectures: 15)

Probability review: Real valued random variables, expectation and variance, skewness and kurtosis, conditional probabilities and expectations. Discrete Stochastic Processes, Binomial processes, General random walks.

18.1.2 Unit 2: *Tools for Pricing*: (Lectures: 15)

Tools Needed For Option Pricing: Wiener process, stochastic integration, and stochastic differential equations. Introduction to derivatives: Forward contracts, spot price, forward price, future price. Call and put options, zero-coupon bonds and discount bonds

18.1.3 Unit 3: *Pricing Derivatives*: (Lectures: 15)

Pricing Derivatives: Arbitrage relations and perfect financial markets, pricing futures, put-call parity for European options, relationship between strike price and option price.

18.1.4 Unit 4: *Hedging Portfolios*: (Lectures: 15)

Hedging portfolios: Delta, Gamma and Theta hedging. Binomial Model for European options: Cox-Ross-Rubinstein approach to option pricing. Discrete dividends

SUGGESTED READING:

1. Franke, J., Hardle, W.K. and Hafner, C.M. (2011): *Statistics of Financial Markets: An Introduction*, 3rd Edition, Springer Publications.
2. Stanley L. S. (2012): *A Course on Statistics for Finance*, Chapman and Hall/CRC.

PRACTICAL / LAB WORK (Using spreadsheet/ R)

List of Practical

1. To verify “no arbitrage” principle
2. To verify relationship between spot price, forward price, future price
3. To price future contracts
4. To verify put-call parity for European options
5. To construct binomial trees and to evaluate options using these trees
6. To price options using black – Scholes formula
7. To hedge portfolios using delta and gamma hedging

8. To hedge portfolios theta hedging
9. Pricing of call options using binomial model
10. Computation of dividends on call options as a percentage of stock price.
11. Computation of dividends on call options as a fixed amount of money.
12. Pricing of put options using binomial model
13. Call-put parity for options following binomial models.
14. Effect of dividends on put options.

STA-HE- 6016

Econometrics

Total Lectures: 60 Credits: 6 (Theory: 04, Practical/Lab: 02)

19.1 Theory

19.1.1 Unit 1: *Economic Models*: (Lectures: 15)

Introduction: Objective behind building econometric models, nature of econometrics, model building, role of econometrics, linear models: two or more variables.

19.1.2 Unit 2: *Estimation*: (Lectures: 18)

Least square assumptions, estimation of regression parameters, tests of significance and confidence intervals.

19.1.3 Unit 3: *Regression*: (Lectures: 15)

Multiple Regression analysis, estimation and inference.

19.1.4 Unit 4: *Collinearity*: (Lectures: 12)

Violations of Least Square assumptions: multicollinearity, autocorrelation and heteroscedasticity.

SUGGESTED READING:

1. Gujarati, D. and Sangeetha, S. (2007): Basic Econometrics, 4th Edition, McGraw Hill Companies.
2. Johnston, J. (1972): Econometric Methods, 2nd Edition, McGraw Hill International.
3. Koutsoyiannis, A. (2004): Theory of Econometrics, 2nd Edition, Palgrave Macmillan Limited,
4. Maddala, G.S. and Lahiri, K. (2009): Introduction to Econometrics, 4th Edition, John Wiley & Sons.

PRACTICAL /LAB WORK

List of Practical

1. Problems based on estimation of General linear model
2. Testing of parameters of General linear model
3. Forecasting of General linear model
4. Problems concerning specification errors
5. Problems related to consequences of Multicollinearity
6. Diagnostics of Multicollinearity
7. Problems related to consequences of Autocorrelation (AR(I))
8. Diagnostics of Autocorrelation
9. Estimation of problems of General linear model under Autocorrelation

10. Problems related to consequences Heteroscedasticity
11. Diagnostics of Heteroscedasticity
12. Estimation of problems of General linear model under Heteroscedastic distance terms
13. Problems related to General linear model under(Aitken Estimation).

STA-HE- 6026**Demography and Vital Statistics**

Total Lectures: 60 Credits: 6 (Theory: 04, Practical/Lab: 02)

20.1 Theory**20.1.1 Unit 1: *Population Theory*: (Lectures: 10)**

Population Theories: Coverage and content errors in demographic data, use of balancing equations, Population composition, dependency ratio.

20.1.2 Unit 2: *Measurement of Mortality*: (Lectures: 15)

Introduction and sources of collecting data on vital statistics, errors in census and registration data. Measurement of population, rate and ratio of vital events. Measurements of Mortality: Crude Death Rate (CDR), Specific Death Rate (SDR), Infant Mortality, Rate (IMR) and Standardized Death Rates.

20.1.3 Unit 3: *Life Table*: (Lectures: 18)

Stationary and Stable population, Central Mortality Rates and Force of Mortality. Life (Mortality) Tables: Assumption, description.

20.1.4 Unit 4: *Measurement of Fertility*: (Lectures: 17)

Measurements of Fertility: Crude Birth Rate (CBR), General Fertility Rate (GFR), Specific Fertility Rate (SFR) and Total Fertility Rate (TFR). Measurement of Population Growth: Crude rates of natural increase, Pearl's Vital Index, Gross Reproduction Rate (GRR) and Net Reproduction Rate (NRR).

SUGGESTED READING:

1. Mukhopadhyay, P. (1999): Applied Statistics, Books and Allied (P) Ltd.
2. Gun, A.M., Gupta, M.K. and Dasgupta, B. (2008): Fundamentals of Statistics, Vol. II, 9th Edition, World Press.
3. Biswas, S. (1988): Stochastic Processes in Demography & Application, Wiley Eastern Ltd.
4. Croxton, Fredrick E., Cowden, Dudley J. and Klein, S. (1973): Applied General Statistics, 3rd Edition. Prentice Hall of India Pvt. Ltd.
5. Keyfitz N., Beckman John A.: Demography through Problems S-Verlag New York.

PRACTICAL/LAB. WORK:

List of Practical

1. To calculate CDR and Age Specific death rate for a given set of data
2. To find Standardized death rate by:- (i) Direct method (ii) Indirect method
3. To construct a complete life table
4. To fill in the missing entries in a life table
5. To calculate probabilities of death at pivotal ages and use it construct abridged life table using (i) Reed-Merrell Method, (ii) Greville's Method and (iii) King's Method
6. To calculate CBR, GFR, SFR, TFR for a given set of data
7. To calculate Crude rate of Natural Increase and Pearle's Vital Index for a given set of data
8. Calculate GRR and NRR for a given set of data and compare them

STA-HE- 6036

Actuarial Statistics

Total Lectures: 60 Credits: 6 (Theory: 04, Practical/Lab: 02)

21.1 Theory

21.1.1 Unit 1: *Probability Distributions*: (Lectures: 15)

Introductory Statistics and Insurance Applications: Discrete, continuous and mixed probability distributions. Insurance applications, sum of random variables. Utility theory: Utility functions, expected utility criterion, types of utility function, insurance and utility theory.

21.1.2 Unit 2: *Premium Calculation*: (Lectures: 15)

Principles of Premium Calculation: Properties of premium principles, examples of premium principles. Individual risk models: models for individual claims, the sum of independent claims, approximations and their applications.

21.1.3 Unit 3: *Survival Distribution*: (Lectures: 18)

Survival Distribution and Life Tables: Uncertainty of age at death, survival function, time- until-death for a person, curate future lifetime, force of mortality, life tables with examples, deterministic survivorship group, life table characteristics.

21.1.4 Unit 4: *Life Insurance*: (Lectures: 12)

Life Insurance: Models for insurance payable at the moment of death, insurance payable at the end of the year of death.

SUGGESTED READING:

1. Dickson, C. M. D. (2005): Insurance Risk And Ruin (International Series On Actuarial Science), Cambridge University Press.
2. Bowers, N. L., Gerber, H. U., Hickman, J. C., Jones, D. A. And Nesbitt, C. J. (1997): Actuarial Mathematics, Society of Actuaries, Itasca, Illinois, U.S.A.

PRACTICAL / LAB WORK (Using Spreadsheet/R)

List of Practical

- 1 Risk computation for different utility models
2. Discrete and continuous risk calculations
3. Calculation of aggregate claims for collective risks
4. Calculation of aggregate claim for individual risks
5. Computing Ruin probabilities and aggregate losses
6. Annuity and present value of contract
7. Computing premium for different insurance schemes
8. Practical based on life models and tables

STA-HE- 6046

Project Work

Total Lectures: 60 Credits: 6

Objective: The aim of the course is to initiate students to write and present a statistical report, under the supervision of a faculty, on some area of human interest. The project work will provide hands on training to the students to deal with data emanating from some real life situation and propel them to dwell on some theory or relate it to some theoretical concepts.

STA-HG- 1016

Statistical Methods

Total Lectures: 60 Credits: 6 (Theory: 04, Practical/Lab: 02)

23.1 Theory

23.1.1 Unit 1: *Statistical Data*: (Lectures: 12)

Introduction: Definition and scope of Statistics, concepts of statistical population and sample. Data: Univariate Data: quantitative and qualitative, attributes, variables, scales of measurement - nominal, ordinal, interval and ratio. Presentation: tabular and graphic, including histogram and ogives.

23.1.2 Unit 2: *Measures of Central Tendency*: (Lectures: 12)

Measures of Central Tendency: mathematical and positional. Measures of Dispersion: range, quartile deviation, mean deviation, standard deviation, coefficient of variation, moments, skewness and kurtosis.

23.1.3 Unit 3: *Calculus of Finite Difference*: (Lectures: 12)

Finite Difference: Definition, Operators Δ & E , their properties, Difference table, missing terms, Interpolation: Definition, Newton's Forward and Backward interpolation formula. Divided Difference (DD): Definition, DD table, Newton's DD formula. Lagrange's interpolation formula. Numerical Integration: Introduction, General quadrature formula, Trapezoidal, Simpson's 1/3rd & 3/8th rules, Newton-Raphson method.

23.1.4 Unit 4: *Bivariate Data*: (Lectures: 12)

Bivariate data: Definition, scatter diagram, simple, partial and multiple correlation (3 variables only), rank correlation. Simple linear regression, principle of least squares.

23.1.5 Unit 5: *Theory of Attributes*: (Lectures: 12)

Theory of attributes, consistency of data, independence and association of attributes, measures of association and contingency.

SUGGESTED READING:

1. Goon A.M., Gupta M.K. and Dasgupta B. (2002): Fundamentals of Statistics, Vol. I & II, 8th Edn. The World Press, Kolkata.
2. Miller, Irwin and Miller, Marylees (2006): John E. Freund's Mathematical Statistics with Applications, (7th Edn.), Pearson Education, Asia.
3. Mood, A.M. Graybill, F.A. and Boes, D.C. (2007): Introduction to the Theory of Statistics, 3rd Edn., (Reprint), Tata McGraw-Hill Pub. Co.Ltd.

PRACTICAL/ LAB WORK

List of Practical

1. Graphical representation of data
2. Problems based on measures of central tendency
3. Problems based on measures of dispersion
4. Problems based on combined mean and variance and coefficient of variation
5. Problems based on moments, skewness and kurtosis
6. Fitting of polynomials, exponential curves
7. Karl Pearson correlation coefficient
8. Partial and multiple correlations
9. Spearman rank correlation with and without ties.
10. Correlation coefficient for a bivariate frequency distribution
11. Lines of regression, angle between lines and estimated values of variables.
12. Checking consistency of data and finding association among attributes.

STA-HG- 2016

Introductory Probability

Total Lectures: 60 Credits: 6 (Theory: 04, Practical/Lab: 02)

24.1 Theory

24.1.1 Unit 1: *Probability*: (Lectures: 15)

Probability: Introduction, random experiments, sample space, events and algebra of events. Definitions of Probability – classical, statistical, and axiomatic. Conditional Probability, laws of addition and multiplication, independent events, theorem of total probability, Bayes' theorem and its applications.

24.1.2 Unit 2: *Random Variables*: (Lectures: 15)

Random Variables: Discrete and continuous random variables, p.m.f., p.d.f., c.d.f. Illustrations of random variables and its properties. Expectation, variance, moments and moment generating function.

24.1.3 Unit 3: *Convergence in Probability*: (Lectures: 12)

Idea of convergence in probability, Chebyshev's inequality, weak law of large numbers, De-Moivre Laplace and Lindeberg-Levy Central Limit Theorem (C.L.T.) (statement only without proof).

24.1.4 Unit 4: *Standard Distributions*: (Lectures: 18)

Standard probability distributions: Binomial, Poisson, geometric, negative binomial, hypergeometric, uniform, normal, exponential, beta, gamma.

SUGGESTED READING:

1. Hogg, R.V., Tanis, E.A. and Rao J.M. (2009): Probability and Statistical Inference, Seventh Ed, Pearson Education, New Delhi.
2. Miller, Irwin and Miller, Marylees (2006): John E. Freund's Mathematical Statistics with Applications, (7th Edn.), Pearson Education, Asia.
3. Myer, P.L. (1970): Introductory Probability and Statistical Applications, Oxford & IBH Publishing, New Delhi

PRACTICAL/LAB. WORK:

List of Practical

1. Fitting of binomial distributions for n and $p = q = \frac{1}{2}$ given
2. Fitting of binomial distributions for n and p given
3. Fitting of binomial distributions computing mean and variance
4. Fitting of Poisson distributions for given value of λ
5. Fitting of Poisson distributions after computing mean

6. Application problems based on binomial distribution
7. Application problems based on Poisson distribution
8. Problems based on area property of normal distribution
9. To find the ordinate for a given area for normal distribution
10. Application based problems using normal distribution
11. Fitting of normal distribution when parameters are given
12. Fitting of normal distribution when parameters are not given.

STA-HG- 3016

Basics of Statistical Inference

Total Lectures: 60 Credits: 6 (Theory: 04, Practical/Lab: 02)

25.1 Theory

25.1.1 Unit 1: *Tests of Hypothesis: (Lectures: 20)*

Estimation of population mean, confidence intervals for the parameters of a normal distribution (one sample).

The basic idea of significance test. Null and alternative hypothesis. Type I & Type II errors, level of significance, concept of p-value. Tests of hypotheses for the parameters of a normal distribution (one sample), Non-parametric tests: Sign test for median, Sign test for symmetry, Wilcoxon two-sample test.

25.1.2 Unit 2: *Categorical Data Analysis: (Lectures: 18)*

Categorical data: Tests of proportions, tests of association and goodness-of-fit using Chi-square test, Yates' correction.

25.1.3 Unit 3: *Analysis of Variance: (Lectures: 22)*

Analysis of variance, one-way and two-way classification. Brief exposure of three basic principles of design of experiments, treatment, plot and block. Analysis of completely randomized design, randomized complete block design. Bioassay.

SUGGESTED READING:

1. Daniel, Wayne W., Bio-statistics: A Foundation for Analysis in the Health Sciences. John Wiley (2005).
2. Goon, A.M., Gupta M.K. & Das Gupta, Fundamentals of statistics, Vol.-I & II (2005).
3. Dass, M. N. & Giri, N. C.: Design and analysis of experiments. John Wiley.
4. Dunn, O.J Basic Statistics: A primer for the Biomedical Sciences. (1964, 1977) by John Wiley.
5. Bancroft, Holdon Introduction to Bio-Statistics (1962) P.B. Hoebar New York.
6. Goldstein, A Biostatistics-An introductory text (1971). The Macmillan New York.

PRACTICAL/LAB WORK

List of Practical

1. Estimators of population mean.
2. Confidence interval for the parameters of a normal distribution (one sample).
3. Tests of hypotheses for the parameters of a normal distribution (one sample).
4. Chi-square test of proportions.
5. Chi-square tests of association.
6. Chi-square test of goodness-of-fit.
7. Test for correlation coefficient.

8. Sign test for median.
9. Sign test for symmetry.
10. Wilcoxon two-sample test.
11. Analysis of Variance of a one way classified data
12. Analysis of Variance of a two way classified data.
13. Analysis of a CRD.
14. Analysis of an RBD.

STA-HG- 4016

Applied Statistics

Total Lectures: 60 Credits: 6 (Theory: 04, Practical/Lab: 02)

26.1 Theory

26.1.1 Unit 1: *Time Series*: (Lectures: 12)

Economic Time Series: Components of time series, Decomposition of time series- Additive and multiplicative model with their merits and demerits, Illustrations of time series. Measurement of trend by method of free-hand curve, method of semi-averages and method of least squares (linear, quadratic and modified exponential). Measurement of seasonal variations by method of ratio to trend.

26.1.2 Unit 2: *Index Numbers*: (Lectures: 12)

Index numbers: Definition, Criteria for a good index number, different types of index numbers. Construction of index numbers of prices and quantities, consumer price index number. Uses and limitations of index numbers.

26.1.3 Unit 3: *Statistical Quality Control*: (Lectures: 12)

Statistical Quality Control: Importance of statistical methods in industrial research and practice. Determination of tolerance limits. Causes of variations in quality: chance and assignable. General theory of control charts, process & product control, Control charts for variables: X- bar and R-charts. Control charts for attributes: p and c-charts

26.1.4 Unit 4: *Demography*: (Lectures: 12)

Demographic Methods: Introduction, measurement of population, rates and ratios of vital events. Measurement of mortality: CDR, SDR (w.r.t. Age and sex), IMR, Standardized death rates. Life (mortality) tables: definition of its main functions and uses. Measurement of fertility and reproduction: CBR, GFR, and TFR. Measurement of population growth: GRR, NRR.

26.1.5 Unit 5: *Demand Analysis*: (Lectures: 12)

Demand Analysis: Theory of consumption and demand, demand function, elasticity of demand, determination of elasticity of demand by family budget method, Lorentz curve and Gini's coefficient, Engel's law and Engel's curve, Pareto's law of income distribution.

SUGGESTED READING:

- 1 Mukhopadhyay, P. (1999): Applied Statistics, New Central Book Agency, Calcutta.
- 2 Gun, A.M., Gupta, M.K. and Dasgupta, B. (2008): Fundamentals of Statistics, Vol. II, 9th Edition World Press, Kolkata.
- 3 Gupta, S. C. and Kapoor, V.K. (2008): Fundamentals of Applied Statistics, 4th Edition (Reprint), Sultan Chand & Sons
- 4 Montgomery, D. C. (2009): Introduction to Statistical Quality Control, 6th Edition, Wiley India Pvt. Ltd.

PRACTICAL/LAB WORK

List of Practical

1. Measurement of trend: Fitting of linear, quadratic trend, exponential curve and plotting of trend values and comparing with given data graphically.
2. Measurement of seasonal indices by Ratio-to-trend method and plotting of trend values and comparing with given data graphically.
3. Construction of price and quantity index numbers by Laspeyre's formula, Paasche's formula, Marshall-Edgeworth's formula, Fisher's Formula. Comparison and interpretation.
4. Construction of wholesale price index number, fixed base index number and consumer price index number with interpretation
5. Construction and interpretation of \bar{X} & R-chart
6. Construction and interpretation p-chart (fixed sample size) and c-chart
7. Computation of measures of mortality
8. Completion of life table
9. Computation of measures of fertility and population growth

STA – SE - 3014

Statistical Data Analysis Using Software Packages

Total Lectures: 30 Credits: 4 (Theory: 02, Practical/Lab: 02)

27.1 Theory/Practical/Lab

This course will review and expand upon core topics in statistics and probability, particularly by initiating the beneficiaries of the course to at least one of the software packages viz., Microsoft Excel, SPSS, Minitab, Matlab, for statistical computing.

27.1.1 Unit 1: *Graphical Representation*: (Lectures: 8)

Learn how to load data, plot a graph viz. histograms (equal class intervals and unequal class intervals), box plot, stem-leaf, frequency polygon, pie chart, ogives with graphical summaries of data

27.1.2 Unit 2: *Report Generation*: (Lectures: 6)

Generate automated reports giving detailed descriptive statistics, correlation and lines of regression.

27.1.3 Unit 3: *Fitting Curves*: (Lectures: 8)

Random number generation and sampling procedures. Fitting of polynomials and exponential curves. Application Problems based on fitting of suitable distribution, Normal probability plot.

27.1.4 Unit 4: *Analysis*: (Lectures: 8)

Simple analysis and create and manage statistical analysis projects, import data, code editing, Basics of statistical inference in order to understand hypothesis testing and compute p-values and confidence intervals.

SUGGESTED READING:

1. Moore, D.S. and McCabe, G.P. and Craig, B.A. (2014): Introduction to the Practice of Statistics, W.H. Freeman
2. Cunningham, B.J (2012): Using SPSS: An Interactive Hands-on approach
3. Cho, M,J., Martinez, W.L. (2014) Statistics in MATLAB: A Primer, Chapman and Hall/CRC

STA – SE - 3024

Data Base Management Systems

Total Lectures: 20 Credits: 4 (Theory: 02, Practical/Lab: 02)

28.1 Theory/Practical/Lab

This skill based course is structured to enhance database handling, data manipulation and data processing skills through SQL. The course will enable its beneficiaries develop data centric computer applications.

28.1.1 Unit 1: *Overview of DBMS*: (Lectures: 8)

Introduction: Overview of Database Management System, Introduction to Database Languages, advantages of DBMS over file processing systems.

28.1.2 Unit 2: *RDBMS*: (Lectures: 8)

Relational Database Management System: The Relational Model, Introduction to SQL: Basic Data Types, Working with relations of RDBMS: Creating relations e.g. Bank, College Database (create table statement)

28.1.3 Unit 3: *RDBMS Continued*: (Lectures: 6)

Modifying relations (alter table statement), Integrity constraints over the relation like Primary Key, Foreign key, NOT NULL to the tables, advantages and disadvantages of relational Database System

28.1.4 Unit 4: *Data Base Structure*: (Lectures: 8)

Database Structure: Introduction, Levels of abstraction in DBMS, View of data, Role of Database users and administrators, Database Structure: DDL, DML, Data Manager (Database Control System). Types of Data Models Hierarchical databases, Network databases, Relational databases, Object oriented databases

SUGGESTED READING:

1. Gruber, M. (1990): Understanding SQL, BPB publication
2. Silberschatz, A, Korth, H and Sudarshan, S (2011) "Database System and Concepts", 6th Edition McGraw-Hill.
3. Desai, B. (1991): Introduction to Database Management system, Galgotia Publications.

STA – SE - 4014

Statistical Data Analysis using R

Total Lectures: 20 Credits: 4 (Theory: 02, Practical/Lab: 02)

29.1 Theory/Practical/Lab

This course will review and expand upon core topics in probability and statistics through the study and practice of data analysis and graphical interpretation using 'R'.

29.1.1 Unit 1: *Plotting Graphs*: (Lectures: 8)

Learn how to load data, plot a graph viz. histograms (equal class intervals and unequal class intervals), box plot, stem-leaf, frequency polygon, pie chart, ogives with graphical summaries of data

29.1.2 Unit 2: *Report Generation*: (Lectures: 6)

Generate automated reports giving detailed descriptive statistics, correlation and lines of regression.

29.1.3 Unit 3: *Generation of Random Numbers*: (Lectures: 8)

Random number generation and sampling procedures. Fitting of polynomials and exponential curves. Application Problems based on fitting of suitable distribution, Normal probability plot.

29.1.4 Unit 4: *Statistical Analysis*: (Lectures: 8)

Simple analysis and create and manage statistical analysis projects, import data, code editing, Basics of statistical inference in order to understand hypothesis testing and compute p-values and confidence intervals.

SUGGESTED READING:

1. Gardener, M (2012) Beginning R: The Statistical Programming Language, Wiley Publications.
2. Braun W J, Murdoch D J (2007): A First Course in Statistical Programming with R. Cambridge University Press. New York

STA – SE - 4024

Statistical Techniques for Research Methods

Total Lectures: 20 Credits: 4 (Theory: 02, Practical/Lab: 02)

30.1 Theory/Practical/Lab

Statistical Techniques provide scientific approaches to develop the domain of human knowledge largely through empirical studies. The course aims at enabling students understand basic concepts and aspects related to research, data collection, analyses and interpretation.

30.1.1 Unit 1: *Research problems*: (Lectures: 7)

Introduction: Meaning, objection and motivation in research, types of research, research approach, significance of research. Research problems: definition, selection and necessity of research problems.

30.1.2 Unit 2: *Survey Methodology*: (Lectures: 7)

Survey Methodology and Data Collection, inference and error in surveys, the target populations, sampling frames and coverage error, methods of data collection, non-response, questions and answers in surveys.

30.1.3 Unit 3: *Data Analysis and Interpretation*: (Lectures: 7)

Processing, Data Analysis and Interpretation: Review of various techniques for data analysis covered in core statistics papers, techniques of interpretation, precaution in interpretation.

30.1.4 Unit 4: *Questionnaire Preparation*: (Lectures: 9)

Develop a questionnaire, collect survey data pertaining to a research problem (such as gender discriminations in private v/s government sector, unemployment rates, removal of subsidy, impact on service class v/s unorganized sectors), interpret the results and draw inferences.

SUGGESTED READING:

1. Kothari, C.R. (2009): *Research Methodology: Methods and Techniques*, 2nd Revised Edition reprint, New Age International Publishers.
2. Kumar, R (2011): *Research Methodology: A Step - by - Step Guide for Beginners*, SAGE publications.

Syllabus
Mathematics (Honours)

Version 2 submitted to



Gauhati University
under the
Choice Based Credit System

By
Department of Mathematics
Gauhati University

Credit and Marks distribution of the courses

Sl. No.	Stream	Subject	Paper code	Paper name	Credit	Total marks	Theory/External marks/End sem	Internal marks	Practical Marks	Regular/Honours
1257	B.Sc.	Mathematics	MAT-HC-1016	Calculus (including practical)	6	100	60	20	20	Honours
1258	B.Sc.	Mathematics	MAT-HC-1026	Algebra	6	100	80	20		Honours
1259	B.Sc.	Mathematics	MAT-HC-2016	Real Analysis	6	100	80	20		Honours
1260	B.Sc.	Mathematics	MAT-HC-2026	Differential Equations (including practical)	6	100	60	20	20	Honours
1261	B.Sc.	Mathematics	MAT-HC-3016	Theory of Real Functions	6	100	80	20		Honours
1262	B.Sc.	Mathematics	MAT-HC-3026	Group Theory-I	6	100	80	20		Honours
1263	B.Sc.	Mathematics	MAT-HC-3036	Analytical Geometry	6	100	80	20		Honours
1264	B.Sc.	Mathematics	MAT-HC-4016	Multivariate Calculus	6	100	80	20		Honours
1265	B.Sc.	Mathematics	MAT-HC-4026	Numerical Methods (including practical)	6	100	60	20	20	Honours
1266	B.Sc.	Mathematics	MAT-HC-4036	Ring Theory	6	100	80	20		Honours
1267	B.Sc.	Mathematics	MAT-HC-5016	Complex Analysis	6	100	80	20		Honours
1268	B.Sc.	Mathematics	MAT-HC-5026	Linear Algebra	6	100	80	20		Honours
1269	B.Sc.	Mathematics	MAT-HC-6016	Riemann Integration and Matric Space	6	100	60	20	20	Honours
1270	B.Sc.	Mathematics	MAT-HC-6026	Partial Differential Equations (including practical)	6	100	60	20	20	Honours
1271	B.Sc.	Mathematics	MAT-HE-5016	Number Theory	6	100	80	20		Honours
1272	B.Sc.	Mathematics	MAT-HE-5026	Mechanics	6	100	80	20		Honours
1273	B.Sc.	Mathematics	MAT-HE-5036	Probability and Statistics	6	100	80	20		Honours
1274	B.Sc.	Mathematics	MAT-HE-5046	Linear Programming	6	100	80	20		Honours
1275	B.Sc.	Mathematics	MAT-HE-5056	Spherical Trigonometry and Astronomy	6	100	80	20		Honours
1276	B.Sc.	Mathematics	MAT-HE-5066	Programming in C	6	100	60	20	20	Honours
1277	B.Sc.	Mathematics	MAT-HE-6016	Boolean Algebra and Automata Theory	6	100	80	20		Honours
1278	B.Sc.	Mathematics	MAT-HE-	Bio-Mathematics	6	100	80	20		Honours

		s	6026							
1279	B.Sc.	Mathematics	MAT-HE-6036	Mathematical Modeling	6	100	60	20	20	Honours
1280	B.Sc.	Mathematics	MAT-HE-6046	Hydromechanics	6	100	80	20		Honours
1281	B.Sc.	Mathematics	MAT-HE-6056	Rigid Dynamics	6	100	80	20		Honours
1282	B.Sc.	Mathematics	MAT-HE-6066	Group Theory II	6	100	80	20		Honours
1283	B.Sc.	Mathematics	MAT-HE-6076	Mathematical Finance	6	100	80	20		Honours
1284	B.Sc.	Mathematics	MAT-HG-1016/MAT-RC-1016	Calculus	6	100	80	20		Honours
1285	B.Sc.	Mathematics	MAT-HG-1026	Analytical Geometry	6	100	80	20		Honours
1286	B.Sc.	Mathematics	MAT-HG-2016/MAT-RC-2016	Algebra	6	100	80	20		Honours
1287	B.Sc.	Mathematics	MAT-HG-2026	Discrete Mathematics	6	100	80	20		Honours
1288	B.Sc.	Mathematics	MAT-HG-3016/MAT-RC-3016	Differential Equations	6	100	80	20		Honours
1289	B.Sc.	Mathematics	MAT-HG-3026	Linear Programming	6	100	80	20		Honours
1290	B.Sc.	Mathematics	MAT-HG-4016/MAT-RC-4016	Real Analysis	6	100	80	20		Honours
1291	B.Sc.	Mathematics	MAT-HG-4026	Numerical Analysis	6	100	80	20		Honours
1292	B.Sc.	Mathematics	MAT-RC-1016	Calculus	6	100	80	20		Regular
1293	B.Sc.	Mathematics	MAT-RC-2016	Algebra	6	100	80	20		Regular
1294	B.Sc.	Mathematics	MAT-RC-3016	Differential Equations	6	100	80	20		Regular
1295	B.Sc.	Mathematics	MAT-RC-4016	Real Analysis	6	100	80	20		Regular
1296	B.Sc.	Mathematics	MAT-RE-5016	Number Theory	6	100	80	20		Regular
1297	B.Sc.	Mathematics	MAT-RE-5026	Discrete Mathematics	6	100	80	20		Regular
1298	B.Sc.	Mathematics	MAT-RE-6016	Numerical Analysis	6	100	80	20		Regular
1299	B.Sc.	Mathematics	MAT-RE-6026	Programming in C	6	100	80	20		Regular
1300	B.Sc.	Mathematics	MAT-SE-3014	Computer Algebra Systems and Related Software	4	100	60	20	20	Honours
1301	B.Sc.	Mathematics	MAT-SE-3014	Computer Algebra Systems and Related Software	4	100	60	20	20	Regular
1302	B.Sc.	Mathematics	MAT-SE-3024	Combinatorics and Graph Theory	4	100	60	20	20	Honours

1303	B.Sc.	Mathematics	MAT-SE-4014	R-Programming	4	100	60	20	20	Honours
1304	B.Sc.	Mathematics	MAT-SE-4014	R-Programming	4	100	60	20	20	Regular
1305	B.Sc.	Mathematics	MAT-SE-4024	LATEX and HTML	4	100	60	20	20	Honours
1306	B.Sc.	Mathematics	MAT-SE-4034	Boolean Algebra	4	100	80	20		Honours
1307	B.Sc.	Mathematics	MAT-SE-5014	Combinatorics and Graph Theory	4	100	80	20		Regular
1308	B.Sc.	Mathematics	MAT-SE-6014	LATEX and HTML	4	100	60	20	20	Regular

1. Introduction to CHOICE BASED CREDIT SYSTEM (CBCS):

The CBCS provides an opportunity for the students to choose courses from the prescribed courses comprising core, elective/minor or skill-based courses. The courses can be evaluated following the grading system, which is considered to be better than the conventional marks system. Therefore, it is necessary to introduce uniform grading system in the entire higher education in India. This will benefit the students to move across institutions within India to be given with and across countries. The uniform grading system will also enable potential employers in assessing the performance of the candidates. In order to bring uniformity in evaluation system and computation of the Cumulative Grade Point Average (CGPA) based on student's performance in examinations, the UGC has formulated the guidelines to be followed.

2. Outline of Choice Based Credit System:

2.1 Core Course: A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course.

2.2 Elective Course: Generally, a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline/subject of study or which provides an extended scope or which enables an exposure to some other discipline/subject/domain or nurtures the candidate's proficiency/skill is called an Elective Course.

2.2.1 Discipline Specific Elective (DSE) Course: Elective courses may be offered by them an in discipline/subject of study is referred to as Discipline Specific Elective. The University/Institute may also offer discipline related Elective courses of inter disciplinary nature (to be offered by main discipline/subject of study).

2.2.2 Dissertation/Project: An elective course designed to acquire special/advanced knowledge, such as supplement study/support study to a project work, and a candidate studies such a course on his own with an advisory support by a teacher/faculty member is called dissertation/project.

2.2.3 Generic Elective (GE) Course: An elective course chosen generally from an unrelated discipline/subject, with an intention to seek exposure is called a Generic Elective. P.S.: A core course offered in a discipline/subject may be treated as an elective by other discipline/subject and vice versa and such electives may also be referred to as Generic Elective.

3. Ability Enhancement Courses (AEC)/Competency Improvement Courses/Skill Development Courses /Foundation Course: The Ability Enhancement (AE) Courses may be of two kinds: AE Compulsory Course (AECC) and AE Elective Course (AEEC). "AECC" courses are the courses based upon the content that leads to Knowledge enhancement. They are

((i) Environmental Science(ii) English/MIL Communication) are mandatory for all disciplines. AEEC courses are value-based and/or skill-based and are aimed at providing hands-on-training, competencies, skills, etc.

3.1 AE Compulsory Course (AECC): Environmental Science, English Communication /MIL Communication.

3.2 AE Elective Course (AEEC): These courses may be chosen from a pool of courses designed to provide value-based and/or skill-based instruction.

Project work/Dissertation is considered as a special course involving application of knowledge in solving /analyzing /exploring a real life's situation/difficult problem. A Project/Dissertation work would be of 6 credits. A Project/Dissertation work may be given in lieu of a discipline specific elective paper.

4. BACHELOR OF MATHEMATICS(Hons.) Program Details:

4.1. Program Objectives:

Students who choose BMATH(H) Program, develop the ability to think critically, logically and analytically and hence use mathematical reasoning in everyday life.

Pursuing a degree in mathematics will introduce the students to a number of interesting and useful ideas in preparations for a number of mathematics careers in education, research, government sector, business sector and industry.

The program covers the full range of mathematics. The course lays a structured foundation of Calculus, Real and Complex analysis, Algebra, Differential equations and Mathematical modelling, Number theory, Graph theory, Mechanics and C-programming.

An exceptionally broad range of topics covering Pure and Applied Mathematics: Linear Algebra, Metric spaces, Statistics, Linear Programming and Applications, Mathematical Finance, and Bio-Mathematics cater to varied interests and ambitions. Also, to carry out the hand on sessions in Computer lab using various CAS software to have a deep conceptual understanding of the above tools to widen the horizon of students' self-experience.

4.2. Program Learning Outcomes: The completion of the BMATH(H) Program shall enable a student to:

- i) Communicate mathematics effectively by oral, written, computational and graphic means.
- ii) Create mathematical ideas from basic axioms.
- iii) Gauge the hypothesis, theories, techniques and proofs provisionally.
- iv) Utilize mathematics to solve theoretical and applied problems by critical understanding, analysis and synthesis.
- v) Identify applications of mathematics in other disciplines and in the real world, leading to enhancement of career prospects in a plethora of fields.
- vi) Appreciate the requirement of lifelong learning through continued education and research.

4.3. Program Structure: The BMATH(H) program is a three-year course divided into six-semester. A student is required to complete 148creditsforthe completion of course and the award of degree.

		<i>Semester</i>	<i>Semester</i>
Part-I	First Year	Semester I: 22	Semester II:22
Part-II	Second Year	Semester III:28	Semester IV:28
Part-III	Third Year	Semester V:24	Semester VI:24

4.4. Program Implementation Requirement:

The B.MATH(H) program is a three-year course divided into six-semester. For proper implementation of the UG CBCS program the following infrastructure are necessary:

- (a) Sufficient lab facilities with computers and software
- (b) At least 7 faculties for Honours and 5 faculties without Honours.

4.5. Instruction for questions paper setter: Question Paper setter should set from the prescribed text books, mentioned in the syllabus.

5. Credit allocation (B.Sc. Honours):

Course	*Credits	
	Theory +Practical	Theory +Tutorial
I Core Course (6credits)		
(14papers)	14X4=56	14x5=70
Core Course Practical/Tutorial*(14Papers)	14x2=28	14x1=14
I. Elective Course(6credits) (8Papers)		
A.1.Discipline Specific Elective(4Papers)	4x4=16	4x5=20
A.2.Discipline Specific Elective Practical/Tutorial* (4Papers)	4x2=8	4x1=4
B.1.Generic Elective/Interdisciplinary (4Papers)	4x4=16	4x5=20
B.2.Generic Elective Practical/ Tutorial*(4Papers)	4x2=8	4x1=4
Optional dissertation or project work in place of one Discipline Specific Elective paper (6 credits) in 6 th semester		
1.Ability Enhancement Compulsory Courses (AECC) (2 Papers of 4credit each)	2x4=4	2x4=8
Environmental Science		
English Communication		
2.Skill Enhancement Courses (SEC)(Minimum2) (2 Papers of 4credit each)	2x4=8	2x4=8
Total credit	148	148

*Wherever there is practical, there will be no tutorial and vice-versa

CBCS Course Structure for B.Sc. (Hons.) Mathematics Program SEMESTER WISE PLACEMENT OF THE COURSES

Sem	Core Course (14)	Ability Enhancement Compulsory Course (AECC) (2)	Skill Enhancement Course (SEC) (2)	Discipline Specific Elective (DSE) (4)	Generic Elective (GE) (4) (Other than Mathematics Honours)
I	MAT-HC-1016: Calculus (including practical)	ENG-AE-1014			MAT-HG-1016 / MAT-RC-
	MAT-HC-1026: Algebra				1016 MAT-HG-1026
II	MAT-HC-2016: Real Analysis	ENV-AE-2014			MAT-HG-2016 / MAT-RC-2016
	MAT-HC-2026: Differential Equations (including practical)				MAT-HG-2026
III	MAT-HC-3016: Theory of Real Functions		MAT-SE-3014		MAT-HG-3016 / MAT-RC-
	MAT-HC-3026: Group Theory-I		MAT-SE-3024		3016 MAT-HG-
	MAT-HC-3036: Analytical Geometry				3026
IV	MAT-HC-4016: Multivariate Calculus		MAT-SE-4014		MAT-HG-4016 / MAT-RC-
	MAT-HC-4026: Numerical Methods (including practical)		MAT-SE-4024		4016 MAT-HG-
	MAT-HC-4036: Ring Theory		MAT-SE-4034		4026
V	MAT-HC-5016: Complex Analysis			DSE-1 MAT-HE-5016 MAT-HE-5026 MAT-HE-5036	
	MAT-HC-5026: Linear Algebra			DSE-2 MAT-HE-5046 MAT-HE-5056 MAT-HE-5066	
VI	MAT-HC-6016: Riemann Integration and Metric spaces			DSE-3 MAT-HE-6016 MAT-HE-6026 MAT-HE-6036 MAT-HE-6046	
	MAT-HC-6026: Partial Differential Equations (including practical)			DSE-4 MAT-HE-6056 MAT-HE-6066 MAT-HE-6076	
				Project In lieu of DSE-3 or DSE-4	

Legends: HC: Core Papers HE: Discipline Specific Elective Papers SE: Skill

Enhancement Papers HG: Generic Elective Papers

Core Papers:

- MAT-HC-1016: Calculus (including practical)
- MAT-HC-1026: Algebra
- MAT-HC-2016: Real Analysis
- MAT-HC-2026: Differential Equations (including practical)
- MAT-HC-3016: Theory of Real Functions
- MAT-HC-3026: Group Theory-I
- MAT-HC-3036: Analytical Geometry
- MAT-HC-4016: Multivariate Calculus
- MAT-HC-4026: Numerical Methods (including practical)
- MAT-HC-4036: Ring Theory
- MAT-HC-5016: Complex Analysis
- MAT-HC-5026: Linear Algebra
- MAT-HC-6016: Riemann Integration and Metric spaces
- MAT-HC-6026: Partial Differential Equations (including practical)

Skill Enhancement Course (SEC)

papers SEC1(choose one)

- (i) MAT-SE-3014: Computer Algebra Systems and Related Software
- (ii) MAT-SE-3024: Combinatorics and Graph Theory

SEC2(choose one)

- (i) MAT-SE-4014: R-Programming
- (ii) MAT-SE-4024: LATEX and HTML
- (iii) MAT-SE-4034: Boolean Algebra

Discipline Specific Electives (DSE) papers

DSE1(choose one)

- (i) MAT-HE-5016: Number Theory
- (ii) MAT-HE-5026: Mechanics
- (iii) MAT-HE-5036: Probability and Statistics

DSE2(choose one)

- (i) MAT-HE-5046: Linear Programming
- (ii) MAT-HE-5056: Spherical Trigonometry and Astronomy
- (iii) MAT-HE-5066: Programming in C

DSE-3(choose one)

- (i) MAT-HE-6016: Boolean Algebra and Automata Theory
- (ii) MAT-HE-6026: Bio-Mathematics
- (iii) MAT-HE-6036: Mathematical Modeling
- (iv) MAT-HE-6046: Hydromechanics

DSE4(choose one)

- (i) MAT-HE-6056: Rigid Dynamics

- (ii) MAT-HE-6066: Group Theory II
- (iii) MAT-HE-6076: Mathematical Finance

Project (in lieu of DSE3 or DSE4)

Generic Elective (GE) papers

GE1(choose one)

- (i). MAT-HG-1016/MAT-RC-1016: Calculus
- (ii). MAT-HG-1026: Analytical Geometry

GE2(Choose one)

- (i). MAT-HG-2016/MAT-RC-2016: Algebra
- (ii). MAT-HG-2026: Discrete Mathematics

GE3(choose one)

- (i). MAT-HG-3016/MAT-RC-3016: Differential Equations
- (ii). MAT-HG-3026: Linear Programming

GE4(choose one)

- (i). MAT-HG-4016/MAT-RC-4016: Real Analysis
- (ii). MAT-HG-4026: Numerical Analysis

Detailed Syllabus

SEMESTER-I

SEMESTER-I

MAT-HC-1016: Calculus (including practical)

Total marks: 100 (Theory: 60, Practical 20, Internal Assessment: 20)

Lectures 2 Practical, Credits 6 (4+2) *Each unit carry equal credit*

Course Objectives: The primary objective of this course is to introduce the basic tools of calculus and geometric properties of different conic sections which are helpful in understanding their applications in planetary motion, design of telescope and to the real-world problems. Also, to carry out the hand on sessions in computer lab to have a deep conceptual understanding of the above tools to widen the horizon of students' self-experience.

Course Learning Outcomes: This course will enable the students to:

- Learn first and second derivative tests for relative extrema and apply the knowledge in problems in business, economics and life sciences.
- Sketch curves in a plane using its mathematical properties in the different coordinate systems of reference.
- Compute area of surfaces of revolution and the volume of solids by integrating over cross-sectional areas.
- Understand the calculus of vector functions and its use to develop the basic principles of planetary motion.

UNIT 1: (a) Higher order derivatives, Leibnitz rule and its applications to problems of type $e^{ax+b} \sin x$, $e^{ax+b} \cos x$, $(ax+b)^n \sin x$, $(ax+b)^n \cos x$,

(b) Concavity and inflection points, asymptotes, curve tracing in Cartesian coordinates, tracing in polar coordinates of standard curves, L-Hopital's rule, applications in business, economics and life sciences.

[1] Chapter 4 (Sections 4.3-4.5,4.7) (for part (b))

[2] Chapter 10 (Section 10.1-10.6) (for part (b)).

[3] Chapter 5 (only for part (a))

UNIT 2: (a) Reduction formulae, derivations and illustrations of reduction formulae of the type $\int \sin^n x \, dx$, $\int \cos^n x \, dx$, $\int \tan^n x \, dx$, $\int \sec^n x \, dx$, $\int (\log x)^n \, dx$, $\int \sin^n x \cos^m x \, dx$.

(b) Volumes by slicing, disks and washers' methods, volumes by cylindrical shells, parametric equations, parameterizing a curve, arc length, arc length of parametric curves, area of surface of revolution.

[1] Chapter 6 (Section 6.2,6.4), Chapter 9 (Section 9.4) (for part (b))

[2] Chapter 6 (Section 6.1-6.5), (for part (b))

[4] Chapter 4 (4.1-4.6) (only for part (a))

UNIT 3: Triple product, introduction to vector functions, operations with vector-valued functions, limits and continuity of vector functions, differentiation and integration of vector functions, tangent and normal components of acceleration, modelling ballistics and planetary motion, Kepler's second law.

[1] Chapter 9 (Section 9.3), Chapter 10

[2] Chapter 11 (11.3, 11.4) Chapter 12

Practical / Lab work to be performed on a computer:

List of the practical to be done using MATLAB / Mathematica / Maple / Scilab / Maxima etc.

- Plotting the graphs of the following functions: ax , $[x]$ (greatest integer function),

$$\sqrt{ax+b}, |ax+b|, c \pm |ax+b|, x^{\pm n}, x^{1/n}, n \in \mathbb{Z}$$

$$|x|/x, \sin(1/x), x \sin(1/x), \text{ and } e^{\pm 1/x} \text{ for } x \neq 0.$$

$$e^{ax+b}, \log(ax+b), 1/(ax+b), \sin(ax+b), \cos(ax+b), |\sin(ax+b)|, |\cos(ax+b)|.$$

Observe and discuss the effect of changes in the real constants a , b and c on the graphs.

- Plotting the graphs of polynomial of degree 4 and 5, the graphs of their first and second derivatives, and analysis of these graphs in context of the concepts covered in Unit 1.

- (iii). Sketching parametric curves, e.g., Trochoid, Cycloid, Epicycloid and Hypocycloid.
- (iv). Tracing of conic in cartesian coordinates.
- (v). Obtaining surface of revolution of curves.
- (vi). Graph of hyperbolic functions.
- (vii). Computation of limit, Differentiation, Integration and sketching of vector-valued functions.
- (viii). Complex numbers and their representations, Operations like addition, Multiplication, Division, Modulus. Graphical representation of polar form.
- (ix). Find numbers between two real numbers and plotting of finite and infinite subset of R

Text Books:

1. M. J. Strauss, G. L. Bradley and K. J. Smith, Calculus (3rd Edition), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), Delhi, 2007.
2. H. Anton, I. Bivens and S. Davis, Calculus (10th Edition), John Wiley and sons (Asia), Pt Ltd., Singapore, 2011.
3. Shanti Narayan and P.K. Mittal, Differential Calculus, S. Chand, 2005.
4. Shanti Narayan and P.K. Mittal, Integral Calculus, S. Chand, 2007.

Reference Book:

1. G. L. Bradley and K. J. Smith, Calculus, Prentice Hall Inc, (1st Edition) 1995.

MAT-HC-1026: Algebra

Totalmarks:100(Theory:80 InternalAssessment:20)

Perweek:5Lectures1Tutorial, Credits6, *each unit carry equal credit*

Course Objectives: The primary objective of this course is to introduce the basic tools of set theory, functions, induction principle, theory of equations, complex numbers, number theory, matrices and determinant understand their connection with the real-world problems.

Course Learning Out comes: This course will enable the students to:

- i) Employ DeMoivre's theorem in a number of applications to solve numerical problems.
- ii) Learn about equivalent classes and cardinality of a set.
- iii) Use modular arithmetic and basic properties of congruences.
- iv) Recognize consistent and inconsistent systems of linear equations by the row echelon form of the augmented matrix.
- v) Learn about the solution sets of linear systems using matrix method and Cramer's rule

UNIT-1: Polar representation of complex numbers, nth roots of unity, De Moivre's theorem for rational indices and its applications.

[1]: Chapter2

UNIT-2: Statements and logic, statements with quantifier, compound statements, implications, proofs in Mathematics; Sets, operations on sets, family of sets, power sets, Cartesian product; Functions, one-one, onto functions and bijections, Composition of functions, Inverse of a function, Image and Inverse image of subsets

[2] Chapters1– 3

UNIT-3: Relation, Equivalence relations, Equivalence classes and partitions of a set, congruence modulo n in integers; Induction Principles, the well-ordering principle, greatest common divisor of integers.

[3] Chapters 4– 5.

UNIT 4: Systems of Linear Equations, row reduction and echelon forms, vector equations, the matrix equation $Ax = b$, solution sets of linear systems, linear independence, introduction to linear transformations, the matrix of

a linear transformation; Matrix operations, inverse of a matrix, characterizations of invertible matrices; Determinants, Cramer's rule

[4]: Chapter1(Sections1.1–1.9); Chapter2(Sections,2.1–1.3); Chapter3(Sections3.1–3.3)

Text Books:

1. Titu Andreescu and Dorin Andrica, Complex Numbers from A to Z, Birkhauser,2006.
2. A Kumar, S. Kumaresan and B.K.Sarma, A Foundation Course in Mathematics,Narosa,2018.
3. David C. Lay, Linear Algebra and its Applications(3rdEdition), Pearson Education Asia, Indian print,2007.

Reference Books:

1. Edgar G. Goodaire and Michael M. Parmenter, Discrete Mathematics with Graph Theory (3rd Edition), Pearson Education (Singapore) Pvt. Ltd., Indian Reprint, 2005.
2. Gilbert Strang, Linear Algebra and its Applications, Thomson,2007.

GENERIC ELECTIVE

MAT-HG-1016/ MAT-RC-1016: Calculus

Total Marks: 100(Theory: 80, Internal Assessment: 20)

Per week: 5 Lectures, 1 Tutorial **Credits: 6**, Each unit carry equal credit

Course Objectives: Calculus is referred as 'Mathematics of change' and is concerned with describing the precise way in which changes in one variable relate to the changes in another. Through this course, students can understand the quantitative change in the behaviour of the variables and apply them on the problems related to the environment.

Course Learning Outcomes: The students who take this course will be able to:

- i) Understand continuity and differentiability in terms of limits.
- ii) Describe asymptotic behavior in terms of limits involving infinity.
- iii) Use derivatives to explore the behavior of a given function, locating and classifying its extrema, and graphing the function.
- iv) Understand the importance of mean value theorems.

Unit 1: Graphs of simple concrete functions such as polynomial, Trigonometric, Inverse trigonometric, Exponential and logarithmic functions

[1] Chapter 1 (Sections 1.1 to 1.3), and Chapter 7 (Sections 7.2, 7.3, and 7.6)

Unit 2: Limits and continuity of a function including approach, Properties of continuous functions including Intermediate value theorem.

[2] Chapter 1

Unit 3: Differentiability, Successive differentiation, Leibnitz theorem, Recursion formulae for higher derivatives.

[3] Chapter 5.

Unit 4: Rolle's theorem, Lagrange's mean value theorem with geometrical interpretations and simple applications, Taylor's theorem, Taylor's series and Maclaurin's series, Maclaurin's series expansion of functions such as their use in polynomial approximation and error estimation.

[1] Chapter 4 (Sections 4.2, and 4.3), [2] Chapter 9 (Sections 9.8, and 9.9)

Unit 5: Functions of two or more variables, Graphs and level curves of functions of two variables, Partial differentiation up to second order.

[2] Chapter 13 (Sections 13.1, and 13.3)

Text books:

1. Thomas, Jr. George B., Weir, Maurice D., & Hass, Joel (2014). *Thomas' Calculus* (13thed). Pearson Education, Delhi. Indian Reprint 2017.
2. Anton, Howard, Bivens, Irl, & Davis, Stephen (2013). *Calculus* (10th ed.). John Wiley & Sons Singapore Pte. Ltd.

Reprint (2016) by Wiley India Pvt. Ltd. Delhi

3. Shanti Narayan and P.K. Mittal, Differential Calculus, S. Chand, 2005

MAT-HG-1026: Analytical Geometry

Total Marks: 100 (Theory: 80, Internal Assessment: 20)

Per week: 5 Lectures, 1 Tutorial Credits: 6, *Each unit carry equal credit*

Course Objectives: The primary objective of this course is to introduce the basic tools of two-dimensional coordinate systems, general conics, and three-dimensional coordinate systems. Also, introduces the vectors in coordinate systems with geometrical properties

Course Learning Out comes: This course will enable the students to:

- i) Transform coordinate systems, conic sections
- ii) Learn polar equation of a conic, tangent, normal and related properties
- iii) Have a rigorous understanding of the concept of three-dimensional coordinate systems
- iv) Understand geometrical properties of dot product, cross product of vectors

UNIT 1: Transformation of coordinates, pair of straight lines. Parabola, parametric coordinates, tangent and normal, ellipse and its conjugate diameters with properties, hyperbola and its asymptotes, general conics: tangent, condition of tangency, pole and polar, center of a conic, equation of pair of tangents, reduction to standard forms, central conics, equation of the axes, and length of the axes, polar equation of a conic, tangent and normal and properties.

[1] Chapter 3, 4, 10

UNIT 2: Three-Dimensional Space: Vectors

Rectangular coordinates in 3-space, Spheres and Cylindrical surfaces, Vector viewed geometrically, Vectors in coordinate system, Vectors determine by length and angle, Dot product, Cross product and their geometrical properties, Parametric equations of lines in 2-space and 3-space.

[1] Chapter 11 (11.1, 11.2, 11.3 to 11.5)

Text Books:

1. R.M. Khan, Analytical Geometry of two and three dimension and vector analysis. New Central Book agency 2012.
2. Anton, Howard, Bivens, Irl, & Davis, Stephen (2013). *Calculus* (10th ed.). John Wiley & Sons Singapore Pte. Ltd. Reprint (2016) by Wiley India Pvt. Ltd. Delhi.

Reference Book:

1. E.H. Askwith, The Analytical Geometry of the Conic Sections, Nabu Press (27 February 2012)
2. R.J.T. Bell, Coordinate Solid Geometry, Macmillan, 1983.
3. B. Das, Analytical Geometry and Vector Analysis, Orient Book Company, Kolkata - 700007

SEMESTER-II

MAT-HC-2016: Real Analysis

Total marks: 100 (Theory: 80 Internal Assessment: 20)

Per week: 5 Lectures, 1 Tutorial, Credits 6, *Each unit carry equal credit*

Course Objectives: The course will develop a deep and rigorous understanding of real line R and of defining terms to prove the results about convergence and divergence of sequences and series of real numbers. These concepts have wide range of applications in real life scenario.

Course Learning Out comes: This course will enable the students to:

- i) Understand many properties of the real line R , including completeness and Archimedean properties.

- ii) Learn to define sequences in terms of functions from N to a subset of R .
- iii) Recognize bounded, convergent, divergent, Cauchy and monotonic sequences and to calculate their limit superior, limit inferior, and the limit of a bounded sequence. Apply the ratio, root, alternating series and limit comparison tests for convergence and absolute convergence of an infinite series of real numbers.

UNIT 1: Algebraic and order properties of R , absolute value and real line, bounded sets, supremum and infimum, completeness property of R , the Archimedean property, the density theorem, intervals, nested interval theorem.

[1] Chapter2

UNIT-2: Real sequences, limit of a sequence, convergent sequence, bounded sequence, limit theorems, monotone sequences, monotone convergence theorem, subsequences, monotone subsequence theorem, Bolzano Weierstrass theorem for sequences, Cauchy sequences, Cauchy's convergence criterion, properly divergence sequences.

[1] Chapter3

UNIT 3: Infinite series, convergence and divergence of infinite series, Cauchy criterion, Tests for convergence: comparison test, limit comparison test, ratio test, root test, integral test, Absolute convergence, rearrangement theorem, alternating series, Leibniz test, conditional (non-absolute) convergence.

[1] Chapter9Sections9.1-3.

Text Book:

1. R.G. Bartle and D.R. Sherbert, Introduction to Real Analysis, 3rdEd., John Wiley and Sons,2002.

Reference Books:

1. Gerald G. Bilodeau, Paul R. Thie, G.E. Keough, *An Introduction to Analysis*, Jones & Bartlett, Second Edition, 2010.
2. A. Kumar and S. Kumaresan, *Basic Course in Real Analysis*, CRC Press,2014.
3. K.A. Ross, Elementary Analysis: The Theory of Calculus, Undergraduate Texts in Mathematics, Springer (SIE), Indian reprint, 2004.

MAT-HC-2026: Differential Equations (including practical)

Total Marks:100: (Theory60, Practical20, Internal assessment 20)

Per week: 4 Lectures, 2 Practical, Credits 6 (4+2) *Each unit carry equal credit*

Course Objectives: The main objective of this course is to introduce the students to the exciting world of differential equations, mathematical modeling and their applications.

Course Learning Outcomes: The course will enable the students to:

- i) Learn basics of differential equations and mathematical modeling.
- ii) Formulate differential equations for various mathematical models.
- iii) Solve first order non-linear differential equations and linear differential equations of higher order using various techniques.
- iv) Apply these techniques to solve and analyze various mathematical models.

UNIT 1: Differential equations and mathematical models. General, particular, explicit, implicit and singular solutions of a differential equation. Exact differential equations and integrating factors, separable equations and equations reducible to this form, linear equation and Bernoulli equations, special integrating factors and transformations.

[2] Chapter 1 (Sections 1.1, and 1.6), [3] Chapter 2, [2] Chapter 1 (Section 1.4, pages 35 to 38), and Chapter 2(Section 2.3). [3] Chapter3 (Section 3.3, A and B with Examples 3.8, 3.9)

UNIT 2: Introduction to compartmental model, exponential decay model, exponential growth of population, limited growth of population, limited growth with harvesting.

[1] Chapter 2 (Sections 2.1, 2.5, and 2.6), [1] Chapter 2 (Sections 2.7, and 2.8), [1] Chapter 3 (Sections 3.1 to 3.3)

UNIT3: General solution of homogeneous equation of second order, principle of superposition for homogeneous equation, Wronskian: its properties and applications, Linear homogeneous and non-homogeneous equations of higher order with constant coefficients, Euler's equation, method of undetermined coefficients, method of variation of parameters.

[2] Chapter 3 (Sections 3.1 to 3.3, Sections 3.4 (pages 172 to 177), and 3.5)

List of Practical (using any software)

1. Plotting of second order solution family of differential equation.
2. Plotting of third order solution family of differential equation.
3. Growth model (exponential case only).
4. Decay model (exponential case only).
5. Lake pollution model (with constant/seasonal flow and pollution concentration).
6. Case of single cold pill and a course of cold pills.
7. Limited growth of population (with and without harvesting).

Text Books:

1. Barnes, Belinda & Fulford, Glenn R. (2015). *Mathematical Modelling with Case Studies, Using Maple and MATLAB* (3rd ed.). CRC Press, Taylor & Francis Group.
2. Edwards, C. Henry, Penney, David E., & Calvis, David T. (2015). *Differential Equation and Boundary Value Problems: Computing and Modeling* (5th ed.). Pearson Education.
3. Ross, Shepley L. (2004). *Differential Equations* (3rded.). John Wiley & Sons. India

Reference Books:

1. Martha L Abell, James P Braselton, *Differential Equations with MATHEMATICA*, 3rdEd., Elsevier Academic Press, 2004.
2. Ross, Clay C. (2004). *Differential Equations: An Introduction with Mathematica* (2nded.). Springer.

GENERIC ELECTIVE

PAPERSMAT-HG-2016/MAT-RC-2016:

Algebra

Total Marks: 100 (Theory: 80, Internal Assessment: 20)

Per week: 5 Lectures, 1 Tutorial, Credits: 6, *Each unit carry equal credit*

Course Objectives: The primary objective of this course is to introduce the basic tools of theory of equations, complex numbers, number theory, matrices, determinant, along with algebraic structures like group, ring and vector space to understand their connection with the real-world problems.

Course Learning Outcomes: This course will enable the students to:

- i) Learn how to solve the cubic and biquadratic equations, also learn about symmetric functions of the roots for cubic and biquadratic
- ii) Employ De Moivre's theorem in a number of applications to solve numerical problems.
- iii) Recognize consistent and inconsistent systems of linear equations by the row echelon form of the augmented matrix. Finding inverse of a matrix.
- iv) Recognize the mathematical objects that are groups, and classify them as abelian, cyclic and permutation groups, ring etc.

Unit 1: Theory of Equations, De Moivre's Theorem and Roots of complex Numbers:

General properties of equations, Theorems related to real roots of equations, Existence of a root in the general equation, Imaginary roots, Equal roots, Theorems determining the number of roots of an equation. Relation between roots and coefficients of n th degree equation, Solutions of cubic and biquadratic equations, when some conditions on roots of the equation are given, Depression of an equation when a relation exists between two of its roots, Symmetric functions of the roots for cubic and biquadratic.

[2] Chapter II (12- 18) Chapter III (23-25, 27)

De Moivre's theorem (both integral and rational index), Roots of complex numbers, Solutions of equations using trigonometry and De Moivre's theorem.

[1] Chapter 7 (Sections 7.3)

Unit 2: Matrices:

Matrix Algebra, Addition, Transposition, Symmetry, Multiplication of matrices and their properties, Matrix inversion and properties, Row Echelon form and Rank of a matrix, Reduced row Echelon form, Consistency of linear systems, Solutions of system of homogeneous and non-homogeneous linear equations with number of equations and unknowns up to four. Invariance of rank under elementary transformations, Reduction to normal form.

[3] Chapter 3 (Sections 3.2, 3.5, and 3.7) Chapter 2 (Sections 2.1 to 2.5) Chapter 3 (section 3.9)

Unit 3: Groups and Rings:

Permutations. Congruence of Integers. Groups, Properties of group elements. Subgroups. Cyclic groups, Permutation groups, Cosets of a subgroup. Definition of Ring, Subring, Ring with unity, Commutative Ring (Up to definition 5.5)

[1] Chapter 1 (Section 1.5), Chapter 2 (Section 2.5), Chapter 3 (Sections 3.1- 3.4)

Chapter 4 (Sections 4.1 and 4.4) and Chapter 5 (Section 5.1)

Text Books:

1. Gilbert, Linda & Gilbert, Jimmie. *Elements of Modern Algebra*, (8th Edition) 2013, Cengage Learning
2. Burnside, William Snow & Panton, Arthur William. *The Theory of Equations*, Vol. 1 (8th Edition), Dublin University Press Series.
3. Meyer, Carl D. (2000). *Matrix Analysis and Applied Linear Algebra*. Society for Industrial and Applied Mathematics (Siam).

Reference Books:

1. Dickson, Leonard Eugene (2009). *First Course in The Theory of Equations*. The Project Gutenberg eBook (<http://www.gutenberg.org/ebooks/29785>)
2. Gilbert, William J. (2004). *Modern Algebra with Applications* (2nd ed.). John Wiley & Sons.
3. Gilbert, William J., & Vanstone, Scott A. (1993). *Classical Algebra* (3rd ed.). Waterloo Mathematics Foundation, Canada.
4. Beachy, John A., & Blair, William D. (2006). *Abstract Algebra* (3rd ed.). Wavel and Press, Inc.

MAT-HG-2026: Discrete Mathematics

TotalMarks:100(Theory:80InternalAssessment:20)

Per week: 5 Lectures, 1 Tutorial, Credits:6, *Each unit carry equal credit*

Course Objectives: The course aims at introducing the concepts of ordered sets, lattices, sublattices and homomorphisms between lattices. It also includes introduction to modular and distributive lattices along with complemented lattices and Boolean algebra. Then some important applications of Boolean algebra are discussed in switching circuits.

Course Learning outcomes: After the course, the student will be able to:

- i) Understand the notion of ordered sets and maps between ordered sets.
- ii) Learn about lattices, modular and distributive lattices, sub lattices and homomorphisms between lattices.
- iii) Become familiar with Boolean algebra, Boolean homomorphism, Karnaugh diagrams, switching circuits and their applications.

Unit1: Ordered Sets:

Definitions, Examples and basic properties of ordered sets, Order isomorphism, Hasse diagrams, Dual of an ordered set, Duality principle, Maximal and minimal elements, Building new ordered sets, Maps between ordered sets.

[1] Chapter 1(Sections 1.1 to 1.5 and 1.14 to 1.26, and 1.34 to 1.36)

[3] Chapter 1[Section1(1.1to1.3)]

Unit2: Lattices

Lattices as ordered sets, Lattices as algebraic structures, Sublattices, Products and homomorphisms; Definitions, Examples and properties of modular and distributive lattices, The $M_3 - N_5$ Theorem with applications, Complemented lattice, Relatively complemented lattice, Sectionally complemented lattice. homomorphisms.

[1] Chapter2(Sections2.1to2.19) Chapter4(Sections4.1to4.11)

[3] Chapter1[Section1(1.5to1.20)] Chapter2[Section2(2.1to2.14)]

Unit3: Boolean Algebras and Switching Circuits

Boolean Algebras, De Morgan's laws, Boolean homomorphism, Representation theorem; Boolean polynomials, Boolean polynomial functions, Disjunctive normal form and conjunctive normal form, Minimal forms of Boolean polynomial, Quinn-McCluskey method, Karnaugh diagrams, switching circuits and applications of switching circuits.

[3] Chapter 1 (Sections 3,4 and 6) Chapter 2 (Sections 7 and 8).

Text Books:

1. Davey, B.A., & Priestley, H.A. (2002). *Introduction to Lattices and Order* (2nd ed.). Cambridge University press, Cambridge.
2. Goodaire, Edgar G., & Parmenter, Michael M. (2011). *Discrete Mathematics with Graph Theory* (3rd ed.). Pearson Education (Singapore) Pvt. Ltd. Indian Reprint.
3. Lidl, Rudolf & Pilz, Gunter. (2004). *Applied Abstract Algebra* (2nd ed.), Undergraduate Texts in Mathematics. Springer (SIE). Indian Reprint.

SEMESTER-III

MAT-HC-3016: Theory of Real Functions

TotalMarks:100(Theory 80, Internal assessment 20)

Per week: 5 Lectures, 1Tutorial, Credits (6) *Each unit carry equal credit*

Course Objectives: It is a basic course on the study of real valued functions that would develop an analytical ability to have a more matured perspective of the key concepts of calculus, namely; limits, continuity, differentiability and their applications

Course Learning Outcomes: This course will enable the students to:

- i) Have a rigorous understanding of the concept of limit of a function.
- ii) Learn about continuity and uniform continuity of functions defined on intervals.
- iii) Understand geometrical properties of continuous functions on closed and bounded intervals.
- iv) Learn extensively about the concept of differentiability using limits, leading to a better understanding for applications.
- v) Know about applications of mean value theorems and Taylor's theorem

UNIT 1: Cluster point or limit point of a set, limits of a function (ϵ - δ approach), sequential criterion for limits, divergence criteria, limit theorems, one sided limits, infinite limits and limits at infinity.

[1] Chapter4

UNIT 2: Continuous functions, sequential criterion for continuity and discontinuity, algebra of continuous functions, continuous functions on intervals, maximum-minimum theorem, intermediate value theorem, location of roots theorem, preservation of intervals theorem, uniform continuity, uniform continuity theorem.

[1] Chapter5 (5.1 to 5.5)

UNIT 3: Differentiability of a function at a point and in an interval, Caratheodory's theorem, chain rule, derivative of inverse function, Rolle's theorem, mean value theorem, Darboux's theorem, Cauchy mean value

theorem, Taylor's theorem and applications to inequalities, Taylor's series expansions of exponential and trigonometric functions, $\ln(1+x)$, $1/(ax+b)$ and $(1+x)^n$.

[1] Chapter 6, and Taylor series as in Section 6.4.

Text Book:

1. R. Bartle and D.R. Sherbert, Introduction to Real Analysis, John Wiley and Sons, 2015.

Reference Books:

1. Ajit Kumar and S. Kumaresan, A Basic Course in Real Analysis, CRC Press, Indian Edn. 2014.
2. K.A. Ross, Elementary Analysis: The Theory of Calculus, Springer, 2004.
3. A. Mattuck, Introduction to Analysis, Prentice Hall, 1999.
4. S.R. Ghorpade and B.V. Limaye, A Course in Calculus and Real Analysis, Springer, 2006.

MAT-HC-3026: Group Theory-I

Total Marks: 100 (Theory 80 Internal assessment 20)

Per week: 5 Lectures, 1 Tutorial, Credits 6, *Each unit carry equal credit*

Course Objectives: The objective of the course is to introduce the fundamental theory of groups and their homomorphisms. Symmetric groups and group of symmetries are also studied in detail. Fermat's Little theorem is studied as a consequence of the Lagrange's theorem on finite groups.

Course Learning Outcomes: The course will enable the students to:

- i) Recognize the mathematical objects that are groups, and classify them as abelian, cyclic and permutation groups, etc.
- ii) Link the fundamental concepts of groups and symmetrical figures.
- iii) Analyze the subgroups of cyclic groups and classify subgroups of cyclic groups.
- iv) Explain the significance of the notion of cosets, normal subgroups and factor groups.
- v) Learn about Lagrange's theorem and Fermat's Little theorem.
- vi) Know about group homomorphisms and group isomorphisms.

UNIT 1: Symmetries of a square, Dihedral groups, definition and examples of groups including permutation groups and quaternion groups (illustration through matrices), elementary properties of groups. Subgroups and examples of subgroups, centralizer, normalizer, center of a group, product of two subgroups. Properties of cyclic groups, classification of subgroups of cyclic groups.

[1]: Chapters 1, Chapter 2, Chapter 3 (including Exercise 20 on page 66 and Exercise 2 on page 86), Chapter 4.

UNIT 2: Cycle notation for permutations, properties of permutations, even and odd permutations, alternating group, properties of cosets, Lagrange's theorem and consequences including Fermat's Little theorem. External direct product of a finite number of groups, normal subgroups, factor groups, Cauchy's theorem for finite abelian groups.

[1]: Chapter 5 (till end of Theorem 5.7), Chapter 7 (till end of Theorem 7.2, including Exercises 6 and 7 on Page 168), Chapter 8 (till the end of Example 2), Chapter 9 (till end of Example 10, Theorem 9.3 and 9.5).

UNIT 3: Group homomorphisms, properties of homomorphisms, Cayley's theorem, properties of isomorphisms, First, Second and Third isomorphism theorems.

[1]: Chapter 6 (till end of Theorem 6.2), Chapter 10.

Text Book:

1. Gallian, Joseph. A. (2013). *Contemporary Abstract Algebra* (8th ed.). Cengage Learning India Private Limited, Delhi. Fourth impression, 2015.

Reference Books:

1. John B. Fraleigh, A First Course in Abstract Algebra, 7thEd., Pearson, 2002.
2. G. Santhanam, Algebra, Narosa Publishing House, 2017.
3. Joseph J. Rotman, An Introduction to the Theory of Groups, 4thEd., Springer Verlag, 1995.
4. David S. Dummit and Richard M. Foote, Abstract Algebra (2nd Edition), John Wiley and Sons (Asia) Pvt. Ltd, Singapore, 2003.

MAT-HC-3036: Analytical Geometry

Total Marks:100:(Theory 80, Internal assessment 20)

Per week:5 Lectures, 1 Tutorial, Credits 6, *Each unit carry equal credit*

Course Objectives: The primary objective of this course is to introduce the basic tools of two-dimensional coordinates systems, general conics, and three-dimensional coordinate systems.

Course Learning Outcomes: This course will enable the students to:

- i) Learn conic sections and transform co-ordinate systems
- ii) Learn polar equation of a conic, tangent, normal and properties
- iii) Have a rigorous understanding of the concept of three-dimensional coordinates systems

UNIT 1: Transformation of coordinates, pair of straight lines. Parabola, parametric coordinates, tangent and normal, ellipse and its conjugate diameters with properties, hyperbola and its asymptotes, general conics: tangent, condition of tangency, pole and polar, center of a conic, equation of pair of tangents, reduction to standard forms, central conics, equation of the axes, and length of the axes, polar equation of a conic, tangent and normal and properties.

[1] Chapter 1(1.30-1.34),2, 3,4,5,6,7, 9 (up to 9.43)

UNIT 2: Plane, straight lines and shortest distance. Sphere, cone and cylinder, central conicoid, ellipsoid, hyperboloid of one and two sheets, diametral planes, tangent lines, director sphere, polar plane, section with a given center.

[1] Chapter 6 (Part-II) (B &C)

[2] Chapters4,5,6,7(uptopage125)

Text Books:

1. R. M. Khan, Analytical Geometry of two and three-dimension and vector analysis. New Central Book agency 2012.
2. R.J.T. Bell, Coordinate Solid Geometry, Macmillan,1983.

Reference Book:

1. E.H. Askwith, The Analytical Geometry of the Conic Sections, Nabu Press (27 February 2012)
2. B. Das, Analytical Geometry and Vector Analysis, Orient Book Company, Calcutta-7

SKILL ENHANCEMENT COURSES**EC-1****MAT-SE-3014: Computer Algebra Systems and Related Software**

Total marks:100(Theory 50, Practical 50)

Per week;2 Lectures, 2 Practical, Credits 4(2+2) *Each unit carry equal credit.*

Course Objectives: This course aims at familiarizing students with the usage of mathematical software (Mathematica/MATLAB/Maxima/Maple) and the statistical software **R**. The basic emphasis is on plotting and working with matrices using CAS. Data entry and summary commands will be studied in **R**. Graphical representation of data shall also be explored.

Course Learning Outcomes: This course will enable the students to:

- i) Use of software; Mathematica/MATLAB/Maxima/Maple, etc. as a calculator, for plotting functions and animations.
- ii) Use of CAS for various applications of matrices such as solving system of equations and finding eigenvalues

and eigen vectors.

iii) Understand the use of the statistical software **R** as calculator and learn to read and get data into **R**.

iv) Learn the use of **R** in summary calculation, pictorial representation of data and exploring relationship between data.

v) Analyze, test, and interpret technical arguments on the basis of geometry

Unit1: Introduction to CAS and Applications:

Computer Algebra System (CAS), Use of a CAS as a calculator, Computing and plotting functions in 2D, plotting functions of two variables using Plot 3 D and Contour Plot, plotting parametric curves surfaces, customizing plots, animating plots, producing tables of values, working with piecewise defined functions, Combining graphics.

[1] Chapter 12 (Sections 12.1 to 12.5)

[2] Chapter1, and Chapter 3 (Sections 3.1to 3.6, and 3.8) Chapter 6(Sections 6.2,and 6.3)

Unit2: Working with Matrices:

Simple programming in a CAS, working with matrices, Performing Gauss elimination, operations (transpose, determinant, inverse), Minors and cofactors, working with large matrices, Solving system of linear equations, Rank and nullity of a matrix, Eigenvalue, eigen vector and diagonalization.

[2] Chapter7(Sections7.1to7.8)

Practical:

Six practicals should be done by each student. The teacher can assign practical from the exercises from [1,2].

Text Books:

1. Bindner, Donald & Erickson, Martin. (2011). *A Student's Guide to the Study, Practice, and Tools of Modern Mathematics*. CRC Press, Taylor & Francis Group, LLC.
2. Torrence, Bruce F., & Torrence, Eve A. (2009). *The Student's Introduction to Mathematica: A Handbook for Precalculus, Calculus and Linear Algebra* (2nd ed.). Cambridge University Press

MAT-SE-3024: Combinatorics and Graph Theory

Total marks:100(Theory 80, Internal Assessment 20)

Per week :4 Lectures, Credits 4, *Each unit carry equal credit.*

Course Objectives: This course aims to provide the basic tools of counting principles, pigeonhole principle. Also introduce the basic concepts of graphs, Eulerian and Hamiltonian graphs, and applications to dominoes, Diagram tracing puzzles, Knight's tour problem and Gray codes.

Course Learning Outcomes: This course will enable the students to:

- i) Learn about the counting principles, permutations and combinations, Pigeon hole principle
- ii) Understand the basics of graph theory and learn about social networks, Eulerian and Hamiltonian graphs, diagram tracing puzzles and Knight's tour problem.

Unit1: Basic counting principles, Permutations and combinations, the inclusion-exclusion principle, Pigeon hole principle.

[2] Chapter 1 (Sections 1.1, 1.2, 1.3), Chapter 2 (Sections 2.1, 2.2) Chapter 4 (Section 4.1) Chapter 8 (Section8.1).

Unit2: Graphs, Diagraphs, Networks and sub graphs, Vertex degree, Paths and cycles, Regular and bipartite graphs, Four cube problem, Social networks, Exploring and travelling, Eulerian and Hamiltonian graphs, Applications to dominoes, Diagram tracing puzzles, Knight's tour problem, Gray codes.

[1] Chapter1(Section1.1), and Chapter2

Text Books:

1. Aldous, Joan M., & Wilson, Robin J. (2007). *Graphs and Applications: An Introductory Approach*. Springer. Indian Reprint.
2. Sharad S. Sane, *Combinatorial Techniques*, Hindustan Book Agency, 2013.

Reference Books:

1. Michael Towusend, *Discrete Mathematics; Applied Combinatorics and Graph Theory*, Benjamin-Cummings Pub Co (March 1, 1987)
2. K.R. Parthasarathi, *Basic Graph Theory*, Tata McGraw-Hill, 1994.
3. C.L. Liu and D. Mohapatra *Elements of discrete mathematics*, McGraw Hill, Computer Science Series. 2017

GENERIC ELECTIVE PAPERS**MAT-HG-3016/MAT-RC-3016: Differential Equations**

Total Marks: 100 (Theory: 80, Internal Assessment: 20)

Per week: 5 Lectures, 1 Tutorial, Credits: 6, *Each unit carry equal credit*

Course Objectives: The main objective of this course is to introduce the students to the exciting world of ordinary differential equations, mathematical modeling and their applications.

Course Learning Outcomes: The course will enable the students to:

- i) Learn basics of differential equations and mathematical modelling.
- ii) Solve first order non-linear differential equations and linear differential equations of higher order using various techniques.

Unit 1: First Order Ordinary Differential Equations

First order exact differential equations, integrating factors, Rules to find an integrating factor

[1] Chapter 1 (Section 1.1, 1.2, 1.4),

[2] [2] Chapter 1 (Sections 1.1, and 1.2) Chapter 2 (Sections 2.1, and 2.2)

Linear equations and Bernoulli equations, Orthogonal trajectories and oblique trajectories; Basic theory of higher order linear differential equations, Wronskian, and its properties; Solving differential equation by reducing its order.

[3] Chapter 2 (Sections 2.3, and 2.4), Chapter 3 (Section 3.1), and Chapter 4 (Section 4.1)

Unit 2: Second Order Linear Differential Equations

Linear homogenous equations with constant coefficients, Linear non-homogenous equations, The method of variation of parameters, The Cauchy-Euler equation; Simultaneous differential equations.

[1] Chapter 2 (Section 2.2), [2] Chapter 4 (Sections 4.2, 4.3, 4.4, 4.5, 4.6) Chapter 7 (Sections 7.1, 7.3)

Text Books:

1. Kreyszig, Erwin (2011). *Advanced Engineering Mathematics* (10th ed.). John Wiley & Sons, Inc. Wiley India Edition 2015.
2. Ross, Shepley L. (1984). *Differential Equations* (3rd ed.). John Wiley & Sons, Inc

MAT-HG-3026: Linear Programming

Total Marks: 100 (Theory: 80 Internal Assessment: 20)

Per week: 5 Lectures, 1 Tutorial Credits: 6, *Each unit carry equal credit*

Course Objectives: This course develops the ideas underlying the Simplex method. The course covers Linear programming problems with applications to transportation, assignment and game problem. Such problems arise

in manufacturing resource planning and financial sectors.

Course Learning Outcomes: This course will enable the students to:

- i) Learn about the graphical solution of linear programming problem with two variables.
- ii) Learn about the relation between basic feasible solutions and extreme points.
- iii) Understand the theory of the simplex method used to solve linear programming problems.
- iv) Learn about two-phase and big-M methods to deal with problems involving artificial variables.
- v) Learn about the relationships between the primal and dual problems.
- vi) Solve transportation and assignment problems.
- vii) Apply linear programming method to solve two-person zero-sum game problems.

Unit1: The Linear Programming Problem: Standard, Canonical and matrix forms, Graphical solution. Hyper planes, Extreme points, Convex and polyhedral sets. Basic solutions; Basic Feasible Solutions; Reduction of any feasible solution to a basic feasible solution; Correspondence between basic feasible solutions and extreme points.

[1] Chapter1(Section1.1,1.4and1.6)

[2] Chapter2(Sections2.16,2.19and2.20), Chapter 3(Sections3,2,3.4and3.10)

Unit2: Simplex Method: Optimal solution, Termination criteria for optimal solution of the Linear Programming Problem, Unique and alternate optimal solutions, Unboundedness; Simplex Algorithm and its Tableau Format; Artificial variables, Two-phase method, Big-M method.

[1] Chapter 3(Sections 3.3, 3.6,3.7 and 3.8)

Unit3: Motivation and Formulation of Dual problem; Primal-Dual relationships; Fundamental Theorem of Duality; Complimentary Slackness.

[1] Chapter 4(Sections4.1to4.3)

[1] Chapter 6(Section 6.1 and 6.2, up to Example6.4)

Unit4: Applications

Transportation Problem: Definition and formulation; Methods of finding initial basic feasible solutions; North West corner rule. Least cost method; Vogel's Approximation method; Algorithm for solving Transportation Problem.

Assignment Problem: Mathematical formulation and Hungarian method of solving.

Game Theory: Basic concept, Formulation and solution of two-person zero-sum games, Games with mixed strategies, Linear Programming method of solving a game.

[3] Chapter 5(Sections 5.1, 5.3 and 5.4)

[2] Chapter 11(Sections 11.12 and 11.13)

Text Books:

1. Bazaraa, Mokhtar S., Jarvis, John J. and Sherali, Hanif D. (2010). *Linear Programming and Network Flows* (4th ed.). John Wiley and Sons.
2. Hadley, G. (1997). *Linear Programming*. Narosa Publishing House. New Delhi.
3. Taha, Hamdy A. (2010). *Operations Research: An Introduction* (9th ed.). Pearson.

Reference Books:

1. Hillier, Frederick S. & Lieberman, Gerald J. (2015). *Introduction to Operations Research* (10th ed.). McGraw-Hill Education (India) Pvt. Ltd.
2. Thie, Paul R., & Keough, G. E. (2014). *An Introduction to Linear Programming and Game Theory*. (3rd ed.). Wiley India Pvt. Ltd.

SEMESTER-IV

MAT-HC-4016: Multivariate Calculus

Total Marks: 100 (Theory 80, Internal assessment 20)

Per week: 5 lectures 1 Tutorial, Credits 6, *Each unit carry equal credit*

(Use of Scientific calculator is allowed)

Course Objectives: To understand the extension of the studies of single variable differential and integral calculus to functions of two or more independent variables. Also, the emphasis will be on the use of Computer Algebra Systems by which these concepts may be analyzed and visualized to have a better understanding. This course will facilitate to become aware of applications of multivariable calculus tools in physics, economics, optimization, and understanding the architecture of curves and surfaces in plane and space etc.

Course Learning Outcomes: This course will enable the students to:

- i) Learn the conceptual variations when advancing in calculus from one variable to multivariable discussion.
- ii) Understand the maximization and minimization of multivariable functions subject to the given constraints on variables.
- iii) Learn about inter-relationship amongst the line integral, double and triple integral formulations.
- iv) Familiarize with Green's, Stokes' and Gauss divergence theorems

UNIT 1: Functions of several variables, Level curves and surfaces, Limits and continuity, Partial differentiation, Higher order partial derivative, Tangent planes, Total differential and differentiability, Chain rule, Directional derivatives, The gradient, Maximal and normal property of the gradient, Tangent planes and normal lines.

[1] Chapter 11 (Sections 11.1 and 11.2, 11.3 and 11.4, 11.5, 11.6)

UNIT 2: Extrema of functions of two variables, Method of Lagrange multipliers, Constrained optimization problems; Definition of vector field, Divergence and curl.

[1] Chapter 11 [Section 11.7 (up to page 605)], Section 11.8 (pages 610-614)], Chapter 13 (Section 13.1)

UNIT 3: Double integration over rectangular and nonrectangular regions, Double integrals in polar coordinates, Triple integral over a parallelepiped and solid regions, Volume by triple integrals, triple integration in cylindrical and spherical coordinates, Change of variables in double and triple integrals.

[1] Chapter 12 (Sections 12.1-12.4)

UNIT 4: Line integrals, Applications of line integrals: Mass and Work, Fundamental theorem for line integrals, Conservative vector fields, Green's theorem, Area as a line integral; Surface integrals, Stokes' theorem, The Gauss divergence theorem.

[1] Chapter 12 (Sections 12.5 and 12.6) Chapter 13 (Section 13.2, 13.3), [Sections 13.4 (pages 712 to 716), 13.5 (pages 723 to 726)]

Text book:

- [1] Strauss, Monty J., Bradley, Gerald L., & Smith, Karl J. (2007). *Calculus* (3rd ed.). Dorling Kindersley (India) Pvt. Ltd. (Pearson Education). Delhi. Indian Reprint 2011

Reference Books:

1. Marsden, J. E., Tromba, A., & Weinstein, A. (2004). *Basic Multivariable Calculus*. Springer (SIE). First Indian Reprint.
2. G.B. Thomas and R.L. Finney, *Calculus*, 9th Ed., Pearson Education, Delhi, 2005.
3. M. J. Strauss, G. L. Bradley and K. J. Smith, *Calculus* (3 Edition), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), Delhi, 2007.
4. James Stewart, *Multivariable Calculus, Concepts and Contexts*, 2nd Ed., Brooks /Cole, Thomson Learning, USA, 2001.

MAT-HC-4026: Numerical Methods (including practical)

Total marks: 100: (Theory: 60, Practical 20, Internal Assessment: 20)

Per week: 4 Lectures, 2 Practical, Credits 6(4+2), *Each unit carry equal credit*

Course Objectives: To comprehend various computational techniques to find approximate value for possible root(s) of non-algebraic equations, to find the approximate solutions of system of linear equations and ordinary differential equations.

Also, the use of Computer Algebra System (CAS) by which the numerical problems can be solved both numerically and analytically, and to enhance the problem solving skills.

Course Learning Outcomes: The course will enable the students to:

- i) Learn some numerical methods to find the zeroes of nonlinear functions of a single variable and solution of a system of linear equations, up to a certain given level of precision.
- ii) Know about methods to solve system of linear equations, such as False position method, Fixed point iteration method, Newton's method, Secant method, LU decomposition.
- iii) Interpolation techniques to compute the values for a tabulated function at points not in the table.
- iv) Applications of numerical differentiation and integration to convert differential equations into difference equations for numerical solutions.

UNIT 1: Algorithms, Convergence, Bisection method, False position method, Fixed point iteration method, Newton's method, Secant method, LU decomposition.

[1] Chapter 1 (Sections 1.1-1.2), Chapter 2 (Sections 2.1-2.5), Chapter 3 (Section 3.5, 3.8).

UNIT 2: Lagrange and Newton interpolation: linear and higher order, finite difference operators.

[1] Chapter 5 (Sections 5.1, 5.3) [2] Chapter 4 (Section 4.3).

UNIT 3: Numerical differentiation: forward difference, backward difference and central difference. Integration: trapezoidal rule, Simpson's rule, Euler's method.

[1]: Chapter 6 (Sections 6.2, 6.4), Chapter 7 (Section 7.2)

Note: Emphasis is to be laid on the algorithms of the above numerical methods.

Practical / Lab work to be performed on a computer:

Use of computer aided software (CAS), for example *Matlab/Mathematica/Maple/Maxima* etc., for developing the following Numerical programs:

- (i) Calculate the sum $1/1 + 1/2 + 1/3 + 1/4 + \dots + 1/N$.
- (ii) To find the absolute value of an integer.
- (iii) Enter 100 integers into an array and sort them in an ascending order.
- (iv) Any two of the following
 - (a) Bisection Method
 - (b) Newton Raphson Method
 - (c) Secant Method
 - (d) Regula Falsi Method
 - (v) LU decomposition Method
 - (vi) Gauss-Jacobi Method
 - (vii) SOR Method or Gauss-Seidel Method
 - (viii) Lagrange Interpolation or Newton Interpolation
 - (ix) Simpson's rule.

Note: For any of the CAS *Matlab/Mathematica/Maple/Maxima* etc., Data types-simple data types, floating data types, character data types, arithmetic operators and operator precedence, variables and constant declarations, expressions, input/output, relational operators, logical operators and logical expressions, control statements and loop statements, Arrays should be introduced to the students.

Text Books:

1. B. Bradie, *A Friendly Introduction to Numerical Analysis*, Pearson Education, India, 2007.
2. M. K. Jain, S. R. K. Iyengar and R. K. Jain, *Numerical Methods for Scientific and Engineering Computation*, New age International Publisher, India, 5th edition, 2007.

Reference Book:

1. C. F. Gerald and P. O. Wheatley, *Applied Numerical Analysis*, Pearson Education, India, 7th edition, 2008

MAT-HC-4036: Ring Theory

Total Marks: 100: (Theory 80 Internal Assessment: 20)

Per week: 5 Lectures, 1 Tutorial, Credits 6, *Each unit carry equal credit*

Course Objectives: The objective of this course is to introduce the fundamental theory of rings and their corresponding

homomorphisms. Also introduces the basic concepts of ring of polynomials and irreducibility tests for polynomials over ring of integers.

Courses Learning Outcomes: On completion of this course, the student will be able to:

- i) Appreciate the significance of unique factorization in rings and integral domains.
- ii) Learn about the fundamental concept of rings, integral domains and fields.
- iii) Know about ring homomorphisms and isomorphisms theorems of rings.
- iv) learn about the polynomial rings over commutative rings, integral domains, Euclidean domains, and UFD

UNIT 1: Definition and examples of rings, properties of rings, subrings, integral domains and fields, characteristic of a ring. Ideals, ideal generated by a subset of a ring, factor rings, operations on ideals, prime and maximal ideals. Ring homomorphisms, properties of ring homomorphisms, Isomorphism theorems I, II and III, field of quotients.

[1]: Chapter 12, Chapter 13, Chapter 14, Chapter 15.

UNIT 2: Polynomial rings over commutative rings, division algorithm and consequences, principal ideal domains, factorization of polynomials, reducibility tests, irreducibility tests, Eisenstein criterion, unique factorization in $Z[x]$. Divisibility in integral domains, irreducibles, primes, unique factorization domains, Euclidean domains.

[1]: Chapter 16, Chapter 17, Chapter 18.

Text Books:

1. Joseph A. Gallian, Contemporary Abstract Algebra, 4th Ed., Narosa Publishing House, New Delhi, 1999.

Reference Books:

1. John B. Fraleigh (2002), A First Course in Abstract Algebra, 7th Ed., Pearson.
2. M. Artin (2011), Abstract Algebra, 2nd Ed., Pearson.
3. D.A.R. Wallace (1998), Groups, Rings and Fields, Springer Verlag London Ltd.
4. G. Santhanam (2017), Algebra, Narosa Publishing House.

SKILLENHANCEMENTCOURSES

EC-2

MAT-SE-4014: R Programming

Total marks: 100 (Theory 60, Internal assessment 20, Practical 20)

Per week: 2 Lectures 2 Practical, Credits 4(2+2)

Course Objectives: The purpose of this course is to help you begin using **R**, a powerful free software program for doing statistical computing and graphics. It can be used for exploring and plotting data, as well as performing statistical tests.

Course Learning Outcomes: This course will enable the students to:

- i) Be familiar with **R** syntax and use **R** as a calculator.
- ii) Understand the concepts of objects, vectors and data types.
- iii) Know about summary commands and summary table in **R**.
- iv) Visualize distribution of data in **R** and learn about normality test.
- v) Plot various graphs and charts using **R**.

Unit 1: Getting Started with R - The Statistical Programming Language

Introducing **R**, using **R** as a calculator; Explore data and relationships in **R**; Reading and getting data into **R**: combine and scan commands, viewing named objects and removing objects from **R**, Types and structures of data items with their properties, Working with history commands, Saving work in **R**; Manipulating vectors, Data frames, Matrices and lists; Viewing objects within objects, Constructing data objects and their conversions.

[1] Chapter 14 (Sections 14.1 to 14.4), [2] Chapter 2, Chapter 3

Unit 2: Descriptive Statistics and Tabulation

Summary commands: Summary statistics for vectors, Data frames, Matrices and lists; Summary tables.

[2] Chapter 4

Unit 3: Distribution of Data

Stem and leaf plot, Histograms, Density function and its plotting, The Shapiro-Wilk test for normality, The Kolmogorov-Smirnov test.

[2] Chapter 5

Unit 4: Graphical Analysis with R

Plotting in **R**: Box-whisker plots, Scatter plots, Pairs plots, Line charts, Pie charts, Cleveland dot charts, Bar charts; Copy and save graphics to other applications.

[1] Chapter 14 (Section 14.7) [2] Chapter 7

Practical to be done in the Computer Lab using Statistical Software R:

[1] Chapter 14 (Exercises 1 to 3)

[2] Relevant exercises of Chapters 2 to 5, and 7

Note: The practical may be done on the database to be downloaded from <https://data.gov.in/>

Text books:

1. Bindner, Donald & Erickson, Martin. (2011). *A Student's Guide to the Study, Practice, and Tools of Modern Mathematics*. CRC Press, Taylor & Francis Group, LLC.
2. Gardener, M. (2012). *Beginning R: The Statistical Programming Language*, Wiley Publications.

MAT-SE-4024: LaTeX and HTML (practical)

Total marks: 100 (Theory 60, Internal assessment 20, Practical 20)

Per week: 2 Lectures 2 Practical, Credits 4(2+2)

Course Objectives: The purpose of this course is to acquaint students with the latest type setting skills, which shall enable them to prepare high quality typesetting, beamer presentation and webpages

Course Learning Outcomes: After studying this course the student will be able to:

- i) Create and typeset a LaTeX document.
- ii) Typeset a mathematical document using LaTeX.
- iii) Learn about pictures and graphics in LaTeX.
- iv) Create beamer presentations.
- v) Create web page using HTML.

Unit 1: Elements of LaTeX; Hands-on-training of LaTeX; graphics in LaTeX; PS Tricks; Beamer presentation

[1] Chapters 9,10, 11.

Unit 2: HTML, creating simple web pages, images and links, design of web pages.

[1] Chapter 9-11, 15

Practical: Six practical should be done by each student. The teacher can assign practical from the exercises from [1].

Text Book:

1. Martin J. Erickson and Donald Bindner, *A Student's Guide to the Study, Practice, and Tools of Modern Mathematics*, CRC Press, Boca Raton, FL, 2011.

Reference Book:

1. L. Lamport, *LATEX: A Document Preparation System, User's Guide and Reference Manual*. Addison-Wesley, New York, second edition, 1994.

MAT-SE-4034: Boolean Algebra

Total Marks: 100 (Theory 80 Internal Assessment 20)

Per week 3 Lectures, Tutorial 1, Credits 4, *Each unit carry equal credit*

Course Objectives: This course aims to introduce the basic ideas and properties of ordered sets, Lattices, Boolean algebra and automata theory.

Course Learning Outcomes: The course will enable the students to:

- i) learn about the order isomorphism, Hasse diagrams, building new ordered set.
- ii) learn about the algebraic structure lattices, properties of modular and distributive lattices.
- iii) get ideas about the Boolean algebra, Switching circuits and applications of switching circuits.

Unit 1: Ordered Sets

Definitions, Examples and basic properties of ordered sets, Order isomorphism, Hasse diagrams, Dual of an ordered set, Duality principle, Maximal and minimal elements, Building new ordered sets, Maps between ordered sets.

[1] Chapter 1

Unit 2: Lattices

Lattices as ordered sets, Lattices as algebraic structures, Sublattices, Products and homomorphisms; Definitions, Examples and properties of modular and distributive lattices, The M3 – N5 Theorem with applications, Complemented lattice, Relatively complemented lattice, Sectionally complemented lattice homomorphisms.

[1] Chapter 2 and 4

[2] Chapter 1

Unit 3: Boolean Algebras and Switching Circuits

Boolean Algebras, De Morgan's laws, Boolean homomorphism, Representation theorem; Boolean polynomials, Boolean polynomial functions, Disjunctive normal form and conjunctive normal form, Minimal forms of Boolean polynomial, Quinn-McCluskey method, Karnaugh diagrams, Switching circuits and applications of switching circuits.

[2] Chapter 1 (Section 2) and Chapter 2

Text Books:

1. Davey, B. A., & Priestley, H. A. (2002). *Introduction to Lattices and Order* (2nd ed.). Cambridge University press, Cambridge
2. Lidl, Rudolf and Pilz, Gunter. (2004). *Applied Abstract Algebra* (2nd ed.), Undergraduate Texts in Mathematics. Springer (SIE). Indian Reprint.

Reference Books:

1. H.R. Lewis, C.H. Papadimitriou, C. Papadimitriou, *Elements of the Theory of Computation*, 2nd Ed., Prentice-Hall, NJ, 1997.
2. Goodaire, Edgar G. and Parmenter, Michael M. (2011). *Discrete Mathematics with Graph Theory* (3rd ed.) Pearson Education (Singapore) Pvt. Ltd. Indian Reprint.

GENERIC ELECTIVE PAPERS

GENERIC ELECTIVE PAPERS

MAT-HG-4016/ MAT-RC-4016: Real Analysis

Total Marks: 100(Theory: 80 Internal Assessment: 20)

Per week: 5 Lectures, 1 Tutorial, Credits: 6, *Each unit carry equal credit*

Course Objectives: The course will develop a deep and rigorous understanding of real line \mathbb{R} and of defining terms to prove the results about convergence and divergence of sequences and series of real numbers. These concepts have wide range of applications in real life scenario.

Course Learning Outcomes: This course will enable the students to:

- i) Understand many properties of the real line \mathbb{R} , including completeness and Archimedean properties.
- ii) Learn to define sequences in terms of functions from \mathbb{R} to a subset of \mathbb{R} .
- iii) Recognize bounded, convergent, divergent, Cauchy and monotonic sequences and to calculate their limit superior, limit inferior, and the limit of a bounded sequence.
- iv) Apply the ratio, root and limit comparison tests for convergence and absolute convergence of an

infinite series of real numbers.

Unit 1: Algebraic and order properties of Real numbers, Order completeness of Real numbers, Open and closed sets, Limit of functions, Sequential criterion for limits, Algebra of limits, Properties of continuous functions, Uniform continuity.

[1] Chapter 2 (Sections 2.1 and 2.2, Sections 2.3, and 2.4) Chapter 11 (Section 11.1, Definition and Examples only) Chapter 4 (Sections 4.1 to 4.3). Chapter 5 (Sections 5.1, 5.3, 5.4.1, 5.4.3 up to Uniform Continuity theorem excluding continuous extension and approximation)

Unit 2: Sequences, Convergent and Cauchy sequences, Sub sequences, Limit superior and limit inferior of a bounded sequence, Monotonically increasing and decreasing sequences, Infinite series and their convergences, Positive term series, Absolute convergence, Comparison tests, Cauchy's nth root test, D'Alembert's ratio test, Raabe's test.

[1] Chapter 3, (Sections 3.1, 3.2, 3.3, 3.4, 3.5, 3.7), Chapter 9 [Section 9.1 (excluding grouping of series)] Sections 9.2 (Statements of related tests only)

Text Book:

1. Bartle, Robert G., & Sherbert, Donald R. (2015). *Introduction to Real Analysis* (4th ed.) Wiley India Edition.

Reference Book:

1. Ross, Kenneth A. (2013). *Elementary Analysis: The Theory of Calculus* (2nd ed.). Undergraduate Texts in Mathematics, Springer. Indian Reprint
2. Bilodeau, Gerald G., Thie, Paul R., & Keough, G. E. (2010). *An Introduction to Analysis* (2nd ed.). Jones & Bartlett India Pvt. Ltd. Student Edition. Reprinted 2015.

MAT-HG-4026: Numerical Analysis

Total Marks:100 (Theory:80 Internal Assessment:20)

Per week: 5 Lectures, 1 Tutorial, Credits: 6, *Each unit carry equal credit*

Course Objectives: To comprehend various computational techniques to find approximate value for possible root(s) of non-algebraic equations, to find the approximate solutions of system of linear equations and Quadratic equations.

Course Learning Outcomes: The course will enable the students to:

- i) Learn some numerical methods to find the zeroes of nonlinear functions of a single variable and solution of a system of linear equations, up to a certain given level of precision.
- ii) Know about methods to solve system of linear equations, such as Gauss–Jacobi, Gauss–Seidel and SOR methods.
- iii) Interpolation techniques to compute the values for a tabulated function at points not in the table.
- iv) Applications of numerical differentiation and integration to convert differential equations into difference equations for numerical solutions.

Unit 1: Gaussian elimination method (with row pivoting), Gauss-Jordan method; Iterative methods: Jacobi method, Gauss-Seidel method; Interpolation: Lagrange form, Newton form, Finite difference operators, Gregory-Newton forward and backward difference interpolations, Piecewise polynomial interpolation (Linear and Quadratic).

[2] Chapter 3 (Sections 3.1 and 3.2), Chapter 6 (Sections 6.1 and 6.2) Chapter 8 (Section 8.1 Section 8.3 (8.3.1 and 8.3.2)

[3] Chapter 3 (Sections 3.2 and 3.4) Chapter 4 (Section 4.2) Chapter 4 (Sections 4.3, and 4.4)

[1] Chapter 18 (Sections 18.1 to 18.3).

Unit 2: Numerical differentiation: First and second order derivatives; Numerical integration: Trapezoid rule, Simpson's

rule; Extrapolation methods: Richardson extrapolation, Romberg integration; Ordinary differential equation: Euler's method, Modified Euler's methods (Heun and Mid-point).

[2] Chapter 11 [Sections 11.1 (11.1.1, 11.1.2, 11.1.4) and 11.2 (11.2.1, 11.2.2, 11.2.4)]

[1] Chapter 22 (Sections 22.1, 22.2, 22.3)

Text Books:

1. Chapra, Steven C. (2018). *Applied Numerical Methods with MATLAB for Engineers and Scientists* (4th ed.). McGraw-Hill Education.
2. Fausett, Laurene V. (2009). *Applied Numerical Analysis Using MATLAB*. Pearson. India
3. Jain, M. K., Iyengar, S. R. K., & Jain R. K. (2012). *Numerical Methods for Scientific and Engineering Computation* (6th ed.). New Age International Publishers. Delhi.

SEMESTER-V

MAT-HC-5016: Complex Analysis (including practical)

Total marks: 100 (Theory: 60, Practical 20, Internal Assessment: 20)

Per week: 4 Lectures, Practical 2, Credits 6 (4+2) *Each unit carry equal credit*

Course Learning Outcomes: The completion of the course will enable the students to:

- i) Learn the significance of differentiability of complex functions leading to the understanding of Cauchy–Riemann equations.
- ii) Learn some elementary functions and evaluate the contour integrals.
- iii) Understand the role of Cauchy–Goursat theorem and the Cauchy integral formula.
- iv) Expand some simple functions as their Taylor and Laurent series, classify the nature of singularities, find residues and apply Cauchy Residue theorem to evaluate integrals.

UNIT 1: Properties of complex numbers, regions in the complex plane, functions of complex variable, mappings. Derivatives, differentiation formulas, Cauchy-Riemann equations, sufficient conditions for differentiability. Limits, Limits involving the point at infinity, continuity.

[1]: Chapter 1 (Section 11), Chapter 2 (Section 12, 13) Chapter 2 (Sections 15, 16, 17, 18, 19, 20, 21, 22)

UNIT 2: Analytic functions, examples of analytic functions, exponential function, Logarithmic function, trigonometric function, derivatives of functions, definite integrals of functions.

[1]: Chapter 2 (Sections 24, 25), Chapter 3 (Sections 29, 30, 34), Chapter 4 (Section 37, 38)

UNIT 3: Contours, Contour integrals and its examples, upper bounds for moduli of contour integrals.

[1]: Chapter 4 (Section 39, 40, 41, 43)

UNIT 4: Antiderivatives, proof of antiderivative theorem, Cauchy-Goursat theorem, Cauchy integral formula. Liouville's theorem and the fundamental theorem of algebra.

[1]: Chapter 4 (Sections 44, 45, 46, 50), Chapter 4 (Sections 51, 52, 53)

LAB WORK TO BE PERFORMED ON A COMPUTER

(MODELING OF THE FOLLOWING PROBLEMS USING MATLAB/ MATHEMATICA/ MAPLE ETC.)

1. Declaring a complex number and graphical representation. e.g. $Z_1 = 3 + 4i$, $Z_2 = 4 - 7i$
2. Program to discuss the algebra of complex numbers, e.g.,
 $Z_1 = 3 + 4i$, $Z_2 = 4 - 7i$, then find $Z_1 + Z_2$, $Z_1 - Z_2$, $Z_1 * Z_2$ and Z_1 / Z_2
3. To find conjugate, modulus and phase angle of an array of complex numbers. e.g.
 $Z = [2+ 3i, 4-2i, 6+11i, 2-5i]$
4. To compute the integral over a straight line path between the two specified end points.
e. g., $\oint \text{Sin}z \, dz$, along the contour C which is a straight line path from $-1+ i$ to $2 - i$.

5. To perform contour integration., e.g.,
 - (i) $\oint (z^2 - 2z + 1)dz$ along the Contour C given by $x = y^2 + 1; -2 \leq y \leq 2$.
 - (ii) $\oint (z^3 + 2z^2 + 1)dz$ along the contour C given by $x^2 + y^2 = 1$, which can be parameterized by $x = \cos(t), y = \sin(t)$ for $0 \leq t \leq 2\pi$.
 - (iii) parameterized by $x = \cos(t), y = \sin(t)$ for $0 \leq t \leq 2\pi$.
6. To plot the complex functions and analyze the graph. e.g.,
 - (i) $f(z) = z, iz, z^2, z^3, e^z$ and $(z^4-1)^{1/4}$, etc.
7. To perform the Taylor series expansion of a given function $f(z)$ around a given point z . The number of terms that should be used in the Taylor series expansion is given for each function. Hence plot the magnitude of the function and magnitude of its Taylor series expansion, e.g.,
 - (i) $f(z) = \exp(z)$ around $z = 0, n = 40$ and
 - (i) $f(z) = \exp(z^2)$ around $z = 0, n = 160$.
8. To determine how many terms should be used in the Taylor series expansion of a given function $f(z)$ around $z = 0$ for a specific value of z to get a percentage error of less than 5%. e.g., for $f(z) = \exp(z)$ around $z = 0$, execute and determine the number of necessary terms to get a percentage error of less than 5 % for the following values of z :
 - (i) $z = 30 + 30i$ (ii) $z = 10 + 103i$
9. To perform Laurents series expansion of a given function $f(z)$ around a given point z . e.g.,
 - (i) $f(z) = (\sin z - 1)/z^4$ around $z = 0$ (ii) $f(z) = \cot(z)/z^4$ around $z = 0$.

Text Book:

1. James Ward Brown and Ruel V. Churchill, *Complex Variables and Applications* (Eighth Edition), McGraw – Hill International Edition, 2009.

Reference Book:

1. Joseph Bak and Donald J. Newman, *Complex analysis* (2nd Edition), Undergraduate Texts in Mathematics, Springer-Verlag New York, Inc., New York, 1997.
2. M.R. Spiegel, *Complex Variables*, Schaum series, **Year**

MAT-HC-5026: Linear Algebra

Total Marks: 100: (Theory 80 Internal Assessment: 20)

Per week: 5 Lectures 1 Tutorial. Credits 6, *Each unit carry equal credit*

Course Objectives: The objective of this course is to introduce the fundamental theory of vector spaces, also emphasizes the application of techniques using the adjoint of a linear operator and their properties to least squares approximation and minimal solutions to systems of linear equations.

Course Learning Outcomes: The course will enable the students to:

- i) Learn about the concept of linear independence of vectors over a field, and the dimension of a vector space.
- ii) Basic concepts of linear transformations, dimension theorem, matrix representation of a linear transformation, and the change of coordinate matrix.
- iii) Compute the characteristic polynomial, eigenvalues, eigenvectors, and eigenspaces, as well as the geometric and the algebraic multiplicities of an eigenvalue and apply the basic diagonalization result.
- iv) Compute inner products and determine orthogonality on vector spaces, including Gram–Schmidt orthogonalization to obtain orthonormal basis.
- v) Find the adjoint, normal, unitary and orthogonal operators.

Unit 1: Vector spaces and subspaces, null space and column space of a matrix, linear transformations, kernel and range, linearly independent sets, bases, coordinate systems, dimension of a vector space, rank, change of basis.

[1]: Chapter 4 (Sections 4.1 – 4.7)

Unit 2: Eigenvectors and eigenvalues of a matrix, the characteristic equation, diagonalization, eigenvectors of a linear transformation, complex eigenvalues,

[1]: Chapter 4 (Sections 5.1 – 5.5)

Invariant subspaces and Cayley-Hamilton theorem.

[2]: Chapter 5 (Section 5.4)

Unit 3: Inner product, length, and orthogonality, orthogonal sets, orthogonal projections, the Gram–Schmidt process, inner product spaces; Diagonalization of symmetric matrices, the Spectral Theorem.

[1]: Chapter 6 (Sections 6.1 – 6.4, 6.7); Chapter 7 (Section 7.1)

Text Books:

1. David C. Lay, *Linear Algebra and its Applications* (3rd Edition), Pearson Education Asia, Indian Reprint, 2007.
2. Stephen H. Friedberg, Arnold J. Insel, Lawrence E. Spence, *Linear Algebra* (4th Edition), Prentice-Hall of India Pvt. Ltd., New Delhi, 2004.

Reference Books:

1. S. Kumaresan, *Linear Algebra- A Geometric Approach*, Prentice Hall of India, 1999.
2. Gilbert Strang, *Linear Algebra and its Applications*, Thomson, 2007.
3. Kenneth Hoffman, Ray Alden Kunze, *Linear Algebra*, 2nd Ed., Prentice-Hall of India Pvt. Ltd., 1971.
4. G. Schay, *Introduction to Linear Algebra*, Narosa, 1997.

DISCIPLINESPECIFICSELECTIVEPAPERS

DSE-1

MAT-HE-5016: Number Theory

Total Marks: 100 (Theory 80 Internal assessment 20)

Per week: 5 lectures 1 Tutorial Credits 6, *Each unit carry equal credit*

Course Objectives: In number theory there are challenging open problems which are comprehensible at undergraduate level, this course is intended to build a micro aptitude of understanding aesthetic aspect of mathematical instructions and gear young minds to ponder upon such problems.

Course Learning Outcomes: This course will enable the students to:

- i) Learn about some fascinating discoveries related to the properties of prime numbers, and some of the open problems in number theory, viz., Goldbach conjecture etc.
- ii) Know about number theoretic functions and modular arithmetic.
- iii) Solve linear, quadratic and system of linear congruence equations.

Unit 1: Linear Diophantine equation, prime counting function, statement of prime number theorem, Goldbach conjecture, linear congruences, complete set of residues, Chinese Remainder theorem, Fermat's Little theorem, Wilson's theorem.

[1] Chapter 2 (Section 2.5), [2] Chapter 2 (Section 2.2, 2.3), [3] Chapter 4 (Sections 4.2, 4.4), Chapter 5: Section 5.2

Unit 2: Number theoretic functions, sum and number of divisors, totally multiplicative functions, definition and properties of the Dirichlet product, the Mobius Inversion formula, the greatest integer function, Euler's phi function, Euler's theorem, reduced set of residues, some properties of Euler's phi-function.

[1] Chapter 6 (Sections 6.1 to 6.2, 7.2, 7.3, and 7.4)

Text Books:

1. David M. Burton, *Elementary Number Theory*, 6th Ed., Tata McGraw Hill, Indian reprint, 2007.
2. G. A. Jones and J. Mary Jones, *Elementary Number Theory*. Undergraduate Mathematics Series (SUMS). First Indian Print. 2005

Reference Books:

1. Neville Robinns, *Beginning Number Theory*, 2nd Ed., Narosa Publishing House Pvt. Ltd., Delhi, 2007.
2. K. C. Chowdhury, *A First Course in Number Theory*, Asian Books Publications 2012

MAT-HE-5026: Mechanics

Total Marks: 100: (Theory 80, Internal assessment 20)

Per week: 5 Lectures 1 Tutorial, Credits 6 (5+1) *Each unit carry equal credit*

Course Objectives: The course aims at understanding the various concepts of physical quantities and their late defects on different bodies using mathematical techniques. It emphasizes knowledge building for applying mathematics in physical world.

Course Learning Outcomes: The course will enable the students to:

- i) Know about the concepts in statics such as moments, couples, equilibrium in both two and three dimensions.
- ii) Understand the theory behind friction and center of gravity.
- iii) Know about conservation of mechanical energy and work-energy equations.
- iv) Learn about translational and rotational motion of rigid bodies.

UNIT1: Composition and resolution of forces, Parallelogram of forces, Triangle of forces, Converse of triangle of forces, Lami's Theorem, Parallel forces, Moment of a force about a point and an axis. Couple, Resultant of a system of forces. Equilibrium of coplanar forces. Friction, C.G of an arc, plane area, surface of revolution, solid of revolution.

[3] Chapter I-X

UNIT 2: Velocities and acceleration along radial and transverse directions and along tangential and normal directions, motion in a straight line under variable acceleration, simple harmonic motion and elastic string. Newton's law of motion. Work, Energy and momentum, Conservative forces-Potential energy, Impulsive forces, Motion in resisting medium.

[1] Chapter I Sections 1.1, 1.2,1.3, Chapter –2 Sections 2.1,2.2, Chapter 3 Sections 3.1.3.2, Chapter 4 Sections 4.1, Chapter 5 Sections 5.1, 5.3, Chapter 6 Sections6.1,6.3.

[2]Chapter3(Sections:3.1,3.2,3.3,3.4).

Text Book:

1. S.L. Loney, An elementary treatise on the dynamics of a particle and of rigid bodies, Surjeet publications
2. F. Chorlton, Textbook of Dynamics, CBS, Publications 2nd Edition,1985
3. B.C. Das & B. N. Mukherjee, Statics, U. N. Dhur & Sons Pvt. Ltd.

Reference books:

1. M.R. Spiegel, Theoretical Mechanics, Schaum Series 2010.

MAT-HE-5036: Probability and Statistics

Total Marks: 100 (Theory: 80, Internal Assessment: 20)

Per week: 5 Lectures, 1 Tutorial, **Credits 6**, *Each unit carry equal credit*

Course Objectives: To make the students familiar with the basic statistical concepts and tools which are needed to study situations involving uncertainty or randomness. The course intends to render the students to several examples and exercises that blend their everyday experiences with their scientific interests.

Course Learning Outcomes: This course will enable the students to:

- i) Learn about probability density and moment generating functions.
- ii) Know about various univariate distributions such as Bernoulli, Binomial, Poisson, gamma and exponential distributions.
- iii) Learn about distributions to study the joint behavior of two random variables.
- iv) Measure the scale of association between two variables, and to establish a formulation helping to predict one variable in terms of the other, i.e., correlation and linear regression.
- v) Understand central limit theorem, which helps to understand the remarkable fact that: the empirical frequencies of so many natural populations, exhibit a bell-shaped curve, i.e., a normal distribution

UNIT-1: Sample space, Probability set function, Real random variables - Discrete and continuous, Cumulative distribution

function, Probability mass/density functions, Transformations, Mathematical expectation, Moments, Moment generating function, Characteristic function.

[1] Chapter 1 (Sections 1.1, 1.3, 1.5, 1.6 to 1.9)

UNIT-2: Discrete distributions: Uniform, Bernoulli, Binomial, Negative binomial, Geometric and Poisson; Continuous distributions: Uniform, Gamma, Exponential, Chi-square, Beta and normal; Normal approximation to the binomial distribution.

[1] Chapter 5 (Sections 5.2 to 5.4, Sections 5.5, and 5.7)

[2] Chapter 6 (Sections 6.2 to 6.4, Sections 6.5, and 6.6)

UNIT-3: Joint cumulative distribution function and its properties, Joint probability density function, Marginal distributions, Expectation of function of two random variables, Joint moment generating function, Conditional distributions and expectations.

[1] Chapter 2 (Sections 2.1, and 2.3)

UNIT-4: The Correlation coefficient, Covariance, Calculation of covariance from joint moment generating function, Independent random variables, Linear regression for two variables, The method of least squares, Bivariate normal distribution, Chebyshev's theorem, Strong law of large numbers, Central limit theorem and weak law of large numbers.

[1] Chapter 2 (Section 2.4, and Section 2.5), [2] Chapter 14 (Sections 14.1 to 14.3)

[2] Chapter 6 (Section 6.7), and Chapter 4 (Section 4.4), [3] Chapter 2 (Section 2.8, and Exercise 76, page 89)

Text Books:

1. Hogg, Robert V., McKean, Joseph W., & Craig, Allen T. (2013). *Introduction to Mathematical Statistics* (7th ed.). Pearson Education, Inc.
2. Miller, Irwin & Miller, Marylees. (2014). John E. Freund's *Mathematical Statistics with Applications* (8th ed.). Pearson. Dorling Kindersley (India).
3. Ross, Sheldon M. (2014). *Introduction to Probability Models* (11th ed.). Elsevier Inc.

Reference Books:

1. Mood, A. M., Graybill, F. A. & Boes, D. C. (1974). *Introduction to the Theory of Statistics* (3rd ed.). McGraw-Hill Education Pvt. Ltd. Indian Edition (2017)

DSE-2

MAT-HE-5046: Linear Programming

Total Marks: 100 (Theory: 80 Internal Assessment: 20)

Per week: 5 Lectures, 1 Tutorial Credits: 6, *Each unit carry equal credit*

Course Objectives: This course develops the ideas underlying the Simplex Method for Linear Programming Problem, as an important branch of Operations Research. The course covers Linear programming with applications to transportation, assignment and game problem. Such problems arise in manufacturing resource planning and financial sectors.

Course Learning Outcomes: This course will enable the students to:

- i) Learn about the graphical solution of linear programming problem with two variables.
- ii) Learn about the relation between basic feasible solutions and extreme points.
- iii) Understand the theory of the simplex method used to solve linear programming problems.
- iv) Learn about two-phase and big-M methods to deal with problems involving artificial variables.
- v) Learn about the relationships between the primal and dual problems.
- vi) Solve transportation and assignment problems.
- vii) Apply linear programming method to solve two-person zero-sum game problems.

Unit 1: The Linear Programming Problem: Standard, Canonical and matrix forms, Graphical solution. Hyperplanes, Extreme points, Convex and polyhedral sets. Basic solutions; Basic Feasible Solutions; Reduction of any feasible solution to a basic feasible solution; Correspondence between basic feasible solutions and extreme points.

[1] Chapter 1 (Section 1.1, 1.4, and 1.6)

[2] Chapter 2 (Sections 2.16, 2.19, and 2.20), and Chapter 3 (Sections 3.2, 3.4, and 3.10)

Unit 2: Simplex Method: Optimal solution, Termination criteria for optimal solution of the Linear Programming Problem, Unique and alternate optimal solutions, Unboundedness; Simplex Algorithm and its Tableau Format; Artificial variables, Two-phase method, Big-M method.

[1] Chapter 3 (Sections 3.3, and 3.6, 3.7, and 3.8)

Unit 3: Motivation and Formulation of Dual problem; Primal-Dual relationships; Fundamental Theorem of Duality; Complimentary Slackness.

[1] Chapter 4 (Sections 4.1 to 4.3)

[1] Chapter 6 (Section 6.1, and 6.2, up to Example 6.4)

Unit 4: Applications *Transportation Problem:* Definition and formulation; Methods of finding initial basic feasible solutions; North West corner rule. Least cost method; Vogel's Approximation method; Algorithm for solving Transportation Problem.

Assignment Problem: Mathematical formulation and Hungarian method of solving.

Game Theory: Basic concept, Formulation and solution of two-person zero-sum games, Games with mixed strategies, Linear Programming method of solving a game.

[3] Chapter 5 (Sections 5.1, 5.3, and 5.4)

[2] Chapter 11 (Sections 11.12, and 11.13)

Text Books:

1. Bazaraa, Mokhtar S., Jarvis, John J. and Sherali, Hanif D. (2010). *Linear Programming and Network Flows* (4th ed.). John Wiley and Sons.
2. Hadley, G. (1997). *Linear Programming*. Narosa Publishing House. New Delhi.
3. Taha, Hamdy A. (2010). *Operations Research: An Introduction* (9th ed.). Pearson.

Reference Books:

1. Hillier, Frederick S. & Lieberman, Gerald J. (2015). *Introduction to Operations Research* (10th ed.). McGraw-Hill Education (India) Pvt. Ltd.
2. Thie, Paul R., & Keough, G. E. (2014). *An Introduction to Linear Programming and Game Theory*. (3rd ed.). Wiley India Pvt. Ltd.

MAT-HE-5056: Spherical Trigonometry and Astronomy

Total Marks:100 (Theory 80, Internal Assessment 20)

Per week: 5 Lecture Tutorial 1, *Each unit carry equal credit*

Course Objectives: This main objective of this course is to provide the spherical triangles, Napier's rule of circular parts and Planetary motion

Course Learning Outcomes: This course will enable the students to:

- i) Learn about the properties of spherical and polar triangles
- ii) Know about fundamental formulae of spherical triangles
- iii) Learn about the celestial sphere, circumpolar star, rate of change of zenith distance and azimuth
- iv) Learn about Kepler's law of planetary motion, Cassini's hypothesis, differential equations or fraction

Unit1: Section of a sphere by a plane, spherical triangles, properties of spherical and polar triangles, fundamental formulae of spherical triangles, sine formula, cosine formula, sine-cosine formula, cot formula, Napier's rule of circular parts.

[1] Chapter1: Sections:1-8,16

Unit2: The standard (or geometric) celestial sphere, system of coordinates, conversion of one coordinate system to another system, diurnal motion of heavenly bodies, sidereal time, solar time(mean), rising and setting of stars, circumpolar star, dip of the horizon, rate of change of zenith distance and azimuth, examples.

[1] Chapter2Sections18,19,22,27

Unit3: Planetary motion: annual motion of the sun, planetary motion, synodic period, orbital period, Kepler's law of planetary motion, deduction of Kepler's law from Newton's law of gravitation, the equation of the orbit, velocity of a planet in its orbit, components of linear velocity perpendicular to the radius vector and to the major axis, direct and retrograde motion in a plane, laws of refraction: refraction for small zenith distance, general formula for refraction, Cassini's hypothesis, differential equation for refraction, effect of refraction on sunrise, sunset, right ascension and declination, shape of the disc of the sun.

[1] Chapter 5 Sections 57-59, 64-69, 74, 81-83

Text Book:

1. W.M. Smart and R.M. Green Spherical Astronomy. Cambridge University Press; 6 edition, 1977.

Reference Books:

1. Sir Robert Ball, Spherical Astronomy, Publisher: Forgotten Books 2018
2. Brunnow Franz, Spherical Astronomy Publisher: Biblio Life, Aug 2009.

MAT-HE-5066: Programming in C (including practical)

Total Marks: 100 (Theory 60, Practical 20, Internal Assessment 20)

Per week: 4 Lectures 2 Tutorial, Credits 6(4+2) *Each unit carry equal credit*

Course Objectives: This course introduces C programming in the idiom and context of mathematics and imparts a starting orientation using available mathematical libraries, and their applications.

Course Learning Outcomes: After completion of this paper, student will be able to:

- i) Understand and apply the programming concepts of C which is important to mathematical investigation and problem solving.
- ii) Learn about structured data-types in C and learn about applications in factorization of an integer and understanding Cartesian geometry and Pythagorean triples.
- iii) Use of containers and templates in various applications in algebra.
- iv) Use mathematical libraries for computational objectives.
- v) Represent the outputs of programs visually in terms of well formatted text and plots.
- vi) In practical students learn about the roots of a quadratic equation, solution of an equation using N-R algorithm, $\sin(x)$, $\cos(x)$ with the help of functions

Unit 1: Variables, constants, reserved words, variable declaration, initialization, basic data types, operators and expression (arithmetic, relational, logical, assignment, conditional, increment and decrement), hierarchy of operations for arithmetic operators, size of and comma operator, mixed mode operation and automatic (implicit) conversion, cast (explicit) conversion, library functions, structure of a C program, input/output functions and statements.

Unit 2: Control Statements: if-else statement (including nested if-else statement), switch statement.

Loop control Structures (for and nested for, while and do-while). Break, continue, go to statements, exit function.

Unit 3: Arrays and subscripted variables: One and Two-dimensional array declaration, accessing values in an array, initializing values in an array, sorting of numbers in an array, addition and multiplication of matrices with the help of array.

Functions: function declaration, actual and formal arguments, function prototype, calling a function by value, recursive function.

Programs for practical:

To find roots of a quadratic equation, value of a piecewise defined function (single variable), factorial of a given positive integer, Fibonacci numbers, square root of a number, cube root of a number, sum of different algebraic and trigonometric series, a given number to be prime or not, sum of the digits of any given positive integer, solution of an equation using N-R algorithm, reversing digits of an integer. Sorting of numbers in an array, to find addition, subtraction and multiplication of matrices. To find $\sin(x)$, $\cos(x)$ with the help of functions.

[1] Chapters 3, 4, 5, 6, 7 and 9

Text Book:

1. T. Jeyapoovan, A First Course in Programming with C T. Jeyapoovan, Vikash Publishing House Pvt. Ltd.

Reference books:

1. E. Balaguruswamy, Programming with C, Schaum Series.
2. Y. Kanetkar, *Let us C*, B.P. Publication.

SEMESTER-VI**MAT-HC-6016: Riemann Integration and Metric spaces**

Total Marks: 100: (Theory 80, Internal assessment 20)

Per week: 5 Lectures 1 Tutorial, Credits 6, *Each unit carry equal credit*

Course Objectives: To understand the integration of bounded functions on a closed and bounded interval and its extension to the cases where either the interval of integration is infinite, or the integrand has infinite limits at a finite number of points on the interval of integration. Up to this stage, students do study the concepts of analysis which evidently rely on the notion of distance. In this course, the objective is to develop the usual idea of distance into an abstract form on any set of objects, maintaining its inherent characteristics, and the resulting consequences.

Course Learning Outcomes: The course will enable the students to:

- i) Learn about some of the classes and properties of Riemann integrable functions, and the applications of the Fundamental theorems of integration.
- ii) Know about improper integrals including, beta and gamma functions.
- iii) Learn various natural and abstract formulations of distance on the sets of usual or unusual entities. Become aware one such formulations leading to metric spaces.
- iv) Analyse how a theory advances from a particular frame to a general frame.
- v) Appreciate the mathematical understanding of various geometrical concepts, viz. Balls or connected sets etc. in an abstract setting.
- vi) Know about Banach fixed point theorem, whose far-reaching consequences have resulted into an independent branch of study in analysis, known as fixed point theory.
- vii) Learn about the two important topological properties, namely connectedness and compactness of metric spaces.

UNIT 1: Riemann integration: upper and lower sums; Darboux integrability, properties of integral, Fundamental theorem of calculus, mean value theorems for integrals, Riemann sum and Riemann integrability, Riemann integrability of monotone and continuous functions on intervals, sum of infinite series as Riemann integrals, logarithm and exponential functions through Riemann integrals, improper integrals, Gamma functions.

[1] Chapter 6

UNIT 2: Metric spaces: definition and examples, sequences in metric spaces, Cauchy sequences, complete metric spaces. Open and closed balls, neighbourhood, open set, interior of a set. Limit point of a set, closed set, diameter of a set, Cantor's theorem. Subspaces, dense sets, separable spaces.

[2] Chapter 1, Sections: 1.1-1.4, Chapter 2, Sections: 2.1.2.2, 2.3.12-2.3.16

UNIT 3: Continuous mappings, sequential criterion and other characterizations of continuity. Uniform continuity. Homeomorphism, Contraction mappings, Banach contraction mapping principle. Connectedness, connected subsets of \mathbf{R} , connectedness and continuous mappings.

[2] Chapter 3, Sections 3.1, 3.4, 3.5, 3.7 (up to 3.7.7), Chapter 4 Sections 4.1.

Text Books:

1. Ajit Kumar and S. Kumaresan, A Basic Course in Real Analysis, CRC Press, Indian Edn. 2014.
2. Satish Shirali & Harikishan L. Vasudeva, Metric Spaces, Springer Verlag London (2006) (First Indian Reprint 2009)

Reference Books:

1. R.G. Bartle D.R. Sherbert, Introduction to Real Analysis, 3rd Ed., John Wiley and Sons (Asia) Pvt. Ltd., Singapore, 2002.

2. Charles G. Denlinger, Elements of Real Analysis, Jones & Bartlett (Student Edition), 2011.
3. S. Kumaresan, Topology of Metric Spaces, 2nd Ed., Narosa Publishing House, 2011.
4. G.F. Simmons, Introduction to Topology and Modern Analysis, McGraw-Hill, 2004.
5. Micheal O. Searcoid, Metric Spaces, Springer Publication, 2007

MAT-HC-6026: Partial Differential Equations (including practical)

Total marks: 100: (Theory: 60, Practical 20, Internal Assessment: 20)

Per week: 4 Lectures, 2 Practical, Credits 6(4+2), *Each unit carry equal credit*

Course Objectives: The main objectives of this course are to teach students to form and solve partial differential equations and use them in solving some physical problems.

Course Learning Outcomes: The course will enable the students to:

- i) Formulate, classify and transform first order PDEs into canonical form.
- ii) Learn about method of characteristics and separation of variables to solve first order PDE's.
- iii) Classify and solve second order linear PDEs.
- iv) Learn about Cauchy problem for second order PDE and homogeneous and non-homogeneous wave equations.
- v) Apply the method of separation of variables for solving many well-known second order PDEs.

Unit 1: Introduction, Classification, Construction of first order partial differential equations (PDE). Cauchy's problem for first order equations, linear equations of the first order, Integral surfaces passing through a given curve, Nonlinear partial differential equations of the first order, Cauchy's method of characteristics, Charpit's method. Solutions satisfying given conditions, Jacobi's method.

[1] Chapter 2 (Sections 2.1 to 2.3), [2] Chapter 2 (Section 3, 4,5, 7,8,10,12, 13)

Unit 2: Canonical form of first order PDE, Method of separation of variables for first order PDE.

[1] Chapter 2 (Sections 2.6 and 2.7)

Unit 3: Reduction to canonical forms, Equations with constant coefficients, General solution.

[1] Chapter 4 (Sections 4.1 to 4.5), [2] Chapter 3 (Sections 4, 5)

Practical /Lab work to be performed in a Computer Lab:

Modelling of the following similar problems using Mathematica /MATLAB/ Maple/ Maxima/ Scilab etc.

1. Solution of Cauchy problem for first order PDE.
2. Plotting the characteristics for the first order PDE.
3. Plot the integral surfaces of a given first order PDE with initial data.
4. Solution of wave equation $\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}$ for any two of the following associated conditions:
 - (a) $u(x,0) = \phi(x); u_t(x,0) = \psi(x), x \in R; t > 0$
 - (b) $u(x,0) = \phi(x); u_t(x,0) = \psi(x); u(0,t) = 0, x > 0; t > 0$
 - (c) $u(x,0) = \phi(x); u_t(x,0) = \psi(x); u_x(0,t) = 0, x > 0; t > 0$
 - (d) $u(x,0) = \phi(x); u_t(x,0) = \psi(x); u(0,t) = 0, u(l,t) = 0; x > 0; t > 0$
5. Solving systems of ordinary differential equations.
6. Solution of one-Dimensional heat equation $u_t = k u_{xx}$, for a homogeneous rod of length l .

That is - solve the IBVP:

$$\begin{aligned}
 u_t &= k u_{xx}, & 0 < x < l, & & t > 0 \\
 u(0, t) &= 0, & u(l, t) &= 0, & t \geq 0 \\
 u(0, t) &= f(x), & 0 \leq x \leq l & &
 \end{aligned}$$

Text Book:

1. Tyn Myint-U and Lokenath Debnath, *Linear Partial Differential Equation for Scientists and Engineers*, Springer, Indian reprint, 2006.
2. Sneddon, I. N. (2006). *Elements of Partial Differential Equations*, Dover Publications. Indian Reprint.

Reference Book:

1. Stavroulakis, Ioannis P & Tersian, Stepan A. (2004). *Partial Differential Equations: An Introduction with Mathematica and MAPLE* (2nd ed.). World Scientific.
2. M. D. Raisinghania, *Advanced Differential Equations*, S. Chand & Company LTD.

DISCIPLINE SPECIFIC PAPERS

DSE-3

MAT-HE-6016: Boolean Algebra and Automata Theory

Total Marks: 100 (Theory 80 Internal Assessment 20)

Per week 5 Lectures, Tutorial 1, Credits 6, *Each unit carry equal credit*

Course Objectives: This course aims to introduce the basic ideas and properties of ordered sets, Lattices, Boolean algebra and automata theory.

Course Learning Outcomes: The course will enable the students to:

- i) learn about the order isomorphism, Hasse diagrams, building new ordered set.
- ii) learn about the algebraic structure lattices, properties of modular and distributive lattices.
- iii) get ideas about the Boolean algebra, Switching circuits and applications of switching circuits.
- iv) Appreciate the theory of automata and its applications

Unit 1: Ordered Sets

Definitions, Examples and basic properties of ordered sets, Order isomorphism, Hasse diagrams, Dual of an ordered set, Duality principle, Maximal and minimal elements, Building new ordered sets, Maps between ordered sets.

[1] Chapter 1 (Sections 1.1 to 1.5 and 1.14 to 1.26, and 1.34 to 1.36), [3] Chapter 1 [Section 1 (1.1 to 1.3)]

Unit 2: Lattices

Lattices as ordered sets, Lattices as algebraic structures, Sublattices, Products and homomorphisms; Definitions, Examples and properties of modular and distributive lattices, The M3 – N5 Theorem with applications, Complemented lattice, Relatively complemented lattice, Sectionally complemented lattice homomorphisms.

[1] Chapter 2 (Sections 2.1 to 2.19) Chapter 4 (Sections 4.1 to 4.9) (Sections 4.10, and 4.11)

[3] Chapter 1 [Section 1 (1.5 to 1.20)] Chapter 1 [Section 2 (2.1 to 2.6) Chapter 1 [Section 2 (2.7 to 2.14)]

Unit 3: Boolean Algebras and Switching Circuits

Boolean Algebras, De Morgan's laws, Boolean homomorphism, Representation theorem; Boolean polynomials, Boolean polynomial functions, Disjunctive normal form and conjunctive normal form, Minimal forms of Boolean polynomial, Quinn-McCluskey method, Karnaugh diagrams, Switching circuits and applications of switching circuits.

[3] Chapter 1 (Sections 3, and 4) Chapter 1 (Section 6) Chapter 2 (Sections 7, and 8).

Unit 4: Introduction: Alphabets, strings, and languages. Finite Automata and Regular Languages: deterministic and non-deterministic finite automata, regular expressions, regular languages and their relationship with finite automata, pumping lemma and closure properties of regular languages.

[4] Chapter 1, 2,3,4

Context Free Grammars and Pushdown Automata: Context free grammars (CFG), parse trees, ambiguities in grammars and languages, pushdown automaton (PDA) and the language accepted by PDA, deterministic PDA, Non- deterministic PDA, properties of context free languages; normal forms, pumping lemma, closure properties, decision properties.

[4] Chapter 5

Text Books:

3. Davey, B. A., & Priestley, H. A. (2002). *Introduction to Lattices and Order* (2nd ed.). Cambridge University press, Cambridge
4. Goodaire, Edgar G. and Parmenter, Michael M. (2011). *Discrete Mathematics with Graph Theory* (3rd ed.). Pearson Education (Singapore) Pvt. Ltd. Indian Reprint.
5. Lidl, Rudolf and Pilz, Gunter. (2004). *Applied Abstract Algebra* (2nd ed.), Undergraduate Texts in Mathematics. Springer (SIE). Indian Reprint.
6. J.E. Hopcroft, R. Motwani and J. D. Ullman, *Introduction to Automata Theory, Languages, and Computation*, 2nd Ed., Addison-Wesley, 2001.

Reference Books:

3. H.R. Lewis, C.H. Papadimitriou, C. Papadimitriou, *Elements of the Theory of Computation*, 2nd Ed., Prentice-Hall, NJ, 1997.
4. J.A. Anderson, *Automata Theory with Modern Applications*, Cambridge University Press, 2006.

MAT-HE-6026: Bio-Mathematics

Total Marks: 100 (Theory: 80, Internal Assessment: 20)

Per week: 5 Lectures, 1 Tutorial Credits: 6, *Each unit carry equal credit*

Course Objectives: The focus of the course is on scientific study of normal functions related to living systems. It is intended to provide basic knowledge of different mathematical models and techniques for studying biomathematics in real life problems.

Course Learning outcomes: Towards the end of the course the student would be able to

- i) Learn the development, analysis and interpretation of bio-mathematical models.
- ii) Learn about the mathematics behind different bio-mathematical models
- iii) Solve basic application-oriented mathematical problems in real life situation. Students also would be able to develop problem solving skills useful in future study.

Unit 1: Discussions on some discrete models

Linear difference equations: Basic Definitions and Notation, Linear difference equations of first and second order, First-Order Linear Systems and Leslie's Age-Structured Model, Properties of the Leslie Matrix (Theorem 1.5, Example 1.17, Example 1.18).

[1] Chapter1 (1.2-1.7)

Nonlinear difference equations: Basic Definitions and Notation, Local Stability in First-order Equations, The Approximate Logistic Equation (excluding bifurcations), Stability in First- Order Systems, Jury Conditions, An Example: Epidemic Model.

[1] Chapter 2 (2.2, 2.3, 2.6, 2.8,2.9, 2.10)

Some applications of difference equations: Predator-Prey Models (excluding bifurcations), Measles Model with Vaccination.

[1] Chapter 3(3.6, 3.9)

Unit 2: Discussions on some continuous models

Linear differential equations: Basic Definitions and Notation, Linear differential equations of first and higher order, Routh-Hurwitz Criteria, First-Order Linear Systems, Phase Plane Analysis, An Example: Pharmacokinetics Model.

[1] Chapter 4(4.1-4.5,4.7-4.8, 4.10)

Nonlinear differential equations: Basic Definitions and Notation, Local Stability in First-order Equations, Application to Population Growth Models (excluding bifurcations), Phase line diagram, Local Stability in First-Order Systems, Phase Plane Analysis.

[1] Chapter5 (5.1-5.6)

Some applications of differential equations: Epidemic Models, The Simple Kermack–McKendrick Epidemic Model

[1] Chapter 6 (6.8.1)

[2] Chapter9 (9.2)

Text Books:

1. Linda J. S. Allen, Introduction to Mathematical Biology, Pearson; 1st edition (17 August 2006).
2. Jones, D. S., & Sleeman B. D. (2003). Differential Equations and Mathematical Biology, Chapman & Hall, CRC Press, London, UK.

MAT-HE-6036: Mathematical Modelling (including practical)

TotalMarks:100(Theory:60, Practical20, Internal Assessment:20)

Per week: 4 Lectures, 2 practical, Credits 6 *Each unit carry equal credits*

Course Objectives: The main objective of this course is to teach students how to model physical problem using differential equations and solve them. Also, the use of Computer Algebra Systems (CAS) by which the listed problems can be solved both numerically and analytically.

Course Learning Outcomes: The course will enable the students to:

- i) Know about power series solution of a differential equation and learn about Legendre's and Bessel's equations.
- ii) Use of Laplace transform and inverse transform for solving initial value problems.
- iii) Learn about various models such as Monte Carlo simulation models, queuing models, and linear programming models.

Unit 1: Power series solution of a differential equation about an ordinary point, solution about a regular singular point, The method of Frobenius; Legendre's and Bessel's equation.

[1] Chapter 8 (Sections 8.1 to 8.3, Section 8.5 up to Equation (19), page 551).

Unit2: Laplace transform and inverse transform, application to initial value problem up to second order.

[1] Chapter 7 (Sections 7.1 to 7.3).

Unit 3: Monte Carlo Simulation Modelling: Simulating deterministic behaviour (area under a curve, volume under a surface); Generating Random Numbers: Middle square method, Linear congruence; Queuing Models: Harbor system, Morning rush hour.

[2] Chapter 5 (Sections 5.1 to 5.2, and 5.5), Chapter 7.

Practical/Lab work to be performed in Computer Lab:

Modelling of the following problems using Mathematica/MATLAB/Maple/Maxima/Sci lab etc.

- (i) Plotting of Legendre polynomial for $n = 1$ to 5 in the interval $[0, 1]$. Verifying graphically that all the roots of $P_n(x)$ lie in the interval $[0, 1]$.
- (ii) Automatic computation of coefficients in the series solution near ordinary points.
- (iii) Plotting of the Bessel's function of first kind of order 0 to 3.
- (iv) Automating the Frobenius Series Method.

- (v) Random number generation and then use it for one of the following:
 - (a) Simulate area under a curve. (b) Simulate volume under a surface.
- (vi) Programming of either one of the queuing model:
 - (a) Single server queue (e.g. Harbor system). (b) Multiple server queue (e.g. Rush hour).
- (vii) Programming of the Simplex method for 2/3 variables

Text Books:

1. Edwards, C. Henry, Penney, David E., & Calvis, David T. (2015). *Differential Equation and Boundary Value Problems: Computing and Modeling* (5th ed.). Pearson.
2. Giordano, Frank R., Fox, William P., & Horton, Steven B. (2014). *A First Course in Mathematical Modeling* (5th ed.). Brooks/Cole, Cengage Learning.

MAT-HE-6046: Hydromechanics

Total Marks: 100: (Theory 80 Internal assessment: 20)

Per week: 5 Lectures, 1 Tutorial, Credits 6, *Each unit carry equal credit*

Course Objectives: The main objectives of this course are to teach students about fluid pressure on plane surfaces, curved surfaces and Gas law. Also introduce velocity of a fluid at a point, Eulerian and Lagrangian method, velocity potential and acceleration of a fluid at a point.

Course Learning Outcomes: The course will enable the students to:

- i) Know about Pressure equation, rotating fluids.
- ii) learn about Fluid pressure on plane surfaces, resultant pressure on curved surfaces, Gas law, mixture of gases
- iii) learn about the Eulerian and Lagrangian method.
- iv) learn about equation of continuity, examples, acceleration of a fluid at a point

Unit 1: Hydrostatics

Pressure equation, condition of equilibrium, lines of force, homogeneous and heterogeneous fluids, elastic fluids, surface of equal pressure, fluid at rest under action of gravity, rotating fluids. Fluid pressure on plane surfaces, center of pressure, resultant pressure on curved surfaces. Gas law, mixture of gases, internal energy, adiabatic expansion.

[1] Part I Chapter 1 – IV (related sections only), Chapter VI

Unit 2 Hydrodynamics

Real and ideal fluid, velocity of a fluid at a point, Eulerian and Lagrangian method, stream lines and path lines, steady and unsteady flows, velocity potential, rotational and irrotational motions, material local, convective derivatives, local and particle rate of change, equation of continuity, examples, acceleration of a fluid at a point. Equation of motion (For non-viscous fluid)

[1] Part II Chapter I, Chapter II (Sections 2.1, 2.2)

Text Book:

1. Besant, W. H., Ramsey, A. S., *A Treatise on Hydromechanics*. (part I & part II), G. Bell and Sons Limited. CBS Publication 1988 (Indian print).

Reference:

1. Raisinghania, M.D., *Fluid Dynamics*, S. Chand
2. Kar, J.M., *Hydrostatics*,

DSE-4

MAT-HE-6056: Rigid Dynamics

Total Marks 100 (Theory 80 Internal assessment 20)

Per week: 5 Lectures 1 Tutorial, Credits 6, *Each unit carry equal credit*

Course Objectives: The main objectives of this course to introduce moments and products of inertia, theorem of six constants, D'Alembert's principle, Motion of a body in two dimension and Lagrange's equations.

Course Learning Outcomes: The course will enable the students to:

- i) Know about find the moments and products of inertia.
- ii) learn about the motion of the center of inertia.
- iii) learn about the D'Alembert's principle and Lagrange's equations.
- iv) learn about motion of a body in 2-dimension.

Unit1: Moments and products of inertia, parallel axes theorem, theorem of six constants, the momental ellipsoid, equimomental systems, principle axes.

Unit2: D'Alembert's principle, the general equation of motion of a rigid body, motion of the centre of inertia and motion relative to the center of inertia.

Unit3: Motion about a fixed axis, the compound pendulum, centre of percussion. Motion of a body in two dimension under finite and impulsive forces.

Unit4: Conservation of momentum and energy, generalized coordinates, Lagrange's equations, initial motions.

[1] Chapter -11-18 (related sections only)

Text Book:

1. S.L. Loney, An elementary treatise on the Dynamics of a particle and of Rigid bodies, Cambridge University Press Kindle Edition August 2018.

Reference Book:

1. A.S. Ramsey, Dynamics Part I, Cambridge University Press; 1 edition, 1952.
2. Spiegel, M. *Theoretical Mechanics*, Schaum Series

MAT-HE-6066: Group Theory II

Total Marks: 100 (Theory: 80, Internal Assessment: 20)

Per week: 5 Lectures, 1 Tutorial, Credits: 6, *Each unit carry equal credit*

Course Objectives: The course will develop an in-depth understanding of one of the most important branch of the abstract algebra with applications to practical real-world problems. Classification of all finite abelian groups (up to isomorphism) can be done.

Course Learning Outcomes: The course shall enable students to:

- i) Learn about automorphisms for constructing new groups from the given group.
- ii) Learn about the fact that external direct product applies to data security and electric circuits.
- iii) Understand fundamental theorem of finite abelian groups.
- iv) Be familiar with group actions and conjugacy in S_n .
- v) Understand Sylow's theorems and their applications.

Unit 1: Isomorphisms, automorphisms, inner automorphisms, Automorphisms groups; External direct products of groups and their properties; the group of units modulo n as an external direct product

[1] Chapter 6 Chapter 8.

Unit 2: Normal subgroups, factor groups and their applications, Internal direct products, of subgroups, Fundamental theorem of finite Abelian groups, isomorphism classes of finite abelian groups.

[1] Chapter 9 Chapter 11 (with proof of Fundamental theorem)

Unit 3: Conjugacy classes, the class equation, Conjugacy classes in the symmetric group S_n , p -groups, The Sylow's theorems and their applications.

[1] Chapter 24, [2] Chapter 4 [Section 4.3(Pages 125-126, Ex 2-12)]

Text Books:

1. Gallian, Joseph. A. (2013). *Contemporary Abstract Algebra* (8th ed.). Cengage Learning India Private Limited. Delhi. Fourth impression, 2015.
2. Dummit, David S., & Foote, Richard M. (2016). *Abstract Algebra* (3rd ed.). Student Edition. Wiley India.

Reference Book:

1. Joseph J. Rotman, (1995). *An Introduction to The Theory of Groups* (4th ed.). Springer Verlag, New York.
2. John B. Fraleigh (2002), *A First Course in Abstract Algebra*, 7th Ed., Pearson.
3. G. Santhanam (2017), *Algebra*, Narosa Publishing House.

MAT-HE-6076: Mathematical Finance

Total Marks: 100 (Theory: 80, Internal Assessment: 20)

Per week: 5 Lectures, 1 Tutorial Credits: 6, *Each unit carry equal credit*

Course Objectives: This course is an introduction to the application of mathematics in financial world, that enables the student to understand some computational and quantitative techniques required for working in the financial markets and actuarial mathematics.

Course Learning outcomes: On completion of this course, the student will be able to:

- i) Know the basics of financial markets and derivatives including options and futures.
- ii) Learn about pricing and hedging of options, as well as interest rate swaps.
- iii) Learn about no-arbitrage pricing concept and types of options.
- iv) Learn stochastic analysis (Ito formula, Ito integration) and the Black–Scholes model.
- v) Understand the concepts of trading strategies and valuation of currency swaps.

Unit 1: Interest Rates: Types of rates, Measuring interest rates, Zero rates, Bond pricing, Forward rate, Duration, Convexity, Exchange traded markets and OTC markets, Derivatives--Forward contracts, Futures contract, Options, Types of traders, Hedging, Speculation, Arbitrage.

[1] Chapter 4 (Section 4.1 to 4.4, 4.6, 4.8, and 4.9) Chapter 1 (Sections 1.1 to 1.9)

Unit 2: Mechanics and Properties of Options: No Arbitrage principle, Short selling, Forward price for an investment asset, Types of Options, Option positions, Underlying assets, Factors affecting option prices, Bounds on option prices, Put-call parity, Early exercise, Effect of dividends.

[1] Chapter 5 (Sections 5.2 to 5.4), Chapter 8 (Sections 8.1 to 8.3), Chapter 9 (Section 9.1, Sections 9.2 to 9.7)

Unit 3: Stochastic Analysis of Stock Prices and Black-Scholes Model

Binomial option pricing model, Risk neutral valuation (for European and American options on assets following binomial tree model), Lognormal property of stock prices, Distribution of rate of return, expected return, Volatility, estimating volatility from historical data, Extension of risk neutral valuation to assets following GBM, Black-Scholes formula for European options.

[1] Chapter 11 (Sections 11.1 to 11.5) Chapter 13 (Sections 13.1 to 13.4, 13.7, and 13.8)

Unit 4: Hedging Parameters, Trading Strategies and Swaps

Hedging parameters (the Greeks: Delta, Gamma, Theta, Rho and Vega), Trading strategies involving options, Swaps, Mechanics of interest rate swaps, Comparative advantage argument, Valuation of interest rate swaps, Currency swaps, Valuation of currency swaps.

[1] Chapter 17 (Sections 17.1 to 17.9) Chapter 10 (except box spreads, calendar spreads and diagonal spreads) Chapter 7 (Sections 7.1 to 7.4, and 7.7 to 7.9)

Text Book:

1. Hull, J. C., & Basu, S. (2010). *Options, Futures and Other Derivatives* (7th ed.). Pearson Education. New Delhi.

Reference Books:

1. Luenberger, David G. (1998). *Investment Science*, Oxford University Press. Delhi.
2. Ross, Sheldon M. (2011). *An elementary Introduction to Mathematical Finance* (3rd ed.). Cambridge University Press. USA.

EDUCATION
FOR
UNDER GRADUATE CBCS COURSE (HONOURS)
(REVISED)



**(Approved by Academic Council on 8th November, 2019
effective from July, 2019)**

GAUHATI UNIVERSITY
GUWAHATI

Course Structure of B.A. Education (Honours) under CBCS

Gauhati University, Guwahati

It aims to develop a holistic and multidimensional understanding of the topics. It attempts to approach new areas of learning, develop competencies in the students thereby opening various avenues for self-discovery, academic understanding and employment.

Instruction on Teaching Method:

- The classroom transaction of all the papers will be done through Blended mode of learning. However, offline learning will be conducted through lectures, group discussions, experiential exercises, projects, presentations, workshops, seminars and hands on experiences.
- Students would be encouraged to develop an understanding of real life issues and participate in the programs and practices in the social context. To this end, practicum is incorporated as an important component in many of the papers.
- Use of ICT and mass media and web based sources is highly recommended to make the teaching learning process interactive and interesting.
- 40% of the courses will be covered by online mode of learning.

Evaluation: The mode of evaluation would be through a combination of external and internal assessment in the ratio of 80: 20 respectively. Equal weightage will be given to all the units while setting of questions papers in external examination. Along with routine examinations, classroom participations, class assignments, project work, and presentations would also be a part of the overall assessment of the student.

Semester	Core Credit- 14x6=84	AECC 2x4=8	SEC 2x4=8	DSE 4x6=24	GE 4x6=24
I	EDU-HC-1016	English/MIL communication			EDU-HG-1016
	EDU-HC-1026				
II	EDU-HC-2016	Environmental science			EDU-HG-2016
	EDU-HC-2026				
III	EDU-HC-3016		EDU-SEC-3014		EDU-HG-3016
	EDU-HC-3026				
	EDU-HC-				

	3036				
IV	EDU-HC-4016		EDU-SEC-4014		EDU-HG-4016
	EDU-HC-4026				
	EDU-HC-4036				
V	EDU-HC-5016			<i>Any one</i> EDU-HE-5016 / EDU-HE-5026	
	EDU-HC-5026			<i>Any one</i> EDU-HE-5036/ EDU-HE-5046	
VI	EDU-HC-6016			<i>Any one</i> EDU-HE-6016/ EDU-HE-6026	
	EDU-HC-6026			<i>Any one</i> EDU-HE-6036/ EDU-HE-6046	

UG CBCS Education, GU (Honours)

List of Papers

Core Papers					
Sl. No	Course code	Title of the Paper	Credit	External	Internal
1	EDU-HC-1016	Principles of Education	6	80	20
2	EDU-HC-1026	Psychological foundations of Education & laboratory practical	4+2	80	20
3	EDU-HC-2016	Philosophical and Sociological Foundations of Education	6	80	20
4	EDU-HC-2026	Development of Education in India- I	6	80	20
5	EDU-HC-3016	Development of Education in India- II	6	80	20
6	EDU-HC-3026	Educational Technology and Teaching Methods	6	80	20
7	EDU-HC-3036	Value and Peace Education	6	80	20
8	EDU-HC-4016	Great Educational Thinkers	6	80	20
9	EDU-HC-4026	Educational Statistics & Practical	4+2	80	20
10	EDU-HC-4036	Emerging Issues in Education	6	80	20
11	EDU-HC-5016	Measurement and Evaluation in Education & Laboratory Practical	4+2	80	20
12	EDU-HC-5026	Guidance and Counselling	6	80	20
13	EDU-HC-6016	Education and Development	6	80	20
14	EDU-HC-6026	Project	6	80	20
Discipline Specific Elective Papers (DSE)					

1	EDU-HE-5016/	Continuing Education/	6	80	20
2	EDU-HE-5026	Developmental Psychology			
3	EDU-HE-5036/	Human Rights Education/	6	80	20
4	EDU-HE-5046	Teacher Education in India			
5	EDU-HE-6016/	Mental Health & Hygiene/	6	80	20
6	EDU-HE-6026	Special Education			
7	EDU-HE-6036/	Educational Management/	6	80	20
8	EDU-HE-6046	Women and Society			
Generic Elective (GE)					
1	EDU-HG-1016	Foundations of Education	6	80	20
2	EDU-HG-2016	Psychology of Adolescents	6	80	20
3	EDU-HG-3016	Guidance and Counselling	6	80	20
4	EDU-HG-4016	History of Education in India	6	80	20
Skill Enhancement Course (SEC)					
1	EDU-SEC-3014	Public speaking skill	4	30	30
2	EDU-SEC-4014	Writing Bio-data and facing an Interview	4	30	30
Ability Enhancement Compulsory Course (AECC)					
1		English/MIL Communication			
2		Environmental Science			

1st SEMESTER (HONOURS)

EDU-HC-1016

PRINCIPLES OF EDUCATION

Total Marks: 100 (External: 80 and Internal: 20)

Credit-6

Course Objectives:

After completion of this course the learner will be able to:

- Acquaint the students with the sound principles of education
- Acquaint the students with the important concepts of Education, Curriculum, Democracy, Discipline and Freedom.
- Develop knowledge about different Aims of Education, various types of Curriculum, Correlation of Studies and Forms of Discipline.
- Familiarise the students with democratic idea of modern education.

Course contents

Units	Contents
Unit-1	Meaning and Concept of Education <ul style="list-style-type: none">• Meaning, nature and scope of education.• Forms of education- Formal, Informal and Non-formal education and their agencies• School and its functions, relationship between school and society.• Distance and Open Education with special reference to India.• Functions of education.
Unit-2	Aims of education <ul style="list-style-type: none">• Meaning and importance of Aims.• Determinants of aims.• Historical retrospect.• Social Vs Individual aim.• Vocational and Liberal aim• Democratic, Citizenship, Moral and Complete living as an aim of education
Unit- 3	Curriculum <ul style="list-style-type: none">• Concept and nature of Curriculum• Importance of Curriculum.• Types of Curriculum.• Principles of Curriculum Construction• Correlation of Studies—Meaning, Types and importance.• Co-curricular activities- Meaning, Types and importance.
Unit-4	Discipline and Freedom

	<ul style="list-style-type: none"> • Meaning and importance • Discipline Vs. Order • Forms of discipline • Place of reward and punishment in schools • Concept of free-discipline. • Maintenance of discipline in school.
Unit-5	<p>Democracy and Education</p> <ul style="list-style-type: none"> • Meaning of Democracy in Education • Democracy and the Education of Masses • The child in democratic education. • Role of Teachers and the Administrators in Democracy. • Methods of teaching in Democracy

Recommended Readings:

- Agarwal J.C. (2010). *Theory and Principles of Education*. Delhi: Vikash Publishing House Pvt. Ltd.
- Baruah, J. (2006). *Sikshatatta Adhyayan*. Guwahati: Lawyer's Book Stall.
- Bhatia & Bhatia (1994). *Theory and Principles of Education*. Delhi: Doaba.
- Chatterjee, S. (2012). *Principles and Practice of Modern Education*. Delhi: Books & Allied Ltd.
- Goswami, Dulumoni (2021) : Principles of Education, LBS Publications, Guwahati
- Raymont T. (1904). *Principles of Education*. London, New York & Bombay: Longmans, Green & Co.
- Ross J.S. (1945). *The Ground Work of Educational Theory*. London, Toronto, Bombay, Sydney: George G. Harrap & Co. Ltd.
- Safaya R.N. & Shaida B.D. (2010). *Modern Theory and Practice of Education*. New Delhi: Dhanpatrai Publishing Company Pvt. Ltd.

EDU-HC-1026
PSYCHOLOGICAL FOUNDATIONS OF EDUCATION
Total Marks: 100 (External: 80 and Internal: 20)
Credit-6

Course Objectives:

After completion of this course the learner will be able to:

- Make the students understand the relationship between education and psychology.
- Explain the need of educational psychology in teaching learning process.
- Describe the nature and theories of learning and role of motivation in learning.
- Understand the concept of memory, forgetting, attention and interest.
- Understand intelligence, its theories and measurement.
- Acquaint with different types of personality and the adjustment mechanism.

Course contents

Units	Contents
Unit-1	<p>Psychology and Education:</p> <ul style="list-style-type: none"> • Meaning and nature of Psychology • Relation between education and psychology • Educational Psychology-Nature,Scope,Methods— Observation,Experimentation,Case study method • Importance of Educational Psychology in teaching –learning process
Unit-2	<p>Learning and Motivation:</p> <ul style="list-style-type: none"> • Learning -Meaning and nature • Theories of learning—Connectionism, Classical conditioning, Operant conditioning and Theory of Insightful learning • Laws of learning--law of readiness, law of exercise ,law of effect • Factors affecting learning • Motivation-meaning, role in learning
Unit-3	<p>Memory, Attention and Interest:</p> <ul style="list-style-type: none"> • Memory—Meaning, nature and types • Economy in memorization • Forgetting—meaning and causes • Attention-concept,characteristics,determinants and types • Interest-Meaning, relation between Attention and Interest • Role of attention and Interest in learning

Unit-4	Intelligence, Creativity and personality <ul style="list-style-type: none"> • Intelligence-Meaning, nature and theories :Two-factor theory, Group factor theory • Creativity-concept, characteristics • Personality—meaning and nature • Theories of personality-Type and trait theory
Unit-5	Laboratory Practical Recall and Recognition, Trial and Error learning, Span of attention (The three practical will be done in Psychological laboratory, there will be 2 credits for practical class)

Recommended Readings:

- Baron,R.A. (2001). *Psychology*. New Delhi: Prentice Hall.
- Bichler,R.F. and Snowman,J. (1993). *Psychology Applied to Teaching*. Boston: Houghton Mifflin
- Chauhan,S.S. (1996). *Advanced Educational Psychology*.New Delhi: Vikash Publishing House Pvt. Ltd.
- Crow & Crow (1962).*Educational Psychology*.New Delhi: Prentice Hall.
- Guilford,J.P. (1965). *General Psychology*. New Delhi: East West Press Pvt. Ltd.
- Kuppuswamy B. (2013).*Advanced Educational Psychology*,New Delhi: Sterling Publishers Private Limited.
- Mangal, S.K.(2009). *Advanced Educational Psychology*. New Delhi: PHI Learning Private Limited.
- Saikia, L.R. (2018). *Psychological and Physiological Experiments in Education*. Guwahati.
- Skinner, Charles,(2012).*E- Educational Psychology*. New Delhi: Prentice Hall.

EDU-HG-1016
FOUNDATIONS OF EDUCATION
Total Marks: 100 (External: 80 and Internal: 20)
Credit-6

Course Objectives:

After completion of this course the learner will be able to

- Acquaint with the principles of education
- Gain knowledge about different various Forms and Aims of Education
- Understand the concept and importance of Discipline and Freedom.
- Acquire knowledge about the concept of Emotional and National Integration and International Understanding.

Course contents

Units	Content
Unit-1	<p>Concept of Education</p> <ul style="list-style-type: none"> • Meaning ,Nature and Scope of education • Forms of education- • Formal education, Informal and Non formal education- Meaning and Nature. School as an agency of formal education • Aims of education, Meaning and importance of Aims. Types of Aims- • Social Vs Individual aim. • Vocational and Liberal aim • Democratic aim of education.
Unit-2	<p>Philosophy and Education</p> <ul style="list-style-type: none"> • Philosophy: Meaning, Nature and Scope • Philosophy of Education: Meaning and Scope • Relationship between education and philosophy • Impact of philosophy on education
Unit-3	<p>Psychology and Education</p> <ul style="list-style-type: none"> • Meaning and nature of Psychology • Relation between education and psychology • Educational Psychology-Nature, Scope, Method Observation, Experimentation, Case study method • Importance of Educational Psychology in teaching –learning process
Unit-4	<p>Education for National Integration and International understanding</p> <ul style="list-style-type: none"> • Meaning and Nature of National Integration and International understanding • Role of education in development of National Integration and International understanding. • Globalization and its impact in developing International cooperation

Unit-5	<p>Sociology and Education</p> <ul style="list-style-type: none"> • Concept and methods of Sociology, Educational Sociology: Meaning, Nature, Scope and Importance, Relation between education and sociology • Social group: Meaning, Nature and Classification, Importance of Primary and Secondary Groups • Concept of socialization, Education as a socialization process
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Recommended Readings:

- Agarwal J.C. (2010). *Theory and Principles of Education*. Delhi: Vikash Publishing House Pvt. Ltd.
- Baruah, J. (2006). *Sikshatatta Adhyayan*. Guwahati: Lawyer's Book Stall.
- Bhatia & Bhatia (1994). *Theory and Principles of Education*. Delhi: Doaba.
- Chatterjee, S. (2012). *Principles and Practice of Modern Education*. Delhi: Books & Allied Ltd.
- Goswami, Dulumoni (2014). *Philosophy of Education*. Guwahati: DVS Publishers.
- Raymont T. (1904). *Principles of Education*. London, New York & Bombay: Longmans, Green & Co.
- Ross J.S. (1945). *The Ground Work of Educational Theory*. London, Toronto, Bombay, Sydney: George G. Harrap & Co. Ltd.
- Safaya R.N. & Shaida B.D. (2010). *Modern Theory and Practice of Education*. New Delhi: Dhanpatrai Publishing Company Pvt. Ltd.
- Saikia, Polee (2019) 2nd Edition. *Sociological Foundations of Education*. Guwahati: DVS Publishers.

2nd SEMESTER (HONOURS)

EDU-HC-2016

PHILOSOPHICAL AND SOCIOLOGICAL FOUNDATION OF EDUCATION

Total Marks: 100 (External: 80 and Internal: 20)

Credit-6

Course Objectives:

After completion of this course the learner will be able to:

- Know the concept of philosophy and its relationship with education.
- Understand the educational implications of different Indian schools of philosophy.
- Understand the educational implications of different Western schools of philosophy.
- Know the concept of sociology and its relationship with education.
- Develop understanding about the concept of educational sociology, social groups and socialisation.

Course contents

Units	Contents
Unit-1	Philosophy and Education <ul style="list-style-type: none">• Philosophy: Meaning, Nature and Scope• Philosophy of Education: Meaning and Scope• Relationship between education and philosophy• Impact of philosophy on education
Unit-2	Various Indian Schools of Philosophy and Education <ul style="list-style-type: none">• Vedic Philosophy: Different concepts of Vedic philosophy, Implication in education• Yoga and Philosophy: Different types, Astangika Yoga, Implication in education• Buddhist Philosophy: Four principles, Implication in education
Unit-3	Various Western Schools of Philosophy and Education <ul style="list-style-type: none">• Idealism: Meaning, Principles, Implication in education• Naturalism: Meaning, Principles, Implication in education• Pragmatism: Meaning, Principles, Implication in education
Unit-4	Sociology and Education <ul style="list-style-type: none">• Concept and methods of Sociology, Educational Sociology: Meaning, Nature, Scope and Importance, Relation between education and sociology• Social group: Meaning, Nature and Classification, Importance of Primary

	<p>and Secondary Groups</p> <ul style="list-style-type: none"> • Concept of socialization, Education as a socialisation process
Unit-5	<p>Socio-cultural Context of Education</p> <ul style="list-style-type: none"> • Social Change: Meaning, Nature and Factors • Education as an instrument of Social Change • Culture: Meaning, Nature, Cultural change and Cultural Lag • Relation between education and culture • Social Organisation: Meaning and Types • Social Disorganisation: Meaning, Causes and Remedies

Recommended Readings:

- Bhatia & Narang (2013). *Philosophical and Sociological Bases of Education*. Ludhiana: Tandon Publications.
- Brown, F. J. (1954): *Educational Sociology (2nd Edition)*. New York: Prentice Hall.
- Brubacher, John S. (1962). *Modern Philosophies of Education*. McGraw Hill: New Delhi.
- Chanda, S.S. & Sharma, R. K. (2002). *Sociology of Education*. New Delhi: Atlantic Publishers.
- Chandra S. S., R. Sharma, & Rejendra K (2002). *Philosophy of Education*. New Delhi: Atlantic Publishers.
- Goswami, Dulumoni (2013). *Philosophy of Education*. Guwahati: DVS Publishers.
- Ogburn, W.F. & Nimkoff, W.F. (1966). *A handbook of Sociology*. New Delhi: Eurasia Publishing House (Pvt.) Ltd.
- Rao, C. N. Shankar (2005). *Sociology-Principles of Sociology with an introduction to Social Thought*. New Delhi: S. Chand & Company.
- Ravi, S. S. (2015). *Philosophical and Sociological Bases of Education*. New Delhi: Prentice Hall India Pvt. Ltd.
- Saikia, Polee (2019) 2nd Edition. *Sociological Foundations of Education*. Guwahati: DVS Publishers.
- Singh, Y. K. (2007). *Philosophical Foundation of Education*. New Delhi: APH Publishing Corporation.

EDU-HC-2026
DEVELOPMENT OF EDUCATION IN INDIA-I
Total Marks: 100 (External: 80 and Internal: 20)
Credit-6

Course Objectives:

After completion of this course the learner will be able to:

- Recount the concept of Ancient Indian education system
- Describe the education system in Ancient India, particularly Vedic Education
- Examine the education system in Medieval India.
- Analyse the education system during British Period

Course contents

Units	Content
Unit-1	<p>Education in Ancient and Medieval India</p> <ul style="list-style-type: none"> • Education in Ancient India <ul style="list-style-type: none"> - The Vedic System of Education: Concept and Salient Features - Education in the <i>Arthashastra</i> of Kautilya • Education during Buddhist Period <ul style="list-style-type: none"> - General Features of Buddhist Education - Ancient Universities and Centres of Education: Taxila, Nalanda, Vikramshila, Varanasi, • Education in Medieval India <ul style="list-style-type: none"> • The Islamic System of Education <ul style="list-style-type: none"> - General Features of Muslim Education - Defects of Muslim Education
Unit-2	<p>Education in British India: The Beginning</p> <ul style="list-style-type: none"> • Indigenous Education at the Beginning of British Rule • Educational Activities of Missionaries in Assam • The East India Company's Role • The Charter Act of 1813 • The Anglicists-Orientalists Controversy • Macaulay's Minute, 1835 • Downward Filtration Theory
Unit-3	<p>Education in British India: In 19th Century</p> <ul style="list-style-type: none"> • Wood's Despatch of 1854 <ul style="list-style-type: none"> - Background of the Despatch - Recommendations - Implementation of the Despatch • Indian Education Commission-1882 <ul style="list-style-type: none"> - Appointment of Indian Education Commission

	<ul style="list-style-type: none"> - Its Terms of Reference - Major Recommendations - Criticism of the Commission
Unit-4	<p>Rise of Nationalism and its impact on education</p> <ul style="list-style-type: none"> • Indian University Commission- 1902, Major Recommendations - Lord Curzon's Education policy on Primary, Secondary and Higher Education - Government of India's Resolution on Educational Policy-1904, The University Act of 1904 • Gokhale's Bill for Compulsory Primary Education- 1910-1912 - Impact of Compulsory Primary Education Movement in Assam: Assam Elementary Education Act-1926 • Calcutta University Commission-1917, Major Recommendations
Unit-5	<p>Education in British India: A Period of Experiment</p> <ul style="list-style-type: none"> • Hartog Committee Report-1929, Major Recommendations • Basic Education-1937, Background - Wardha Education Conference-1937 - Salient Features of Basic Education - Criticism of the Basic Education • The Sargent Report- 1944

Recommended Readings:

- Aggarwal, J.C. (2004). *Landmarks in the History of the Modern Indian Education*. New Delhi: Vikas Publishing House Pvt. Ltd.
- Chaube, S. P. and Chaube, A. (2005). *Education in Ancient and Medieval India*. New Delhi: Vikas Publishing House Pvt. Ltd.
- Dash, B.N. (2014). *History of Education in India*. New Delhi: Dominant Publishers and Distributors Pvt. Ltd.
- Ghosh, Suresh C. (2007). *History of Education in India*. New Delhi: Rawat Publications.
- Thakur, A.S. and Thakur, A. (2015). *Development of Education System in India: Problems and Prospects*. Agra: Agarwal Publications.

EDU-HG-2016
PSYCHOLOGY OF ADOLESCENTS
Total Marks: 100 (External: 80 and Internal: 20)
Credit-6

Course Objectives:

After completion of this course the learner will be able to:

- Enable the students to understand the period of adolescence
- Enable the students to understand the significance of the adolescence period in human life
- Enable the students to know about various problems associated with this stage
- Enable the students to understand the development aspects of adolescence, importance of adolescence period and problems associated with this stage.

Course contents

Units	Contents
Unit-1	Introduction to adolescent psychology <ul style="list-style-type: none">• Meaning and definition of adolescence• Need and importance of studying adolescent psychology• Adolescence – age of transition• Is adolescence a period of storm and stress?
Unit-2	Physical and mental development <ul style="list-style-type: none">• Characteristics of physical development• Characteristics of mental development• Educational implications of physical and mental development
Unit-3	Social development <ul style="list-style-type: none">• Characteristics of social development• Influence of peers in social development• Factors affecting social adjustment
Unit-4	Emotional and personality development <ul style="list-style-type: none">• Characteristics of emotional development• Personality changes during adolescence• Adjustment problems of adolescence
Unit-5	Delinquency <ul style="list-style-type: none">• Meaning , Nature and types of delinquency• Causes of delinquency – biological, psychological and sociological• Role of school, family and society in preventing delinquency• Prevention and control of drug addiction

Recommended Readings:

- Chaube, S.P. (2011). *Developmental Psychology*. New Delhi: Neelkamal Publications Ltd.

- Cole, L.(1936). *Psychology of Adolescence*, New York: Rinchart and Winsten
- Goswami, G. (2008). *Child Development and Child Care*. Guwahati: Arun Prakashan.
- Hurllock, E.B. (1980). *Developmental Psychology-A Life span approach*.New Delhi: Tata McGraw Hill Publishing Com.Ltd.
- S P Chaube ,2002 , *Psychology of Adolescence*, Concept Publishing house

3rd SEMESTER (HONOURS)

EDU-HC-3016

DEVELOPMENT OF EDUCATION IN INDIA-II

Total Marks: 100 (External: 80 and Internal: 20)

Credit-6

Course Objectives:

After completion of this course the learner will be able to:

- Understand the Educational situation during the time of Independence
- Explain the recommendations and educational importance of different Education Commission and Committees in post Independent India
- Analyse the National Policy on Education in different tomes
- Accustom with the recent Educational Development in India

Course Content:

Units	Content
Unit-1	Development of Indian Education the post independence period <ul style="list-style-type: none">• Educational Provisions of the Indian Constitution and their Implementation• University Education Commission – 1948<ul style="list-style-type: none">- Appointment of University Education Commission- Aims and Recommendations of the Commission- Evaluation of the Recommendations
Unit-2	Development of Secondary Education in the Post-Independent Period <ul style="list-style-type: none">• Dr. Tara Chand Committee-1948<ul style="list-style-type: none">- Major Recommendations• Secondary Education Commission-1952-53<ul style="list-style-type: none">- Terms and Condition- Aims and Objectives of Secondary Education- Defects of Secondary Education- Recommendations of the Commission- Evaluation of the Recommendations of the Commission
Unit-3	Education Commission-1964-66 <ul style="list-style-type: none">• Reasons for appointing Education Commission• Major Recommendations of Education Commission on:<ul style="list-style-type: none">- National Objectives of Education- National Pattern of Education- National Curriculum- Text Book- Method of Teaching

	<ul style="list-style-type: none"> - Teaching Personnel and Teacher Status - Teacher Education - Guidance and Counselling - Examination and Evaluation • Critical assessment and Relevance of the recommendations in Present Education System.
Unit-4	<p>National Policies on Education in Post Independent India</p> <ul style="list-style-type: none"> • National Policy on Education-1968 • National Policy on Education-1986: Recommendations, National System of Education • Review of National Policy of Education <ul style="list-style-type: none"> - Ramamurthy Review Committee, 1990 - Janardan Reddy Committee Report, 1991 • Revised National Policy of Education-1992
Unit-5	<p>Recent Developments and programmes in Indian Education</p> <ul style="list-style-type: none"> • The National Knowledge Commission Report <ul style="list-style-type: none"> - Background and Recommendations • Report of the Committee to Advise on Renovation and Rejuvenation of Higher Education <ul style="list-style-type: none"> - Recommendations • National Curriculum Framework, 2005 • Government Programmes of Education: SSA, RMSA, RUSA • Right to Education (RTE) • Quality Control of Higher Education: NAAC- Its Objectives and Roles.

Recommended Readings

- Aggarwal, J.C. (2004). *Landmarks in the History of the Modern Indian Education*. New Delhi: Vikas Publishing House Pvt. Ltd.
- Dash, B.N. (2014). *History of Education in India*. New Delhi: Dominant Publishers and Distributors Pvt. Ltd.
- Ghosh, Suresh C. (2007). *History of Education in India*. New Delhi: Rawat Publications.
- Thakur, A.S. and Thakur, A. (2015). *Development of Education System in India: Problems and Prospects*. Agra: Agarwal Publications.

EDU-HC-3026
EDUCATIONAL TECHNOLOGY AND TEACHING METHODS
Total Marks: 100 (External: 80 and Internal: 20)
Credit-6

Course Objectives:

After completion of this course the learner will be able to:

- Make the students understand the objective of educational technology in teaching learning process
- Acquaint the students with innovations in the field of education through technology
- Make the students understand about various methods and devices of teaching
- Acquaint students with levels, effectiveness of teaching and classroom management
- Make the students understand the strategies of effective teaching as a profession.

Course contents

Units	Contents
Unit:1	Educational technology: <ul style="list-style-type: none"> • Meaning and nature of Educational technology • Components of Educational Technology- Hardware and Software and Systems Approach • Instructional Technology-Difference between Educational Technology and Instructional Technology, Programmed Instruction
Unit:2	Information and Communication Technology in teaching-learning <ul style="list-style-type: none"> • Concept, nature and components of communication technology • Marks of effective classroom communication • Barriers of effective classroom communication • Application of ICT in teaching-learning • Resources of learning- Projected and Non-projected resources, Internet, E-learning, EDUSAT, INFLIBNET and Social media
Unit:3	Models of teaching <ul style="list-style-type: none"> • Concept, nature and characteristics • Inquiry model • Personalized system of instruction • Computer Assisted Instructions(CAI), Team teaching, Collaborative teaching, Cooperative mastery learning
Unit:4	Methods and techniques of teaching <ul style="list-style-type: none"> • Teaching learning process- Meaning and Nature of teaching and learning

	<ul style="list-style-type: none"> • Criteria of good teaching • Teaching Methods- lecture method, play way method, Activity method, Discussion, Project method, problem solving method • Teaching techniques- Maxims of teaching, devices of teaching-Narration, Illustration, Questioning
Unit:5	Lesson Planning and Micro Teaching <ul style="list-style-type: none"> • Lesson plan –Its meaning and Importance • Types of Lessons- Knowledge Lesson, Skill Lesson, Appreciation Lesson • Herbartian Steps of Lesson Planning • Criteria of a good lesson plan • Micro teaching- meaning and components

Recommended Readings:

- Aggarwal J.C. (2005). *Educational Technology*. New Delhi: Vikash Publishing House Pvt. Ltd.
- Chauhan, S. S. (2008). *Innovations in Teaching-learning Process*. New Delhi: Vikash Publishing House Pvt. Ltd.
- Joshi, A. (). *Models of Teaching*. Agra: H.P. Bhargava, Book House
- Kochhar, S. K. (1996). *Methods and Techniques of Teaching*. New Delhi: Sterling Publishers Pvt. Ltd.
- Mangal, S.K. and Mangal, Verma (2009). *Essentials of Educational Technology*. New Delhi: PHI Learning Pvt. Ltd.
- Passi, B.K. (1976). *Becoming Better teacher-Micro Teaching Approach*. Ahmedabad: SahityaMudranalaya
- Sharma, R.A. (2000). *Teaching Foundation of Education*. Meerut: R. Lall Book Depot
- Siddiqui, M.H.(2008).*Models of teaching*. New Delhi: APH Publishing Corporation
- Singh, Amarjit (2006): *Classroom Management*, New Delhi: Kanishka Publishers

EDU-HC-3036
VALUE AND PEACE EDUCATION
Total Marks: 100 (External: 80 and Internal: 20)
Credit-6

Course Objectives:

After completion of this course the learner will be able to:

- Understand the concept and meaning of value.
- Become aware about the role of educational institutions in building a value based society.
- Understand the meaning and concept of peace and its importance in human life.
- Understand the meaning and importance of peace education and its relevance at national and international level.
- Identify the different issues/ challenges in imparting peace education.
- Identify the strategies and skills in promoting peace education at institutional level.

Course contents

Unit	Contents
Unit-1	<p>Value</p> <ul style="list-style-type: none"> • Concept and characteristics of value. • Sources of values • Impact of globalization on culture and values. • Importance of values in human life
Unit-2	<p>Types of values, their characteristics, functions and educational significance</p> <ul style="list-style-type: none"> • Core values. • Social values • Moral values • Religious and spiritual values. • Aesthetic values. • Personal values
Unit-3	<p>Value education</p> <ul style="list-style-type: none"> • Concept, characteristics, Objectives and Importance of value education. • Value education at different stages – <ul style="list-style-type: none"> - Primary - Secondary - Higher education. • Role of teacher and family in imparting value education.
Unit-4	<p>Peace education</p>

	<ul style="list-style-type: none"> • Meaning, definition and characteristics of peace. • Importance of peace in human life. • Teacher’s role in promoting peace. • Concept, need and characteristics of peace education • Curricular contents of peace education at different levels – Primary, Secondary and Higher Education • Strategies and skills in promoting peace education • Relevance of peace education in national and international context
Unit-5	<p>Challenges of Peace education and Role of Different Organisations</p> <ul style="list-style-type: none"> • Challenges of peace education • Role of national and international organizations for promoting peace education – <ul style="list-style-type: none"> - International Institute for Peace(IIP), - UNESCO, - International Peace Bureau (IBP), - UNO - UNICEF, - Global Peace Foundation(GPF), - Mahatma Gandhi Institute of Education for Peace and Sustainable Development.

Recommended Readings:

- Agarwal, J.C.(2005). *Education for Values, Environment and Human rights*. New Delhi: Shipra Publication.
- Chakrabarty, M. (1997).*Value education: Changing Perspective*.New Delhi:Krishna Publishers Distribution.
- Chitakra,M.G. (2007).*Education and Human Values*. New Delhi APH Publishing Corporation.
- Mishra, L (2009). *Peace education-Framework for teachers*.New Delhi: APH Publishing Corporation.
- Panda. P.K.(2017). *Value Education*.Guwahati: Nivedita Book Distributors.
- Rajput,J.S.(2002).*Human Values in School Education*. New Delhi: Anmol Publication.
- Singh,S.P. (2011).*Education for World Peace*. New Delhi: Discovery Publishing House.
- Suryanarayana.N.V.S.(2017). *Education and Human Value*.Guwahati: Nivedita Book Distributors.

EDU-HG-3016
GUIDANCE AND COUNSELLING
Total Marks: 100 (External: 80 and Internal: 20)
Credit-6

Course Objectives:

After completion of this course the learner will be able to:

- Help the students to understand the concept, need and importance of Guidance and Counselling
- Enable the students to know the different types and approaches to Guidance and Counselling
- Acquaint the students with the organization of guidance service and school guidance clinic
- Enable the learners to understand the challenges faced by the teacher as guidance worker.

Course contents

Units	Contents
Unit-1	<p>Introduction to Guidance</p> <ul style="list-style-type: none"> • Meaning, objectives and scope of guidance • Need and principles of guidance • Types of guidance and their importance : Educational guidance, Vocational guidance, Personal guidance, Social guidance, Health guidance
Unit-2	<p>Introduction to Counselling</p> <ul style="list-style-type: none"> • Meaning, objectives and scope of counselling • Need and principles of counselling • Types of counselling : Directive, Non-directive and Eclectic counselling • Relation between Guidance and Counselling
Unit-3	<p>Organization of guidance service</p> <ul style="list-style-type: none"> • Meaning of guidance service • Need and principles of organizing guidance service • Components of guidance service: counselling service, techniques of counselling service • Qualities of a good counsellor
Unit-4	<p>Guidance needs of students</p> <ul style="list-style-type: none"> • Guidance needs of students in relation to home-centred and school-centred problems • Group guidance and Group counselling

	<ul style="list-style-type: none"> • Guidance for CWSN • School Guidance Clinic
Unit-5	School guidance programme <ul style="list-style-type: none"> • Importance of guidance and counselling cells in educational institutions • Follow-up Services • Role of the Head of the institution and parents in guidance and counselling • Challenges and functions of the teacher as guidance provider/ counsellor

Recommended Readings:

- Agarwal, Rashmi(2010).*Educational, Vocational guidance and Counselling, Principles, Techniques and programmes*. New Delhi: Shipra Publication.
- Aggarwal J.C. (1989):*Educational and Vocational Guidance and Counselling*. New Delhi: Doaba House.
- Bhatia,K.K.(2009). *Principles of Guidance and Counselling*. New Delhi: Kalyani Publishers
- Kochhar,S.K. (2010).*Educational and vocational guidance in secondary schools*. New Delhi: Starling Publishers Pvt. Ltd.

EDU-SEC- 3014

PUBLIC SPEAKING SKILL

Total Marks-60 (External-30 Internal-30)

Credit – 4

Course Outcome:

After completing this course, students will be able to acquire the capacities of public speaking skill.

Course contents

a. Theory (2 Credits)

Units	Contents
Unit-1	Public Speaking and Communication Skill <ul style="list-style-type: none">• Meaning and Importance of Public Speaking• Components of Public Speaking: Illustration, Voice modulation, The Power of Pause, Visual Aids, Sense of humour, Articulation• Principles of Effective Public Speaking: Principle of Preciseness, Principle of Clarity, Principle of Completeness, Principle of Consciousness, Principle of Adaption• Ways of becoming Better Public Speaker• Concept and Nature of Communication• Types of Communication: Verbal and non-Verbal• Barriers of Communication• Ways of Effective Communication
Unit-2	Personality Development and Motivation as Means for Effective Public Speaking <ul style="list-style-type: none">• Concept and Nature of Personality• Types of Personality: Extrovert and Introvert• Role of Personality in Effective Communication• Concept of Balanced Personality• Meaning and Nature of Motivation• Ways or means of motivating audience

b. Practical (2 Credits)

Students shall prepare a write-up based on topic selected for speech.

Guidelines:

- The students will be trained on public speaking

- Teachers will give demonstrations on public speaking
- It will cover: Style of presentation, voice modulation, body language, communication with audience, eye contact
- Topics of speech will be selected by the students discussing with teachers.

Mode of Delivery:

Teachers should use lecture, demonstration and any other method as per required for explaining the contents for the students.

Evaluation Plan:

- For theory part, written examination will be conducted with 50 marks.
- Evaluation for practical examination (Public Speaking Skill+Write-up of the speech) will be done by an External Examiner.

Recommended Readings:

- Mangal, S. K. (2013). *Essentials of Educational Psychology*. Delhi: PHI Learning Private Limited.
- Manoharan, P. K. (2008). *Education and Personality Development*. New Delhi: APH Publishing Corporation.
- Morgan, Clifford T. (1993). *Introduction to Psychology*. New Delhi: Tata McGraw Hill Publishing Company Limited.
- Nikitina, Arina (2011). *Successful Public Speaking*. Arina Nikitina & bookboon.com

4th SEMESTER (HONOURS)

EDU-HC-4016

GREAT EDUCATIONAL THINKERS

Total Marks: 100 (External: 80 and Internal: 20)

Credit-6

Course Objectives:

After completion of this course the learner will be able to:

- Enable the students to learn the Philosophy of life of different Educational Thinkers and their works.
- Enable the students to learn about the views of thinkers in educational context.
- Enable the students to learn about relevance of some of their thoughts at present day context.

Course contents

Units	Topics
Unit-1	Educational Thoughts of Srimanta Sankardeva <ul style="list-style-type: none">- Brief Life Sketch and Philosophy of Life- Views of Sankardeva on Education and practices.- Educational system of Satras and Namgharas and their relevance in modern era
Unit-2	Educational Thoughts of Mahatma Gandhi and Rabindranath Tagore <ul style="list-style-type: none">• Mahatma Gandhi<ul style="list-style-type: none">- Brief Life Sketch and Philosophy of Life- Views of Gandhiji on Educational Philosophy and practices- Gandhiji's Nai Talim.• Rabindranath Tagore<ul style="list-style-type: none">- Brief Life Sketch and Philosophy of Life- Views of Tagore on Educational Philosophy and practices- Tagore's Vishvabharati
Unit-3	Educational Thoughts of A.P.J. Abdul Kalam <ul style="list-style-type: none">- Brief Life Sketch and Philosophy of Life- Views of Kalam on Educational Philosophy and practices- Kalam's Education Model for the 21st Century
Unit-4	Educational Thoughts of Rousseau and Froebel <ul style="list-style-type: none">• Jean Jacques Rousseau<ul style="list-style-type: none">- Brief Life Sketch and Philosophy of Life- Views of Rousseau on Educational Philosophy and practices

	<ul style="list-style-type: none"> - Rousseau's Negative Education • Fredric Wilhelm August Froebel - Brief Life Sketch and Philosophy of Life - Views of Froebel on Educational Philosophy and practices - Froebel's Kindergarten.
Unit-5	<p>Educational Thoughts of John Dewey and Madam Maria Montessori</p> <ul style="list-style-type: none"> • John Dewey <ul style="list-style-type: none"> - Brief Life Sketch and Philosophy of Life - Views of Dewey on Educational Philosophy and practices - Dewey's Concept of Democratic Education • Madam Maria Montessori <ul style="list-style-type: none"> - Brief Life Sketch and Philosophy of Life - Views of Montessori on Educational Philosophy and practices - Montessori's Children House.

Recommended Readings

- Abdul Kalam, A. P. J. (1998). *India 2020, A Vision for the New Millennium*. Penguin Books India Ltd.
- Bezbarua, L.(2004). *Mahapurush Sri Sankardev aru Sri Madhavdev*. Guwahati: Jyoti Prakashan.
- Dewey, John (2014). *Democracy and Education*. Akar Books.
- Goswami,Dr.Renu (1996). *A Text book on Great Educators and Educational Classics*. Guwahati: Lawyar's Book Stall.
- Narang,C.L. & Bhatia,K.K.(2013). *Philosophical and Sociological Bases of Education (Revised Edition)*. Ludhina: Tandon Publications.
- Neog, M. (1998). *Sankaradeva and his Times: Early History of the Vaisnava Faith and Movement in Assam (3rd edition)*. Guwahati: Lawyer'sBook Stall.

EDU-HC-4026
EDUCATIONAL STATISTICS AND PRACTICAL

Total Marks: 100 (External: 80 and Internal: 20)

Credit-6

Course Objectives:

After completion of this course the learner will be able to:

- Develop the basic concept of Statistics,
- Be acquainted with different statistical procedures used in Education.
- Develop the ability to represent educational data through graphs.
- Familiarize the students about the Normal Probability Curve and its applications in Education.

Course contents

Units	Topics
Unit-1	Basics of Educational Statistics <ul style="list-style-type: none">• Statistics- Meaning, Nature and Functions• Need of statistics in Education• Measures of central tendency and their uses• Mean, Median and Mode from ungrouped and grouped data• Measures of variability –Concept, Types and their uses, merits and demerits• Quartile Deviation, Average Deviation, Standard deviation-(grouped and ungrouped data-short method), Combined SD
Unit-2	Graphical presentations of data <ul style="list-style-type: none">• Usefulness of Graphical presentations of data,• Basic principle of constructing a graph,• Different types of graph –histogram, frequency polygon,• Cumulative frequency percentage curve (Ogive), Smoothed graph.
Unit-3	Co-efficient of Correlation and Percentiles <ul style="list-style-type: none">• Coefficient of correlation – Meaning and types,• Computation of, co-efficient of correlation by Rank difference method & Product-moment method and interpretation of result• Calculation of Percentile and Percentile Rank
Unit-4	Normal Probability Curve and Its Application <ul style="list-style-type: none">• Normal Probability Curve: Its Meaning, Properties and Uses

	<ul style="list-style-type: none"> • Table of Area under NPC • Applications of Normal Probability Curve • Divergence from Normality: Skewness and Kurtosis
Unit-5	Statistical Practical <ul style="list-style-type: none"> • To determine the Mean Median and Mode • Graphical Representation – Frequency Polygon, Histogram and Pie diagram

Recommended Readings:

- Garrett, H.E. (2014). *Statistics in Psychology and Education*. Mumbai: Vakils, Feffer and SimonsPvt. Ltd.
- Goswami, Marami (2012). *Measurement and Evaluation in Psychology and Education*. Hyderabad: Neel Kamal Publications Pvt. Ltd.
- Mangal, S.K. (2005). *Statistics in Psychology and Education*. New Delhi: Prentice Hall of India.
- Saha,Kaberi (2012). *Statistics in Education and Psychology*. New Delhi: Asian Books Pvt. Ltd.
- Sahu, Binod, K. (1998). *Statistics in Psychology and Education*. New Delhi: Kalyani Publishers.

EDU-HC-4036
EMERGING ISSUES IN EDUCATION
Total Marks: 100 (External=80 and Internal=20)]
Credit-6

Objectives:

After completion of this unit, students will able to-

- Make the students acquaint with major emerging issues national, state, and local
- Acquaint the students with the various issues in education that are emerging in the recent years in the higher education system
- Address the various problems and challenges of education in India at all levels.

Course contents

Units	Contents
Unit-1	<p>Social Inequality in Education and Constitutional Safeguards</p> <ul style="list-style-type: none"> • Concept of Social Inequality • Constitutional Provision for Ensuring Equality in Education • Education of Socially Disadvantaged Section: SCs, STs and Minorities , Education of people of Char area of Assam • Education for Backward Children, Child Labour, Street Children and Slum Dwellers • Gender Disparity and Rural-Urban Disparity in Education
Unit-2	<p>Liberalization, Privatization and Globalization of Education</p> <ul style="list-style-type: none"> • Liberalization: Concept and its impact on education • Privatization: Concept and its impact on education • Globalization: Concept and its impact on education • Public-private Partnership • Education as investment
Unit-3	<p>Issues related to Students</p> <ul style="list-style-type: none"> • Youth Unrest: Concept, Causes and Remedies • Campus Disturbance: Concept, Causes and Remedies • Examination Anxiety: Concept, Causes and Remedies • Issues related to Educated Unemployment.
Unit-4	<p>Environmental Education and Population Education</p> <ul style="list-style-type: none"> • Main Environmental Issues: Global Warming, Ozone Depletion and

	<p>Environmental Pollution</p> <ul style="list-style-type: none"> • Role of Environmental Education for Sustainable Development • Role of Different Stakeholders (Government and Non-Government Organisations, Women, Media) in Environmental Protection • Population Explosion: Its Causes and Consequences • Population Education for Population Control
Unit-5	<p>Multi-Cultural Education and Alternative Education</p> <ul style="list-style-type: none"> • Concept, Objectives and Need of Multi-Cultural Education • Curriculum and Instruction of Multi-Cultural Education • Issues related to Multi-Cultural Education • Concept of Alternative Education and its related Issues • Role of NIOS and Sakshar Bharat Mission in Alternative Education • Role of IGNOU and KKHSOU in Alternative Higher Education • MOOC and its related Issues.

Recommended Readings:

- Aggarwal J. C. (1997). *Development and Planning of Modern Education*. New Delhi: Vikas Publishing House Ltd.
- Chandel and Nand (2011). *Population Education*. Agra: ShriVinodPustakMandir.
- Krishnamacharyulu, V. (2005). *Environmental Education*. Hyderabad: Neelkamal Publications Pvt. Ltd.
- Mishra and Mohanty (2013). *Trends and Issues in Indian Education*. Meerut: R. Lall Book Depot.
- Taj, Haseen (2011). *Current Challenges in Education*. Hyderabad: Neelkamal Publications Pvt. Ltd.
- Tiwari, R.P. *Problems of Education in N.E. India*. Ludhiana: Tandon Publications.

EDU-HG-4016
HISTORY OF EDUCATION IN INDIA
Marks: 100 (External: 80 Internal: 20)
CREDIT: 6

Course Objectives:

After completion of this course the learner will be able to:

- Analyse the education system during British Period
- Understand the Educational situation during the time of Independence
- Explain the recommendations and educational importance of different Education Commission and Committees in post Independent India
- Analyse the National Policy on Education in different tomes
- Accustom with the recent Educational Development in India.

Course contents

Units	Content
Unit-1	<p>Education in British India</p> <ul style="list-style-type: none"> • The Beginning <ul style="list-style-type: none"> - The Charter Act of 1813 - The Anglicists-Orientalists Controversy - Macaulay’s Minute, 1835 - Downward Filtration Theory • Wood Despatch of 1854 <ul style="list-style-type: none"> - Background of the Despatch - Recommendations - Implementation of the Despatch • Indian Education Commission-1882 <ul style="list-style-type: none"> - Appointment of Indian Education Commission - Background for appointing the Commission - Major Recommendations - Criticism of the Commission
Unit-2	<p>Raise of Nationalism and its impact on Education</p> <ul style="list-style-type: none"> • Initiative of Gopalkrishna Gokhle, Gokhale’s Bill for Compulsory Primary Education- 1910-1912 • All India Educational Conference, Wardha, 1937 • Gandhiji’s Basic Education –Concept , Philosophy and Salient Features, Criticism of the Basic Education
Unit-3	<p>Development of Indian Education: Post Independence I</p> <ul style="list-style-type: none"> • University Education Commission-1948 <ul style="list-style-type: none"> - Appointment of University Education Commission

	<ul style="list-style-type: none"> - Aims of University Education - Recommendations of the Commission - Evaluation of the Recommendations • Secondary Education Commission-1952-53 <ul style="list-style-type: none"> - Appointment of Secondary Education Commission - Aims and Objectives of Secondary Education - Defects of Secondary Education - Recommendations of the Commission - Evaluation of the Recommendations of the Commission
Unit-4	Development of Indian Education: Post Independence- II <ul style="list-style-type: none"> • Education Commission-1964-66 <ul style="list-style-type: none"> - Major Recommendations and its effects on existing Indian education • National Policy of Education-1986 <ul style="list-style-type: none"> - Background - Major Recommendations - Impact on Indian Education
Unit -5	Recent Developments in Indian Education <ul style="list-style-type: none"> • The National Knowledge Commission's Report <ul style="list-style-type: none"> - Major recommendation and its implementation • National Curriculum Framework, 2005 • Government Programmes of Education: SSA, RMSA and RUSA • The Right to Education Act, 2009 and its implementation.

Recommended Readings:

- Aggarwal, J.C. (2004). *Landmarks in the History of the Modern Indian Education*. New Delhi: Vikas Publishing House Pvt. Ltd.
- Chaube, S.P. and Chaube, A. (2005). *Education in Ancient and Medieval India*. New Delhi: Vikas Publishing House Pvt. Ltd.
- Dash, B.N. (2014). *History of Education in India*. New Delhi: Dominant Publishers and Distributors Pvt. Ltd.
- Ghosh, Suresh C. (2007). *History of Education in India*. New Delhi: Rawat Publications.
- Thakur, A.S. and Thakur, A. (2015). *Development of Education System in India: Problems and Prospects*. Agra: Agarwal Publications.

EDU-SEC-4014
WRITING BIODATA AND FACING AN INTERVIEW
Total Marks-60 (External-30 Internal-30)
Credit- 4

Course Outcome:

After completing this course, students will be able to write a bio-data scientifically and will develop confidence to face different types of interview.

Course contents

a. Theory (2 Credits)

Units	Contents
Unit-1	Bio-data <ul style="list-style-type: none">• Meaning, Purpose and Types of Bio-data• Components of Bio-data• Bio-data: Do's and Donot's• Meaning of Resume and Curriculum Vitae• Differences among Bio-data, Resume and Curriculum Vitae• How to write a Good Academic Bio-data
Unit-2	Interview <ul style="list-style-type: none">• Meaning and objectives of Interview• Different types of Interview: Structured interview, Unstructured interview, Job-related interview• Characteristics of good interview• Importance of interview• Skills of facing interview

b. Practical (2 credits):

Students shall write a bio-data to face interview.

Guidelines:

- The teachers will have to guide the students in writing their Bio-data, if necessary outside experts may also be invited to train the students in writing the Bio-data.
- Teachers will guide the students to differentiate amongst Bio-data, Resume and Curriculum Vitae (CV).

- Teachers will explain the style and skill of appearing a formal interview.
- Students will practice mock interview within the classroom.

Mode of Delivery:

Teachers should use lecture, demonstration and any other method as per required for explaining the contents for the students.

Evaluation Plan:

- For theory part, written examination will be conducted with 50 marks.
- For Practical part, evaluation (Submission of Prepared Bio-data+ Facing an Interview) will be done by an External Examiner.

Recommended Readings:

- Innes, James (2009). *The CV Book-Your Definite Guide to Writing the Perfect CV*. Prentice Hall.
- Kothari, C. R. (2004). *Research Methodology: Methods and Techniques*. New Age International.
- Sidhu, Kulbir Singh (1984). *Methodology of Research in Education*. New Delhi: Sterling Publisher's Private Limited.

5th SEMESTER (HONOURS)

Instruction:

- EDU-HC-5016 and EDU-HC-5026 papers are compulsory for all the 5th semester Honours students.
- In DSE paper, students will have to select two papers from four alternatives. They can select first paper from EDU-DSE-5016/EDU-DSE-5026 alternatives. And they can select the second paper from EDU-DSE-5036/EDU-DSE-5046 alternatives.

EDU-HC-5016
MEASUREMENT AND EVALUATION IN EDUCATION & PRACTICAL
Total Marks: 100 (External: 80 and Internal: 20)
Credit-6

Course Objectives:

After completion of this course the learner will be able to:

- Enable the students to understand the concept of measurement and evaluation in education.
- Acquaint the students with the general procedure of test construction and characteristics of a good test.
- Develop an understanding of different types of educational tests and their uses.
- Acquaint the students about personality test, and aptitude tests.

Course contents

Units.	Contents
Unit-1	Measurement and Evaluation in Education <ul style="list-style-type: none">• Meaning and concept of measurement, Functions of measurement, Types of measurement, Scales of measurement• Evaluation -Its meaning, basic principles

	<ul style="list-style-type: none"> • Relationship and difference between Measurement and Evaluation • Examination and Evaluation • Formative and Summative evaluation • Role of evaluation in education
Unit-2	Test Construction <ul style="list-style-type: none"> • General procedure of Test Construction and Standardization • Item Analysis • Characteristics of a good test • Validity, Reliability, Objectivity and Norms
Unit-3	Educational Achievement Test <ul style="list-style-type: none"> • Meaning and objectives of Achievement Test • Difference between Achievement test and Intelligence Test • Construction of Educational Achievement Test • Different types of Educational Achievement Test
Unit-4	Personality Test <ul style="list-style-type: none"> • Personality Test- Meaning and Nature • Types of Personality Measurement <ul style="list-style-type: none"> - Subjective Technique (Personality Inventory or Questionnaire-MMPI) - Objective Technique (Rating Scale) - Projective Technique (Thematic Apperception Test, Ink-Blot-Test) - Situational Technique (Psycho Drama)
Unit-5	Laboratory Practical <ul style="list-style-type: none"> • Ink Blot Test • Free Association Test, Control Association Test • Personality Test for Introversion-Extroversion

Recommended Readings:

- Asthana, Bipin (2009). *Measurement and Evaluation in Psychology and Education*. Agra: Vinod Pustak Mandir
- Freeman, F.S. (1965). *Theory and Practice of Psychological Testing*. New Delhi: Oxford & IBH Publishing Co. Pvt. Ltd.
- Goswami, Marami (2012). *Measurement and Evaluation in Psychology and Education*. Hyderabad: Neel Kamal Publications Pvt. Ltd.
- Saikia, L.R. (2018). *Psychological and Physiological Experiments in Education*. Guwahati.

EDU-HC-5026
GUIDANCE AND COUNSELLING
Total Marks: 100 (External: 80 and Internal: 20)
Credit-6

Course Objectives:

After completion of this course the learner will be able to:

- Help the students to understand the concept, need and importance of Guidance and Counselling
- Enable the students to know the different types and approaches to Guidance and Counselling
- Acquaint the students with the organization of guidance service and school guidance clinic
- Enable the learners to understand the challenges faced by the teacher as guidance worker.

Course contents

Units	Contents
Unit-1	Introduction to Guidance <ul style="list-style-type: none"> • Meaning, objectives and scope of guidance • Need and principles of guidance • Types of guidance and their importance : Educational guidance, Vocational guidance, Personal guidance, Social guidance, Health guidance
Unit-2	Introduction to Counselling <ul style="list-style-type: none"> • Meaning, objectives and scope of counselling • Need and principles of counselling • Types of counselling : Directive, Non-directive and Eclectic counselling • Relation between Guidance and Counselling
Unit-3	Organization of guidance service <ul style="list-style-type: none"> • Meaning of guidance service • Need and principles of organizing guidance service • Components of guidance service: counselling service, techniques of counselling service • Qualities of a good counsellor
Unit-4	Guidance needs of students

	<ul style="list-style-type: none"> • Guidance needs of students in relation to home-centred and school-centred problems • Group guidance and Group counselling • Guidance for CWSN • School Guidance Clinic
Unit-5	School guidance programme <ul style="list-style-type: none"> • Importance of guidance and counselling cells in educational institutions • Follow-up Services • Role of the Head of the institution and parents in guidance and counselling • Challenges and functions of the teacher as guidance provider/ counsellor

Recommended Readings:

- Agarwal, Rashmi(2010).*Educational, Vocational guidance and Counselling, Principles, Techniques and programmes*. New Delhi: Shipra Publication.
- Aggarwal J.C. (1989):*Educational and Vocational Guidance and Counselling*. New Delhi: Doaba House.
- Bhatia,K.K.(2009). *Principles of Guidance and Counselling*. New Delhi: Kalyani Publishers.
- Kochhar,S.K. (2010).*Educational and vocational guidance in secondary schools*. New Delhi: Starling Publishers Pvt. Ltd.

EDU-HE-5016
CONTINUING EDUCATION
Total Marks: 100 (External: 80 and Internal: 20)
Credit-6

Course Objectives:

After completion of this course the learner will be able to:

- Know the concept, objectives, scope and significance of continuing education in the context of present scenario.
- Understand about different aspects and agencies of continuing education.
- Realize different methods and techniques as well as issues of continuing education.
- Know the meaning of open education and realise the importance of open school and open universities in continuing education.
- Understand the development of adult education in India, kinds of adult education and different problems of adult education.

Course Contents

Units	Contents
Unit-1	Continuing Education <ul style="list-style-type: none">• Continuing Education: Meaning, Nature and objectives• Functions and Scope of Continuing education• Significance of continuing education• Meaning and nature of different Aspects Continuing education: Fundamental education, Adult education, Social education & Extension education• Agencies of continuing education
Unit-2	Methodologies and Issues of Continuing Education <ul style="list-style-type: none">• Different methods of Continuing education

	<ul style="list-style-type: none"> • Strategies and devices of continuing education • Role of Mass-media in continuing education • Issues of continuing education in India
Unit-3	Open Education <ul style="list-style-type: none"> • Open Education: Meaning, Characteristics, Objectives and Types • Open School: Meaning and role of NIOS • Open University: Meaning, Characteristics, Objectives and development • Role of Open university in Continuing education
Unit-4	Adult Education <ul style="list-style-type: none"> • Meaning and Development of Adult education in India • Different kinds of adult education in India • Methods of Teaching adults • Planning adult education programmes in Assam for empowerment of rural women • Problems and Solution of Adult Education in India
Unit-5	Recent Literacy programmes in India <ul style="list-style-type: none"> • Changing concept of Literacy • National Literacy Mission 1988 • Total Literacy Campaign and Post Literacy programme • Shakshar Bharat Mission

Recommended Readings:

- Aggarwal, J. C. (2008). *Adult Education*. Delhi: Doaba House.
- Chandra, Dr. Soti Shivendra (2005). *Adult and Non-Formal Education*. Delhi: Surajeet Publications.
- Das, Dr. Lakshahira (1999). *Adult Continuing Education*. Guwahati: Amrita Prakashan.
- Goswami, Dulumoni (2009). *Literacy and Development*. Guwahati: DVS Publishers.
- Kaur & Sood (2009). *Adult and Non-Formal Education*. Ludhiana: Tandon Publishers.
- Mohanty, S. (2012). *Lifelong and Adult Education*. New Delhi: APH Publishing House.
- Talukdar, B. K. (1993). *Adult Education: Concepts & Methods*. Guwahati: Bina Library.

EDU-HE-5026
DEVELOPMENTAL PSYCHOLOGY
Total Marks: 100 (External: 80 and Internal: 20)
Credit-6

Course Objectives:

After completion of this course the learner will be able to:

- Enable the students to understand the basic concepts relating to development
- Acquaint the students about heredity and environmental factors affecting pre-natal development
- Enable the students to understand the development aspects during infancy and childhood
- Enable the students to understand the development aspects of adolescence, importance of adolescence period and problems associated with this stage.

Course contents

Units	Topics
Unit-1	Introduction to Developmental Psychology <ul style="list-style-type: none">• Meaning, definition, nature and scope of developmental psychology• Different methods of studying developmental psychology• Hereditary and other factors that affect pre-natal development• Periods of pre-natal development• Characteristics of pre-natal development• Precautionary measures to be taken in pre-natal development
Unit-2	Infancy <ul style="list-style-type: none">• Characteristics of infancy• Different developmental aspects during infancy<ul style="list-style-type: none">- Physical development- Cognitive development- Motor development

	<ul style="list-style-type: none"> - Language development - Emotional development • Conditions that affect parental attitude towards the infant • Role of family in the development of infants
Unit-3	Childhood <ul style="list-style-type: none"> • Characteristics of childhood • Developmental tasks of childhood <ul style="list-style-type: none"> - Physical development of early and late childhood - Emotional development of early and late childhood • Influence of family and school in social and personality development in childhood
Unit-4	Adolescence <ul style="list-style-type: none"> • Meaning and definition of adolescence • Need and importance of studying adolescence • Characteristics of adolescence • Developmental tasks of adolescent period • Adolescence – age of transition • Physical changes during adolescence • Intellectual development during adolescence
Unit-5	Social, Emotional and Personality Development of Adolescence <ul style="list-style-type: none"> • Social development during adolescence • Role of family, school and peers in the development of adolescence • Emotionality during adolescence • Personality development during adolescence • Adjustment problems and juvenile delinquency

Recommended Readings:

- Bee, H. and Denise Boyd (2006). *The Developing Child*. New Delhi: Pearson Education Inc. India edition
- Chaube, S. P. (2011). *Developmental Psychology*. New Delhi: Neelkamal Publications Ltd.
- Cole, L. (1936). *Psychology of Adolescence*, New York: Rinehart and Winston
- Goswami, G. (2008). *Child Development and Child Care*. Guwahati: Arun Prakashan.
- Hurllock, E. B. (1980). *Developmental Psychology-A Life span approach*. New Delhi: Tata McGraw Hill Publishing Com. Ltd.

- Hurlock, E.B. (1942). *Child Development*. New Delhi: Tata McGraw Hill Publishing Com. Ltd
- Thompson, G.G. (1969). *Child Psychology*. Bombay: The Times of India Press.

EDU-HE-5036
HUMAN RIGHTS EDUCATION
Total Marks: 100 (External: 80 and Internal: 20)
Credit-6

Course Objectives:

After completion of this course the learner will be able to:

- Explain the basic concept, nature and scope of human rights
- Describe the meaning, nature, principles, curriculum and teaching methods of human rights education at different levels of Education.
- Know the role of United Nations on human rights
- Understand enforcement mechanism in India
- Know the role of advocacy groups

Course Contents

Units	Contents
Unit-1	<p>Basic Concept of Human Rights</p> <ul style="list-style-type: none"> • Concept and Nature of Human Rights • Scope of Human Rights • Concept, objectives, principles of Human Rights Education • Needs and Significance of Human Rights Education in India. • Human Rights Education at Different levels: <ul style="list-style-type: none"> - Elementary level - Secondary level - Higher level. • Methods and Activities of Teaching Human Rights • Curriculum of Human Rights Education
Unit-2	<p>United Nations and Human rights</p> <ul style="list-style-type: none"> • Universal Declaration of Human Rights (1948) by UN

	<ul style="list-style-type: none"> • UN and Promotion and Protection of Human Rights • Human Rights and Indian Constitution • Fundamental Rights similar to the UN Human Rights in Constitution of India
Unit-3	Human Rights – Enforcement Mechanism in India <ul style="list-style-type: none"> • Human Rights Act – 1993 • Human Rights Commission – role and objectives • Judicial organs – Role of Supreme Court and High court in India • Commission of Women and Children in India
Unit-4	Role of Advocacy Groups for Promotion of Human Rights <ul style="list-style-type: none"> • Role of Global Agencies: UN, UNESCO, Vienna Declaration • Role of Government and Non-Governmental Organizations; • Role of educational institutions • Role of press and mass media
Unit-5	Human Rights and Marginalised Sections <ul style="list-style-type: none"> • Human Rights related to Racial Discrimination • Human Rights related to Religions and Religious Minorities • Human Rights related to Linguistic Minorities • Human Rights related to Communal Minorities • Human Rights related to Refugees • Human Rights related to Aged • Human Rights related Women and Children • Human Rights related to Differently Abled • Human Rights related to Transgender

Recommended Readings:

- Aggarwal, J.C.(2008). *Education in the Emerging Indian Society*. New Delhi: Shipra Publication.
- Chand, Jagdish (2007). *Education for Human Rights*.New Delhi: Anashah Publishing House.
- Mohanty, J. (2006). *Human Rights Education*. New Delhi: Deep & Deep Publications.
- Naseema, C. (2008). *Human Rights Education Theory and Practice*. New Delhi: Shipra Publications.
- Rao, Digumarti Bhaskara (2004). *Human Rights Education*. New Delhi: Discovery Publication House.
- Reddy & Others (2015).*Human Rights Education*. Hyderabad: Neelkamal Publications Pvt. Ltd

EDU-HE-5046
TEACHER EDUCATION IN INDIA
Total Marks: 100 (External: 80 and Internal: 20)
Credit-6

Course Objectives:

After completion of this course the learner will be able to:

- Explain the Concept, Scope, Aims & Objectives and Significance of teacher education
- Acquaint with the development of Teacher Education in India
- Acquaint with the different organising bodies of teacher education in India and their functions in preparation of teachers for different levels of education
- Acquaint with the innovative trends and recent issues in teacher education, and be able to critically analyse the status of teacher education in India
- Understand and conceive the qualities, responsibilities and professional ethics of teachers

Course Contents

Units	Contents
Unit-1	Conceptual Framework and Historical Perspectives of Teacher Education in India <ul style="list-style-type: none">• Teacher Education-Concept, scope and aims and objectives• Need and Significance of Teacher Education in 21st Century• Types of Teacher Education-Pre-service and In-service• Development of Teacher Education in India• Shifting focus from Teacher Training to Teacher Education
Unit-2	Teacher Education For Different Levels of Education <ul style="list-style-type: none">• Preparation of Teachers for Pre-Primary Level of education• Preparation of Teachers for Primary Level of education• Preparation of Teachers for Secondary Level of education• Preparation of Teachers for Higher Level of education
Unit-3	Structure and Organisations of Teacher Education in India <ul style="list-style-type: none">• Basic Training Centre (BTC)• District Institute for Education and Training (DIET)• State Council for Educational Research and Training (SCERT)• National Council for Educational Research and Training (NCERT)• National Council for Teacher Education (NCTE)• National University of Educational Training and Administration (NUEPA)

	<ul style="list-style-type: none"> • Regional Colleges of Education
Unit-4	<p>Status of Teacher Education in India: Trends, Issues and Challenges</p> <ul style="list-style-type: none"> • Skill and Competency based Teacher Education, Flanders Interaction Analysis, Micro Teaching and Simulated Social Skill Teaching (SSST) • National Curriculum Framework for Teacher Education (NCFTE), 2009 • NCTE Regulations, 2014 • Present problems of Teacher Education in India and their solution • Quality Assurance in Teacher Education and its challenges
Unit-5	<p>Quality, Responsibility and Professional Ethics of Teachers</p> <ul style="list-style-type: none"> • Qualities and responsibilities of a teacher • Teacher as a Facilitator, Counsellor and Practitioner-Researcher • Role expectations of Teachers in twenty first century • Professional ethics and accountability of teachers

Recommended Readings:

- Aggarwal, J.C. (2004). *Teacher and Education in a Developing Society*. New Delhi: Vikas Publishing House Pvt. Ltd.
- Bhargava, M. & Saikia, L.Rasul (2012). *Teacher in 21st Century- Challenges, Responsibilities, Creditability*. Agra: Rakhi Prakashan.
- Flanders, Ned, A. (1970). *Analysing Teacher Behaviour*. London: Wesly Publishing Company.
- Gurrey, P. (). *Education and the Training of Teachers*. London: Longmans, Green and Company.
- Mukherjee, S.N. (1968). *Education of Teachers in India, Vol.-I and II*. New Delhi: S. Chand and Company.
- Rajput, J.S. and Walia, K. (2002). *Teacher Education in India*. New Delhi: Sterling Publishers Pvt. Ltd.
- Sharma, Sashi Prabha (2004). *Teacher Education in India*. New Delhi: Vikash Publications Pvt. Ltd.

6th SEMESTER (HONOURS)

Instruction:

- EDU-HC-6016 and EDU-HC-6026 papers are compulsory for all the 5th semester Honours students.
- In DSE paper, students will have to select two papers from four alternatives. They can select first paper from EDU-DSE-6016/EDU-DSE-6026 alternatives. And they can select the second paper from EDU-DSE-6036/EDU-DSE-6046 alternatives.

EDU-HC-6016
EDUCATION AND DEVELOPMENT
Total Marks: 100 (External: 80 and Internal: 20)
Credit-6

Course Objectives:

After completion of this course the learner will be able to:

- Relation between education and development
- Educational development in the post globalization era
- Role of education in community development
- Education for human resource development
- Economic and political awareness through education

Course Contents:

Units	Contents
Unit-1	Basic Concepts of Education and Development <ul style="list-style-type: none">• Indicators of educational development• Role of education in national development• Growth and development of education in India in the post globalization era• Concept of modernization- Role of education in modernization
Unit-2	Education and Community Development <ul style="list-style-type: none">• Community: Meaning, Definition, Nature.• Relationship between School and Community.• Role of Teachers in Community Development.• Participation of Community people in Educational Institutions.• Role of Education in Community Development.

	<ul style="list-style-type: none"> • Problems of Educational Institutions in Community Development.
Unit-3	Education and Human Resource Development <ul style="list-style-type: none"> • Human Resource Development: Meaning, Definition and Characteristics. • Objectives and Need of Human Resource Development. • Factors of Human Resource Development. • Role of education in Human Resource Development. • Organisations of Human Resource Development: MHRD, UGC, NCERT, CBSE.
Unit-4	Education and Economic Development <ul style="list-style-type: none"> • Meaning of Economic Development and National Development. • Relationship between education and Economics. • Impact of Economics on Education. • Role of Education in Economic Development. • Education as an Investment.
Unit-5	Education and Developing Political Awareness <ul style="list-style-type: none"> • Education and democracy • Role of education in creating political awareness • Politics among the students • Importance of students unions

Recommended Readings:

- Krishnamacharyulu, V. (2013). *School Management and systems of education*. Hyderabad: Neelkamal Publications Pvt. Ltd.
- Latchanna & Hussein (2007). *Economics of Education*. New Delhi: Discovery Publishing House.
- Ravi, S. Samuel (2015). *Education in emerging India*. Delhi: PHI Learning Private Limited.
- Sharma, R. A. (2007). *Economics of Education*. Meerut: R. Lall Book Depot.
- Taj, Dr. Haseen (2011). *Current Challenges in Education*. Hyderabad: Neelkamal Publications Pvt. Ltd.
- Tiwari, R. P. *Problems of Education in N.E. India*. Ludhiana: Tandon Publications.

**EDU-HC-6026
PROJECT**

**Total Marks: 100 (External: 80 and Internal: 20)
Credit-6**

Course Objectives:

After completion of this course the learner will be able to:

- Explain the process of conducting a Project.
- Prepare a Project Report.

Guideline:

Each student is required to complete anyone project related to any area of the syllabus to be evaluated by Internal and External Examiners jointly through viva-voce test. The project work will be completed according to following heads:

- Title of the Project
- Introduction
- Importance of the Study
- Objectives of the Study
- Review of related literature (if any)
- Methods and Procedure
- Data Analysis and Discussion
- Conclusion

Internal Assessment (20 Marks):

Home Assignment/Group Discussion related to Project: 10 Marks

Library Works: 6 Marks

Attendance: 4 Marks

External Assessment (80 Marks):

Project Report: 60 Marks

Viva Voce: 20 Marks

EDU-HE-6016
MENTAL HEALTH AND HYGIENE
Total Marks: 100 (External: 80 and Internal: 20)
Credit-6

Course Objectives:

After completion of this course the learner will be able to:

- Acquaint with the fundamentals and development of mental health and the characteristics of a mentally healthy person.
- Understand the concept and importance of mental hygiene and its relationship with mental health.
- Acquire knowledge about the principles, factors promoting mental health and the role of home, school, and society in maintaining proper mental health.
- Learn the meaning and problem of adjustment and also the different adjustment mechanisms.
- Familiarise with the concept and issues of positive psychology, mental health of women, role of WHO and stress management.

Course Contents

Units	Content
Unit-1	Fundamentals of Mental Health <ul style="list-style-type: none"> • Mental Health – Meaning and Definitions • Scope of Mental Health • Dimensions of Mental Health • Need and importance of Mental Health • Characteristics of a mentally healthy person • History of development of Mental Health
Unit-2	Mental Hygiene – Meaning and Definitions <ul style="list-style-type: none"> • Mental Hygiene – Meaning and Definitions • Goals of Mental Hygiene • Functions of Mental Hygiene • Need and importance of Mental hygiene • Relationship between Mental health and hygiene
Unit-3	Education and Mental Health <ul style="list-style-type: none"> • Principles of sound Mental Health • Factors affecting Mental Health • Mental Health Hazards • Mental Health of Students -Role of Home

	<ul style="list-style-type: none"> -Role of School -Role of Society • Mental Health of Teachers
Unit-4	Preservation of Mental Health and Hygiene <ul style="list-style-type: none"> • Positive Psychology – Meaning and Nature • Importance of Positive Psychology • Contribution of WHO on Mental Health • Stress management • Mental Health Care Act, 2017
Unit-5	Mental Health and Yoga <ul style="list-style-type: none"> • Concept of Yoga • Importance of Yoga for Physical and Mental Health • Role of Yoga for Personality Development • Role of Yoga for management of Stress • Principles of Yoga for Healthy Living • Pranayama and Meditation for Promoting Mental Health

Recommended Readings:

- Baumgardner, S. And Crother, M. (2009). *Positive Psychology*. New Delhi: Pearson India Education Services Pvt. Ltd.
- Chauhan, S.S. (2007). *Advanced Educational Psychology*. New Delhi: Vikas Publishing House Pvt. Ltd.
- Crow, L.D. and Crow, A. (1951). *Mental Hygiene*. New York: McGraw Hill
- Gururani, G.D. (2006). *Textbook on Mental Health and Hygiene*. New Delhi: Akansha Publishing House.
- Mangal, S.K. (1999). *Essentials of Educational Psychology*. New Delhi: PHI Learning Pvt. Ltd.
- Mangal, S.K. (2008). *Abnormal Psychology*. New Delhi: Sterling Publication
- Safaya, R.N., Shukla, C.S. and Bhatia, B.D. (2002). *Modern Educational Psychology*. Delhi: Dhanpat Rai Publishing Company.

EDU-HE-6026
SPECIAL EDUCATION

Total Marks: 100 (External: 80 and Internal: 20)

Credit-6

Course Objectives:

After completion of this course the learner will be able to

- Understand the meaning and importance of special education
- Acquaint with the different policies and legislations of special education
- Familiarise the students with the different types of special children with their characteristics
- Enable the students to know about different issues, educational provisions and support services of special education

Course Content:

Units	Content
Unit-1	Special Education- <ul style="list-style-type: none">• Meaning, Objectives, Scope and Importance of Special Education• Development of Special Education in India with special reference to Assam• Integration of Special Education in Regular Classroom• Issues relating to integration and innovation• Challenges in Special Education
Unit-2	Physically Challenged Children <ul style="list-style-type: none">• Children with Visual Impairment (Meaning and Definition, Classifications, Identification, Problems, Educational Programmes)• Children with Hearing Impairment (Meaning and Definition, Classifications, Identification, Problems, Educational Programmes)• Children with Orthopedically Handicapped (Meaning and Definition, Classifications, Identification, Problems, Educational Programmes)
Unit-3	Children with Intellectual Disability (Mental Retardation) and Gifted <ul style="list-style-type: none">• Gifted Children<ul style="list-style-type: none">- Meaning and Definition- Characteristics- Educational Programme• Children with Intellectual Disability (Mentally Retarded)<ul style="list-style-type: none">- Meaning and definition- Characteristics- Levels

	<ul style="list-style-type: none"> - Causes - Educational Programme
Unit-4	<p>Children with Learning Disability</p> <ul style="list-style-type: none"> • Meaning and Definition • Characteristics • Types • Causes • Prevention • Educational Programme
Unit-5	<p>Policies, Legislation and Services</p> <ul style="list-style-type: none"> • National Policy on Education-1986 • Central Scheme of Integrated Education for Disabled Children (IEDC) • Rehabilitation Council of India Act-1992 • The Persons with Disabilities (PWD) Act-1995 • National Policy for Persons with Disability, 2006 • Community Based Rehabilitation <ul style="list-style-type: none"> - Definition - Need - Implementation Process

Recommended Readings:

- Mangal, S.K. (2008). *Educating Exceptional Children: An Introduction to Special Education*. New Delhi: PHI Pvt. Ltd.
- Manivannan, M. (2013). *Perspective in Special Education*. New Delhi: Neelkamal Publications Pvt. Ltd.
- Margaret G Werts & Others, *Fundamental of Special Education (Third Edition)*, PEARSON
- Dr. Umedevi , 2021 *Special Education* , Neelkamal Publications

EDU-HE-6036
EDUCATIONAL MANAGEMENT
Total Marks: 100 (External: 80 and Internal: 20)
Credit-6

Course Objectives:

After completion of this course the learner will be able to

- Develop an understanding of the basic concept of educational management.
- Enable the students to know about the various resources in education
- Enable the students to understand the concept and importance of educational planning.
- Enable the students to know about the financial resources and financial management in education.

Course Contents

Units	Contents
Unit-1	Introduction to Educational Management <ul style="list-style-type: none">• Meaning, nature and scope of Educational Management• Objectives/Purpose of Educational Management• Principles of Educational Management• Types of Educational Management• Functions of Educational Management- Planning, Organizing, Directing, Supervising and controlling• Classroom Management- Principles, Strategies and Techniques.
Unit-2	Resources in Education <ul style="list-style-type: none">• Meaning of resources• Types of resources- Human resource, Material resource and Financial resource• Management of Human, Material and Financial resources• Optimum Utilization of resources in educational institutions
Unit-3	Educational Planning <ul style="list-style-type: none">• Meaning, Nature and Importance of educational planning• Types of educational planning• Principles of educational Planning• Central State Relationship in Educational Planning, Central and State Educational Advisory Bodies- MHRD, UGC, NCERT, SCERT
Unit-4	Institutional Planning <ul style="list-style-type: none">• Concept, Nature, and Scope of Institutional Planning• Institutional Planning for Infrastructural Development and Personnel Development

	<ul style="list-style-type: none"> • Procedure of Institutional Planning • Organisation of Time Table and Co-curricular Activities
Unit-5	Financing of Education and Recent Trends in Management <ul style="list-style-type: none"> • Concept of Educational Finance • Sources of Educational Finance • Principles of Educational Finance • Budget: Concept and Components, Process of Preparing Institutional Budget • Recent Trends in Educational Management <ul style="list-style-type: none"> - Total Quality Management - SWOT Analysis

Recommended Readings:

- Bhatnagar and Gupta (2006). *Educational Management*. Meerut: R. Lall Book Depot.
- Bhattacharya, Shantanu (2012). *Educational Management-Theory and Practice*. Guwahati: EBH Publishers.
- Krishnamacharyulu, V. (2008). *School Management and System of Education*. Hyderabad: Neelkamal Publications Pvt. Ltd.
- Mathur and Mathur (2010). *School Organisation and Management*. Agra: Agrawal Publication.
- Sharma, R. N. (2010). *Educational Administration, Management and Organisation*. Delhi: Surjeet Publications.
- Sidhu, I. S. (2012). *Educational Administration and Management*. Delhi: Pearson India Publishers
- Taj Haseen and Bhatnagar,Piyush (2012). *Modern Perspectives of Organizational Behaviour*, Agra: Harprasad Institute of Behavioural Studies.

EDU-HE-6046
WOMEN AND SOCIETY

Total Marks: 100 (External: 80 and Internal: 20)

Credit-6

Course Objectives:

After completion of this course the learner will be able to

- Know the changing role of women in India
- Understand gender discrimination in Indian society
- Make the students understand the constitutional provisions for women and their rights.
- Make the students understand women empowerment
- Develop an awareness and sensitivity towards women

Units	Contents
Unit-1	Status and role of women <ul style="list-style-type: none">• Women in ancient and medieval India• Changing role of Women in India• Women's health and related issues• Role of women in family , school and society• Women's role in social and environmental movement
Unit-2	Constitutional provisions and Rights of women <ul style="list-style-type: none">• Constitutional Provision for equality of Women (Educational and Legal Provisions)• National Policy on Education (1986) on women education• National Council for Women Education• Property Right• National Policy for Empowerment of Women, 2001
Unit-3	Gender inequalities in School and society <ul style="list-style-type: none">• Family attitude• Gender bias in Textbook• Curricular Choices• Teachers' attitude• Classroom Interaction• Peer Culture• Gender inequality in workplace
Unit-4	Women Empowerment <ul style="list-style-type: none">• Concept of women empowerment, importance• Types of women empowerment- Economic, political, Educational , legal• Women entrepreneurship• Barriers of women empowerment• Role of education in women empowerment
Unit-5	The new roles of men and women and its Implications

	<ul style="list-style-type: none"> • Changes in family patterns • Gender roles in transition • New gender roles • Factor influencing gender role • Women as peace builder • Gender sensitivity- new gender roles and its implications for family and society

Recommended Readings:

- Acker, S. (1987). *Feminist Theory and the Study of Gender and Education*. Jstor.
- Agarwal, N. (1993). *Women Education & Population in India*. Allahabad: Chugh Publications,
- Aggarwal J.C.(1976). *Indian Women: Education and Status*. New Delhi: Arya Book Depot.
- Bhatia , R. L. & Ahuja , B. N. (2006). *Modern Indian Education and it's Problems*. Delhi: Surjeet Publication.
- Bhatt B.D. & Sharma S.R. (1992). *Women's Education and Social Development*. Delhi: Kanishka Publishing House.
- Kaur I.(1983). *Status of Hindu Women in India*. Allahabad: Chugh Publications,
- Reddy, V. Govinda (2017). *Gender Perspectives in Peace Education*. Delhi: Manglam Publishers and Distributors.

B.Com (Hons) Course Structure & Syllabus

This is approved in the Academic Council held on 08/11/2019

B. Com. (Hons.): Three-Year (6-Semester) CBCS Programme

Course Structure		
Semester I		
BCM-AE-1014	Business Communication (English/Hindi/MIL)	Ability-Enhancement Compulsory Course (AECC)-1
COM-HC-1026	Financial Accounting	Core Course C-1
COM-HC-1036	Business Law	Core Course C-2
COM-GE-1046(A) COM-GE-1046(B)	Any one of the following Micro Economics Investing in Stock Markets	Generic Elective (GE)-1 Generic Elective (GE)-1
Semester II		
ENV-AE-2014	Environmental Studies	Ability-Enhancement Compulsory Course (AECC)-2
COM-HC-2026	Corporate Accounting	Core Course C-3
COM-HC-2036	Corporate Laws	Core Course C-4
COM-GE-2046(A) COM-GE-2046(B)	Any one of the following Macro Economics Insurance & Risk Management	Generic Elective (GE)-2 Generic Elective (GE)-2
Semester III		
COM-HC-3016	Computer Applications in Business	Core Course C-5
COM-HC-3026	Income-tax Law and Practice	Core Course C-6
COM-HC-3036	Management Principles and Applications	Core Course C-7
COM-GE-3046 (A) COM-GE-3046 (B)	Any one of the following Business Statistics/ Operation Research in Business	Generic Elective (GE)-3
COM-SEC-HC-3054 (A) COM-SEC-HC-3054 (B)	Any one of the following Entrepreneurship/ New Venture Planning	Skill-Enhancement Elective Course (SEC)-1
Semester IV		
COM-HC-4016	Cost Accounting	Core Course C-8
COM-HC-4026	Business Mathematics	Core Course C-9
COM-HC-4036	Human Resource Management	Core Course C-10
COM-GE-4046 (A) COM-GE-4046 (B)	Any one of the following Indian Economy/ Micro Finance	Generic Elective (GE)-4
COM-SEC-HC-4054 (A) COM-SEC-HC-4054 (B)	Any one of the following E-Commerce/ E-Filing of Returns	Skill-Enhancement Elective Course (SEC)-2
Semester V		
COM-HC-5016	Principles of Marketing	Core Course C-11
COM-HC-5026	Fundamentals of Financial Management	Core Course C-12

	DSE-1 (<i>Any one of Group A other than the subject selected under DSE-2</i>)	Discipline Specific Elective (DSE)-1
	DSE-2 (<i>Any one of Group A other than the subject selected under DSE-1</i>)	Discipline Specific Elective (DSE)-2
	Discipline Specific Elective (DSE) Group A	
COM-DSE-HC-5036 (A)	Management Accounting	
COM-DSE- HC-5036 (B)	Advanced Financial Accounting	
COM-DSE- HC-5036 (C)	Advertising	
COM-DSE- HC-5036 (D)	Banking	
COM-DSE- HC-5036 (E)	Computerised Accounting System	
COM-DSE- HC-5036 (F)	Indian Financial System	
Semester VI		
COM-HC-6016	Auditing and Corporate Governance	Core Course C-13
COM-HC-6026	Indirect Tax Laws	Core Course C-14
	DSE-3 (<i>Any one of Group B other than the subject selected under DSE-4</i>)	Discipline Specific Elective (DSE)-3
	DSE-4 (<i>Any one of Group B other than the subject selected under DSE-3</i>)	Discipline Specific Elective (DSE)-4
	Discipline Specific Elective (DSE) Group B	
COM-DSE- HC-6036 (A)	Fundamentals of Investment	
COM-DSE- HC-6036 (B)	Consumer Affairs and Customer Care	
COM-DSE- HC-6036 (C)	Advanced Corporate Accounting	
COM-DSE- HC-6036 (D)	International Business	
COM-DSE- HC-6036 (E)	Industrial Relations and Labour Laws	
COM-DSE- HC-6036 (F)	Business Research Methods and Project Work	

BCM-AE-1014: BUSINESS COMMUNICATION

Marks: 100

Credits: 4

Objective: To equip students of the B.Com (Hons.) course effectively to acquire skills in reading, writing, comprehension and communication, as also to use electronic media for business communication.

Contents:

Unit 1: Introduction:

Nature of Communication, Process of Communication, Types of Communication (verbal & Non Verbal), Importance of Communication, Different forms of Communication
Barriers to Communication Causes, Linguistic Barriers, Psychological Barriers, Interpersonal Barriers, Cultural Barriers, Physical Barriers, Organizational Barriers

Unit 2: Business Correspondence:

Letter Writing, presentation, Inviting quotations, Sending quotations, Placing orders, Inviting tenders, Sales letters, claim & adjustment letters and social correspondence, Memorandum, Inter-office Memo, Notices, Agenda, Minutes, Job application letter, preparing the Resume.

Unit 3: Report Writing:

Business reports, Types, Characteristics, Importance, Elements of structure, Process of writing, Order of writing, the final draft, check lists for reports.

Unit 4: Vocabulary:

Words often confused, Words often misspelt, Common errors in English.

Unit 5: Oral Presentation:

Importance, Characteristics, Presentation Plan, Power point presentation, Visual aids.

Suggested Readings:

1. Bovee, and Thill, *Business Communication Essentials*, Pearson Education
2. Shirley Taylor, *Communication for Business*, Pearson Education
3. Locker and Kaczmarek, *Business Communication: Building Critical Skills*, McGraw Hill Education
4. Herta A Murphy, Herbert W Hildebrandt, Jane P. Thomas, *Effective Business Communication (SIE)*, McGraw Hill Education
5. Dona Young, *Foundations of Business Communication: An Integrative Approach*, McGraw Hill Education
6. Raymond V. Lesikar, Marie E. Flatley, Kathryn Rentz, Paula Lentz, and Neerja Pande, *Business Communication: Connecting in a Digital World (SIE)*, McGraw Hill Education

Note: Latest edition of text books may be used.

BCM-AE-1014 : Assamese

Marks: 100

Credits: 4

গোট-১:পৰিচিতি: যোগাযোগৰ প্ৰকৃতি, যোগাযোগৰ পদ্ধতি,যোগাযোগৰ প্ৰকাৰ (মৌখিক আৰু অমৌখিক), যোগাযোগৰ প্ৰয়োজনীয়তা, বিভিন্ন ধৰণৰ যোগাযোগ,যোগাযোগৰ বাধাৰ কাৰকবোৰ, ভাষাগত বাধা, মানসিক বাধা, আন্ত ব্যক্তি সম্বন্ধীয় বাধা,সংস্কৃতিগত বাধা, দৈহিক বাধা,সাংগঠনিক বাধা ।

গোট-২:ব্যৱসায়িক সংযোগ: পত্ৰ লিখন, উপস্থাপন, মূল্য জ্ঞাপন পত্ৰৰ আহ্বান, মূল্য জ্ঞাপন পত্ৰৰ প্ৰেৰণ, নিৰ্দেশনাৰ উপস্থাপন, নিবিদাৰ আহ্বান, বিক্ৰী পত্ৰ, দাবী আৰু উপযোজন পত্ৰ আৰু সামাজিক যোগাযোগ, স্মাৰক লিপি, আন্ত:কাৰ্যালয় সম্বন্ধীয় পত্ৰ, জাননী, কাৰ্য্য ক্ৰমণিকা, সভা বিৱৰণী, চাকৰি বিচৰা পত্ৰ, অৰ্হতা আৰু যোগ্যতা সম্বন্ধীয় বিবৃতি ।

গোট ৩:প্ৰতিবেদন লিখন: ব্যৱসায়িক প্ৰতিবেদন, প্ৰকাৰ, বৈশিষ্ট, প্ৰয়োজনীয়তা, প্ৰতিবেদনৰ গাৰ্খনিৰ উপাদান, লিখনৰ প্ৰক্ৰিয়া, লিখনৰ ক্ৰম, চূড়ান্ত খচৰা, প্ৰতিবেদনৰ বাবে পৰীক্ষণ তালিকা।

গোট-৪ শব্দ সম্ভাৰ: প্ৰায়ে বিভ্ৰান্ত কৰা শব্দবোৰ, প্ৰায়ে ভুলকৈ বানান লিখা শব্দবোৰ, ইংৰাজীৰ সাধাৰণতে হোৱা ভুল ক্ৰুটি বোৰ ।

গোট:৫:মৌখিক উপস্থাপন: প্ৰয়োজনীয়তা, বৈশিষ্ট, উপস্থাপনৰ পৰিকল্পনা, পাৱাৰ পইণ্ট প্ৰেছেণ্টেশ্যন, দৃশ্য মাধ্যমৰ সহায়ক ।

BCM- AE - 1014 ব্যবসা যোগাযোগ

Marks : 100

Credit : 4

Objective : To equip students of the B.com (Hons.) course effectively to acquire skills in reading, writing, comprehension and communication, as also to use electronic media for business communication.

বিষয়বস্তু :

Unit-1 : অধ্যায় -১ ভূমিকা :

যোগাযোগের প্রকৃতি, যোগাযোগের প্রক্রিয়া, যোগাযোগের ধরন (মৌখিক এবং অ-মৌখিক), যোগাযোগের গুরুত্ব, যোগাযোগের বিভিন্ন প্রকার, যোগাযোগের বাধাসমূহ, কারণসমূহ, ভাষাসংক্রান্ত বাধাসমূহ, মনস্তাত্ত্বিক বাধাসমূহ, আন্তঃব্যক্তিগত বাধাসমূহ, সাংস্কৃতিক বাধাসমূহ, শারীরিক বাধাসমূহ, সাংগঠনিক বাধাসমূহ।

Unit - 2 : অধ্যায় -২ ব্যবসা পত্রবিনিময় :

পত্র লিখন, উপস্থাপন, মূল্যোদ্ধৃতির আমন্ত্রণ, মূল্যোদ্ধৃতির প্রেরণ, ফরমাশ স্থাপন, দরপত্র আমন্ত্রণ, বিক্রয় পত্রসমূহ, দাবি ও সমন্বয় পত্রসমূহ এবং সামাজিক পত্র বিনিময়, স্মারকলিপি, আন্তঃঅফিস স্মারকলিপি, কিংস্টি, বিষয়সূচি, সভার কার্যবিবরণীর সারাংশ, চাকরির আবেদনপত্র, জীবনবৃত্তান্ত প্রস্তুত করা।

Unit - 3 : অধ্যায় - ৩ : প্রতিবেদন লিখন :

ব্যবসায়িক প্রতিবেদন, প্রকার, বৈশিষ্ট্য, গুরুত্ব, কাঠামোর উপাদান, লিখনপ্রক্রিয়া, যথাযথ লিখনবিন্যাস, চূড়ান্ত খসড়া, প্রতিবেদনের নজর তালিকা।

Unit -4 : অধ্যায় - ৪ : শব্দভাণ্ডার :

প্রায়শ বিজ্ঞান্টিমূলক শব্দ, প্রায়শ বানান ভুল করা শব্দ, বাংলা লিখনে সাধারণ ত্রুটি।

Unit -5 : অধ্যায় - ৫ : মৌখিক উপস্থাপন :

গুরুত্ব, বৈশিষ্ট্য, উপস্থাপন পরিকল্পনা, পাওয়ার পয়েন্ট উপস্থাপন, চাক্ষুষ সহায়ক।

बि.कम-ए.ई.-1014

वाणिज्यिक संप्रेषण

अंक: 100

क्रेडिट: 4

उद्देश्य:

बि. कम के विद्यार्थियों को पत्रों में, लिखने में, बोधगम्यता में और संप्रेषण(कम्युनिकेशन) में दक्षता वृद्धि के लिए एवं वाणिज्यिक संप्रेषण में इलेक्ट्रॉनिक माध्यम का प्रयोग करने के लिए उपयोगी बनाना।

विषयवस्तु:

इकाई 1: परिचय:

संप्रेषण का स्वरूप, संप्रेषण की पद्धति, संप्रेषण के प्रकार(मौखिक एवं लिखित), संप्रेषण का महत्व, संप्रेषण के विभिन्न रूप, संप्रेषण में बाधक तत्व(या समस्याएँ), भाषा-वैज्ञानिक अवरोध, मनोवैज्ञानिक अवरोध, आंत:व्यक्तिगत(इंटर पारसनेल), सांस्कृतिक अवरोध, शारीरिक अवरोध, सांगठनिक अवरोध

इकाई 2: वाणिज्यिक पत्र-व्यवहार निविदा

पत्र-लेखन, प्रस्तुतीकरण, उद्धरण(कोटेसन) माँगना, उद्धरण प्रेषित करना, क्रमिक स्थान, निविदा का आमंत्रण, विक्रय-पत्र, दावा(माँग) एवं समायोजन संबद्ध पत्र, सामाजिक पत्र-व्यवहार, ज्ञापन, आंत:ऑफिस संबंधी ज्ञापन, सूचना(नोटिस), कार्यसूची, कार्य-विवरण, नौकरी के लिए आवेदन पत्र, सारांश प्रस्तुतीकरण

इकाई 3: रिपोर्ट लेखन

वाणिज्यिक रिपोर्ट, प्रकार, विशेषताएँ, महत्व, संरचना के तत्व, लेखन की प्रक्रिया, लिखन क्रम, अंतिम प्रारूप, रिपोर्ट के लिए जॉब-सूची

इकाई 4: शब्द-भंडार

भ्रम पैदा करनेवाले शब्द, अशुद्ध वर्तनी संबंधी शब्द, अंग्रेजी में पाये जानेवाली सामान्य अशुद्धियाँ।

इकाई 5: मौखिक प्रस्तुतीकरण

महत्व, विशेषताएँ, प्रस्तुतीकरण-योजना, पावर पॉइंट प्रस्तुतीकरण, दृश्य-साधन(विजुएल एड्स)

संदर्भ-पुस्तकें:

1. बोमी, तथा धील, बिजनेस कम्युनिकेशन इसेनसिएल्स, पियर्सन इडुकेशन
2. शिरल्ये तेइलर, कम्युनिकेशन फॉर बिजनेस, पियर्सन इडुकेशन
3. लोकर एंड केस्जमारेक, बिजनेस कम्युनिकेशन: विल्डिंग क्रिटिकल स्किलस, मेकग्रा हिल इडुकेशन
4. हेरता ए मुरफे, हारवार्ट बी हिलदेब्रांटेट, जेन पी. टोमास, इफेक्टिव बिजनेस कम्युनिकेशन(एस.आइ.ड), मेकग्रा हिल इडुकेशन
5. बोना वांग, फाउंडेशन ऑफ बिजनेस कम्युनिकेशन: एन इनटिग्रेटेड एप्रोस, मेकग्रा हिल इडुकेशन
6. रेमंड वी. लेसिकर, मारिए इ. फ्लेटलि, केथरियन रेनटेज, पउला सेन्टज, एंड निरजा पांडे, बिजनेस कम्युनिकेशन: कानेकटिंग इन ए डिजिटल वर्ल्ड(एस.आइ.ड), मेकग्रा हिल इडुकेशन

नोट: सद्य-प्रकाशित पुस्तकें ही व्यवहार करें।

BCM-AE-1014: फालांगि फोनांजाबथाय

नम्बर: 100

Credits: 4

थांखि: B.Com (Hons) फरायफारिनि फरायसाफोरखौ फरायनाय आरो लिरनाय, बुजिनाय गोहो आरो फोनांजाबथायाव रोंगौथि आरजिनाय आरो फालांगि फोनांजाबथायनि थाखाय मोब्लिबारि बिजोडावबो गोहोमगोनाडै थियारि खालामनाय।

नायखां बिलाइ:

बाहागो 1: सिनायथि:

फोनांजाबथायनि आखुथाइ, फोनांजाबथायनि फारिखान्थि, फोनांजाबथायनि रोखोम (खुगायारि आरो खुगायारि नडै), फोनांजाबथायनि गोनांथि, फोनांजाबथायनि गुबुन गुबुन महर, फोनांजाबथाय जाहोनाव हेंथा, राव-गोनोखोआरि हेंथा, गोसो-गोनोखोआरि हेंथा, सुबुं-गेजेरारि हेंथा, हारिमुवारि हेंथा, मोदोमारि हेंथा, आफादारि हेंथा।

बाहागो 2: फालांगि फोनांजाबनाय:

लाइजाम लिरनाय, दिन्थिफुनाय, थांखिखानाय-बेसेन हांखायनाय, थांखिखानाय-बेसेन थिनहरनाय, बिथोन होनाय, तेन्दार हांखायनाय, फाननायनि लाइजाम, दाबिनाय आरो गोरोबहोनायनि लाइजाम आरो समाजारि फोनांजाबनाय, गोसोखां-बिलाइ, मावख'-गेजेरारि मेम', मिथिसारलाइ, हाबाफारि, रेबसुं, साखि आरजलाइ लाइजाम, सुंदोब फोरमायथि थियारि खालामनाय।

बाहागो 3: खौरां लिरथाय:

फालांगि खौरां, रोखोम, आखुथाय, गोनांथि, दाथायनि थादेरसा, लिरनायनि फारिखान्थि, लिरथाय साजायनाय, जोबथा लिरस्लायनाय, खौरांनि थाखाय फारिलाइ नायग्रोमनाय।

बाहागो 4 : सोदोबबास्त्रि

सम-सम गोनोगोथो खालामनाय सोदोब, सम-सम गोरोन्थियै बानान खालामजानाय सोदोब, इंराजीयाव सरासनसा गोरोन्थि।

बाहागो 5: खुगायारि दिन्थिफुनाय

गोनांथि, आखुथाय, दिन्थिफुनाय बिथांखि, पावार पइन्ट दिन्थिफुनाय, नुथायारि आगजु

BCM AE-1014- व्यापार सञ्चार

नम्बर-100

Credit: 4

उद्देश्य-

बी.कम(अनर्स) पाठ्यक्रम अध्ययन गर्ने विद्यार्थीका लागि पठन, लेखन, बोध तथा संवादका साथै व्यापार सञ्चारका लागि इलेक्ट्रोनिक मेडिया उपयोग गर्दै कौशल सिकाई पारङ्गत गराउने उद्देश्य रहेको छ।

विषयवस्तु

एकाइ 1- परिचय

संवादको विधि, संवादको प्रक्रिया, संवादको प्रकार(मौखिक -गैर मौखिक), संवादको महत्त्व, संवादको विविध स्वरूप, संवादका अवरोध, भाषिक अवरोध, मनोवैज्ञानिक अवरोध, अन्तर्व्यक्तिक अवरोध, सांस्कृतिक अवरोध, शारीरिक अवरोध, साङ्गठनिक अवरोध.

एकाइ 2 कारोबार पत्राचार

पत्रलेखन, उपस्थापन, कोटेसन आह्वान, कोटेसन प्रेरण, निर्देश दिइनु, टेन्डर आह्वान, विक्रय पत्र, माग एवम् समायोजन पत्र तथा सामाजिक पत्राचार, स्मारकपत्र, अन्तर्कार्यालय मेमो, सूचना, कार्यसूची, कार्यवृत्त, जागिरको दर्खास्त, व्यक्ति-परिचय लेखन.

एकाइ 3 टिपोट लेखन

व्यापार टिपोट, टिपोटका प्रकार, टिपोटका विशेषता, टिपोटको महत्त्व, संरचनाको उपादान, लेखन प्रकृया, लेखनका लागि निर्देशन, निचोड खेसा, टिपोट जाँच सूची.

एकाइ 4 शब्दावली

प्रायः अल्मलिने शब्द, प्रायः गलत हुने हिज्जे, अङ्ग्रेजीमा सामान्यत गलत हुने हिज्जे,

एकाइ 5 मौखिक उपस्थापन

महत्त्व, विशेषता, उपस्थापनको योजना, पावर पोइन्ट उपस्थापन, भिजुयल एड्स,

अध्यानार्थ सामग्री

1. Bovee, and Thill, Business Communication essentials, Pearson Education.
2. Shirley Taylor, Communication for business, Pearson Education.
3. Locker and Kaczmarek, Business Communication: Building critical Skill, McGraw Hill Education.
4. Herta A Murphy, Herbert W Hildrebrandt, Jane P. Thomas, Effective Business Communication(SIE). McGraw Hill Education.

5. Dona Young, Foundation of business Communication: An Integrative Approach. McGraw Hill Education
6. Raymond V. Lesikar, Marie E. Flatley, Kathryn REntz, PaulLentz and Neerja Pande, Business McGraw Hill Education: Connecting in a Digital World (SIE) McGraw Hill Education.

COM-HC-1016: Financial Accounting

Marks: 100

Credit: 6

(Theory: 80 and Lab Practical:20)

Lectures 65

Objectives: The objective of this paper is to help students to acquire conceptual knowledge of the Financial Accounting and to impart skills for recording various kinds of business transactions.

CONTENTS

Unit 1: Theoretical Framework

Lectures 16

- i. Accounting as an information system, the users of financial accounting information and their needs. Qualitative characteristics of accounting, information. Functions, advantages and limitations of accounting. Branches of accounting. Bases of accounting: cash basis and accrual basis.
- ii. The nature of financial accounting principles : entity, money measurement, going concern, cost, realization, accruals, periodicity, consistency, prudence (conservatism), materiality and full disclosures.
- iii. Accounting Standards: Concept, needs and objectives; procedure for issuing Accounting Standards in India. Salient features of First-Time Adoption of Indian Accounting Standard (Ind-AS) 101. Salient features of Indian Accounting Standards Ind AS 1, 2, 16 and AS 9. International Financial Reporting Standards (IFRS): - Need and procedures of Issue.

Unit 2: Computerised Accounting System

Lectures 16

Computerised Accounting Systems: Meaning, components, and advantages, Difference between manual and computerised accounting, Various types of Accounting packages/software and their advantages and disadvantages; Tally 9 and its features, working on TALLY. Simple Practical Problems (Lab work) (Lab work -10 and Theory-6)

Unit 3: Measurement of Business Income

Lectures 16

- i. Measurement of business income-Net income, Application of accounting period, continuity doctrine and matching concept in the measurement of net income. Objectives of measurement.
- ii. Capital and revenue expenditures and receipts
- iii. Revenue recognition: Recognition of income and expenses as per AS 9.
- iv. Inventory Valuation: Meaning and Significance.

Unit 4: Final Accounts

Lectures 16

Preparation of financial statements of non-corporate business entities: Sole proprietorship and Partnership firms.

Unit 5: Hire-Purchase, Instalment Systems and Branches:

Lectures 16

- i) **Accounting for Hire-Purchase and Instalment Systems:** Meaning, features, advantages and disadvantages of Hire Purchase and Instalment Systems, Rights of Hire Purchaser and Hire Vendor, Journal entries and preparation of ledger accounts excluding default and repossession.
- ii) **Accounting for Branches:** Meaning, Needs and Objectives of Branch Accounting. Systems of dependent Branch Accounting and their Accounting Treatments (Only debtors system, stock and debtors system).

Note: Practical (with computer) in Computerised Accounting System (Unit 2) WILL be compulsory

Examination Scheme for Computerised Accounts: 6 marks will be included in Question Paper and 10 marks for Practical with computer. The practical examination will be for 1 hour.

Thus, the Theory Exam shall carry 70 marks

Suggested Readings:

1. Robert N Anthony, David Hawkins, Kenneth A. Merchant, *Accounting: Text and Cases*. McGraw- Hill Education, 13th Ed. 2013.
2. Charles T. Horngren and Donna Philbrick, *Introduction to Financial Accounting*, Pearson Education.
3. J.R. Monga, *Financial Accounting: Concepts and Applications*. Mayur Paper Backs, New Delhi.
4. M.C.Shukla, T.S. Grewal and S.C.Gupta. *Advanced Accounts. Vol.-I*. S. Chand & Co., New Delhi.
5. B. B. Dam, H C Gautam and others, *Financial Accounting*, Gayetri Publications, Guwahati
6. K. R. Das & K. M. Sinha. *Financial Accounting*
7. S.N. Maheshwari, and. S. K. Maheshwari. *Financial Accounting*. Vikas Publishing House, New Delhi.
8. Deepak Sehgal. *Financial Accounting*. Vikas Publishing H House, New Delhi.
9. Bhushan Kumar Goyal and HN Tiwari, *Financial Accounting*, International Book House
10. Goldwin, Alderman and Sanyal, *Financial Accounting*, Cengage Learning.
11. Tulsian, P.C. *Financial Accounting*, Pearson Education.
12. *Compendium of Statements and Standards of Accounting*. The Institute of Chartered Accountants of India, New Delhi

Note: Latest edition of the text books should be used.

COM-HC-1026: BUSINESS LAWS

Marks: 100

Credit: 6

Lectures: 65

Objective: The objective of the course is to impart basic knowledge of the important business legislation along with relevant case law.

Contents:

Unit 1: The Indian Contract Act, 1872: General Principle of Law of Contract

13 Lectures

- a) Contract – meaning, characteristics and kinds
- b) Essentials of a valid contract - Offer and acceptance, consideration, contractual capacity, free consent, legality of objects.
- c) Void agreements
- d) Discharge of a contract – modes of discharge, breach and remedies against breach of contract.
- e) Contingent contracts
- f) Quasi - contracts

Unit 2: The Indian Contract Act, 1872: Specific Contract

13 Lectures

- a) Contract of Indemnity and Guarantee
- b) Contract of Bailment
- c) Contract of Agency

Unit 3: The Sale of Goods Act, 1930

13 Lectures

- a) Contract of sale, meaning and difference between sale and agreement to sell.
- b) Conditions and warranties
- c) Transfer of ownership in goods including sale by a non-owner
- d) Performance of contract of sale
- e) Unpaid seller – meaning, rights of an unpaid seller against the goods and the buyer.

Unit 4: Partnership Laws

13 Lectures

A) The Partnership Act, 1932

- a. Nature and Characteristics of Partnership
- b. Registration of a Partnership Firms
- c. Types of Partners
- d. Rights and Duties of Partners
- e. Implied Authority of a Partner
- f. Incoming and outgoing Partners
- g. Mode of Dissolution of Partnership

B) The Limited Liability Partnership Act, 2008

- a) Salient Features of LLP
- b) Differences between LLP and Partnership, LLP and Company
- c) LLP Agreement,
- d) Partners and Designated Partners
- e) Incorporation Document
- f) Incorporation by Registration
- g) Partners and their Relationship

Unit 5 (A): The Negotiable Instruments Act 1881**13 Lectures**

- a) Meaning, Characteristics, and Types of Negotiable Instruments : Promissory Note, Bill of Exchange, Cheque
- b) Holder and Holder in Due Course, Privileges of Holder in Due Course.
- c) Negotiation: Types of Endorsements
- d) Crossing of Cheque
- e) Bouncing of Cheque

5(B): Right to Information Act 2005: Important definitions, object, scope, obligation of public authorities under the act; rights for obtaining information; disposal of request, information commission, appeal and penalties.

Suggested Readings:

1. M.C. Kuchhal, and Vivek Kuchhal, *Business Law*, Vikas Publishing House, New Delhi.
2. Avtar Singh, *Business Law*, Eastern Book Company, Lucknow.
3. Ravinder Kumar, *Legal Aspects of Business*, Cengage Learning
4. SN Maheshwari and SK Maheshwari, *Business Law*, National Publishing House, New Delhi.
5. Aggarwal S K, *Business Law*, Galgotia Publishers Company, New Delhi.
6. Bhushan Kumar Goyal and Jain Kinneri, *Business Laws*, International Book House
7. Sushma Arora, *Business Laws*, Taxmann Publications.
8. Akhileshwar Pathak, *Legal Aspects of Business*, McGraw Hill Education, 6th ed.
9. P C Tulsian and Bharat Tulsian, *Business Law*, McGraw Hill Education
10. Sharma, J.P. and Sunaina Kanojia, *Business Laws*, Ane Books Pvt. Ltd., New Delhi

Note: Latest edition of text books may be used.

COM-GE-1016: MICRO ECONOMICS

Marks: 100

Credit: 6

Lectures: 65

Objective: The objective of the course is to acquaint the students with the concepts of microeconomics dealing with consumer behavior. The course also makes the student understand the supply side of the market through the production and cost behavior of firms.

CONTENTS

Unit 1: Demand and Consumer Behaviour

13 lectures

Concepts of revenue: marginal and Average: Revenue under conditions of Perfect and imperfect competition Elasticity of demand: price, income and cross.

Consumer Behaviour: Indifference curve analysis of consumer behavior; Consumer's equilibrium (necessary and sufficient conditions). Price elasticity and price consumption curve, income consumption curve and Engel curve, price change and income and substitution effects. Indifference curves as an analytical tool (cash subsidy v/s. kind subsidy). Revealed Preference Theory.

Unit 2: Production and Cost

13 lectures

Production isoquants, marginal rate of technical substitution, economic region of production, optimal combination of resources, the expansion path, isoclines, returns to scale using isoquants.

Cost of Production: Social and private costs of production, long run and short run costs of production. Economies and diseconomies of scale and the shape to the long run average cost. Learning curve and economies of scope.

Unit 3: Perfect Competition

13 lectures

Perfect competition: Assumptions. Equilibrium of the firm and the industry in the short and the long runs, including industry's long run supply curve. Measuring producer surplus under perfect competition. Stability Analysis - Walrasian and Marshallian. Demand - supply analysis including impact of taxes and subsidy.

Unit 4: Monopoly

10 lectures

Monopoly: Monopoly short run and long run equilibrium. Shifts in demand curve and the absence of the supply curve. Measurement of monopoly power and the rule of thumb for pricing. Horizontal and vertical integration of firms. The social costs of monopoly power including deadweight loss. Degrees of price discrimination.

Unit 5: Imperfect Competition

16 lectures

Monopolistic Competition and Oligopoly: Monopolistic competition price and output decision-equilibrium. Monopolistic Competition and economic efficiency Oligopoly and Interdependence - Cournot's duopoly model, Stackelberg model, Kinked demand model. Prisoner's dilemma, collusive oligopoly - price-leadership model - dominant firm, cartels, sales maximization, Contestable markets theory. Pricing Public Utilities.

Suggested Readings:

1. Pindyck, R.S., D. L. Rubinfeld and P. L. Mehta; *Microeconomics*, Pearson Education.
2. N. Gregory Mankiw, *Principles of Micro Economics*, Cengage Learning
3. Maddala G.S. and E. Miller; *Microeconomics: Theory and Applications*, McGraw-Hill Education.
4. Salvatore, D. *Schaum's Outline: Microeconomic Theory*, McGraw-Hill, Education.
5. Case and Fair, *Principles of Micro Economics*, Pearson Education
6. Koutsiyannis, *Modern Micro Economic Theory*.
7. C Snyder, *Microeconomic Theory: Basic Principles and Extensions*, Cengage Learning
8. Bilas, Richard A., *Microeconomics Theory: A Graphical Analysis*, McGraw-Hill Education.
9. Paul A Samuelson, William D Nordhaus, *Microeconomics*, McGraw-Hill Education.
10. Amit Sachdeva, *Micro Economics*, Kusum Lata Publishers

Note: Latest edition of text books shall be used.

Objective: This paper intends to provide basic skills to operate in stock markets and the ways of investing in it. It will enable the student to take up investment in stock markets independently.

Contents

Unit I: Investing Fundamentals**15 Lectures**

Types of Investment- Equity shares, IPO/FPO, Bonds, Indian Securities Market: the market participants, trading of securities, security market indices. Sources of financial information; Stock exchanges in India; BSE, NSE, MCX, Buying and selling of stocks: using brokerage and analysis recommendations. Use of limit order and market order.

Unit II: Stock Analysis and Valuation**20 Lectures**

Online trading stock. Understanding stock quotations, types and placing of order. Risk its valuation and mitigation. Analysis of the company; financial characteristics (as explained by ratio analysis, future prospects of the company, assessing quality of management using financial and non-financial data, balance sheet and quarterly results, cash flows and capital structure). Comparative analysis of companies. Stock valuation, using ratios like PF ration PEG ratio and price revenue ratio. Use of historic prices, simple moving average, basic and advanced interactive charts. Examining the shareholding pattern of the company.

Pitfalls to avoid while investing: high P/E stocks, low price stocks, stop loss, excess averaging.

Unit III: Investing in Mutual Funds**15 Lectures**

Background of Mutual Funds: Needs and advantages of investing in Mutual Funds. Net Asset Value. Types of Mutual Funds; Open ended, closed ended, equity, debt, hybrid, money market. Load vs no load funds. Factors affecting choice of mutual funds CRISIL Mutual Fund Ranking and its Usage.

Unit IV: understanding Derivatives**15 Lectures**

Futures, Options, trading in futures and options. Understanding stock market quotes on futures and options. Types of orders, Put and Call options: how Put and Call options work. Commodities, Derivatives of commodities, trading of commodity derivatives on MCX, Currency, derivatives and its trading.

Suggested Readings:

1. Gitman and Joehnk, Fundamentals of Investing, Pearson.
2. Madura, Jeff, Personal Finance, Pearson.
3. Chandra, Prasanna, Investment Analysis and Portfolio Management, Tata McGraw Hill.
4. Damodaran, Aswath, Investment Valuation Tool and Techniques for Determining.

COM-HC-2016: CORPORATE ACCOUNTING

Total Marks : 100

Credit: 6

Lectures 65

Objectives: To help the students to acquire the conceptual knowledge of the corporate accounting and to learn the techniques of preparing the financial statements

Unit - I: Final Accounts

16

Preparation of Final Accounts of a Joint Stock Company (as per Companies Act, 2013) with necessary adjustments.

Unit - II Incentive Equity, Buy Back, and Valuation of shares and goodwill:

16

- i. **Incentive Equity:** Right and Bonus Shares – Meaning, Advantages and Disadvantages, Provisions as per Companies Act, 2013 and their Accounting Treatment.
- ii. **Buy back of shares:** Meaning, Provisions of Companies Act, 2013 and Accounting Treatment.
- iii. **Valuation of shares and goodwill:** Meaning, provision of Companies Act on Valuation of Shares and Valuation of Goodwill, Concepts and calculation: simple problem only.

Unit III: Internal Reconstruction of Companies :

16

Concept and meaning of Internal Reconstruction, Different forms of Internal Reconstruction; Provisions as per Companies Act and Accounting treatment for Alteration of Share Capital and Reduction of Share Capital; Preparation of Balance Sheet after Internal Reconstruction.

Unit - IV Amalgamation of Companies:

16

Meaning and objectives; Provisions as per Accounting Standard 14; Amalgamation in the nature of Merger and Purchase; Consideration for Amalgamation; Accounting Treatment for Amalgamation and preparation of Balance Sheet after Amalgamation.

Unit V. Accounts of Holding Company

16

Concept and meaning of different terms: holding company, subsidiary company, pre-acquisition profit/loss, post acquisition profit/loss, minority interest; cost of control.
Meaning and needs for consolidation of financial statements as per AS 21.
Preparation of consolidated balance sheet of a holding company with one subsidiary.

Note:

1. **The relevant Indian Accounting Standards in line with the IFRS for all the above topics should be covered.**
2. **Any revision of relevant Indian Accounting Standard would become applicable immediately.**

Suggested Readings:

1. Hanif and Mukherjee: *Corporate Accounting*
2. B. B. Dam, H C Gautam and others, *Corporate Accounting*, Gayetri Publications, Guwahati
3. K. R. Das & K. M. Sinha. *Corporate Accounting*
4. M.C.Shukla, T.S. Grewal and S.C.Gupta. *Advanced Accounts*. S. Chand & Co., New Delhi.
5. S. N. Maheshwari *Corporate Accounting* -, Vikash Publishing House
6. S. Sehgal & D. Sehgal, *Advanced Accounting* Taxmann Publication
7. *Modern Accounting* by Hanif and Mukherjee, Tata McGraw Hill.
8. V. K. Saxena *Advanced Accounting* - Sultan Chand & sons.

COM-HC-2026: CORPORATE LAWS

Marks: 100

Credit: 6

Lectures: 65

Objective: The objective of the course is to impart basic knowledge of the provisions of the Companies Act 2013 and the Depositories Act, 1996. Case studies involving issues in corporate laws are required to be discussed.

UNIT 1: Introduction

15 Lectures

Administration of Company Law [including National Company Law Tribunal (NCLT), National Company Law Appellate Tribunal (NCLAT), Special Courts]; Characteristics of a company; lifting of corporate veil; types of companies including one person company, small company, and dormant company; association not for profit; illegal association; formation of company, on-line filing of documents, promoters, their legal position, pre-incorporation contract; on-line registration of a company.

UNIT 2: Documents

15 Lectures

Memorandum of association, Articles of association, Doctrine of constructive notice and indoor management, prospector-shelf and red herring prospectus, misstatement in prospectus, GDR; book-building; issue, allotment and forfeiture of share, transmission of shares, buyback and provisions regarding buyback; issue of bonus shares.

UNIT 3: Management

15 Lectures

Classification of directors, women directors, independent director, small shareholder's director; disqualifications, director identity number (DIN); appointment; Legal positions, powers and duties; removal of directors; Key managerial personnel, managing director, manager; *Meetings:* Meetings of shareholders and board of directors; Types of meetings, Convening and conduct of meetings, Requisites of a valid meeting, postal ballot, meeting through video conferencing, e-voting.
Committees of Board of Directors - Audit Committee, Nomination and Remuneration Committee, Stakeholders Relationship Committee, Corporate Social Responsibility Committee

UNIT 4:

15 Lectures

Dividends, Accounts, Audit: Provisions relating to payment of Dividend, Provisions relating to Books of Account, Provisions relating to Audit, Auditors' Appointment, Rotation of Auditors, Auditors' Report, Secretarial Audit.

Winding Up: Concept and modes of Winding Up.

Insider Trading, Whistle Blowing: Insider Trading; meaning & legal provisions; Whistle-blowing : Concept and Mechanism.

UNIT 5: Depositories Law

5 Lectures

The Depositories Act 1996 – Definitions; rights and obligations of depositories; participants issuers and beneficial owners; inquiry and inspections, penalty.

Suggested Readings:

1. MC Kuchhal, *Modern Indian Company Law*, Shri Mahavir Book Depot (Publishers), Delhi.
2. GK Kapoor and Sanjay Dhamija, *Company Law*, Bharat Law House, Delhi.
3. Anil Kumar, *Corporate Laws*, Indian Book House, Delhi

4. Reena Chadha and Sumant Chadha, *Corporate Laws*, Scholar Tech Press, Delhi.
5. Avtar Singh, *Introduction to Company Law*, Eastern Book Company
6. Ramaiya, *A Guide to Companies Act*, LexisNexis, Wadhwa and Buttersworth.
7. *Manual of Companies Act, Corporate Laws and SEBI Guideline*, Bharat Law House, New Delhi,.
8. *A Compendium of Companies Act 2013, along with Rules*, by Taxmann Publications.
9. Gower and Davies, *Principles of Modern Company Law*, Sweet & Maxwell
10. Sharma, J.P., *An Easy Approach to Corporate Laws*, Ane Books Pvt. Ltd., New Delhi

Note: Latest edition of text books may be used.

COM-GE-2016: MACRO ECONOMICS

Marks: 100

Credit: 6

Lectures: 65

Objectives: The course aims at providing the student with knowledge of basic concepts of the macro economics. The modern tools of macro-economic analysis are discussed and the policy framework is elaborated, including the open economy.

Contents

Unit 1: Introduction

5 Lectures

concepts and variables of macroeconomics, income, expenditure and the circular flow, components of expenditure. Static macroeconomic analysis short_ and the long run – determination of supply, determination of demand, and conditions of equilibrium

Unit 2: Economy in the short run

20 Lectures

IS–LM framework, fiscal and monetary policy, determination of aggregate demand, shifts in aggregate demand, aggregate supply in the short and long run, and aggregate demand- aggregate supply analysis.

Unit 3: Inflation, Unemployment and Labour market

20 Lectures

Inflation: Causes of rising and falling inflation, inflation and interest rates, social costs of inflation; Unemployment – natural rate of unemployment, frictional and wait unemployment. Labour market and its interaction with production system; Phillips curve, the trade-off between inflation and unemployment, sacrifice ratio, role of expectations adaptive and rational

Unit 4: Open economy

13 Lectures

Open economy – flows of goods and capital, saving and investment in a small and a large open economy, exchange rates, Mundell – Fleming model with fixed and flexible prices in a small open economy with fixed and with flexible exchange rates, interest-rate differentials case of a large economy.

Unit 5:

7 Lectures

Behavioral Foundations- Investment –determinants of business fixed investment, effect of tax, determinants of residential investment and inventory investment. Demand for Money – Portfolio and transactions theories of demand for real balances, interest and income elasticities of demand for real balances. Supply of money

Suggested Readings

1. Mankiw, N. Gregory. Principles of *Macroeconomics*. Cengage Learning
2. Robert J Gordon, *Macroeconomics*, Pearson Education
3. Branson, William H. *Macroeconomic Theory and Policy*. HarperCollins India Pvt. Ltd.
4. Rudiger Dornbusch and Stanley Fischer, *Macroeconomics*. McGraw-Hill Education.
5. Rudiger Dornbusch, Stanley Fischer, and Richard Startz, *Macroeconomics*. McGraw-Hill Education
6. Oliver J. Blanchard, *Macroeconomics*, Pearson Education
7. G. S. Gupta, *Macroeconomics: Theory and Applications*, McGraw-Hill Education
8. Shapiro, *Macroeconomic Analysis*,
9. Paul A Samuelson, William D Nordhaus, and Sudip Chaudhuri, *Macroeconomic*, McGraw-Hill Education
10. S N Singh, समिB अथशाए, Pearson Education

Note: Latest edition of text books may be used.

COM-GE-2026: Insurance & Risk Management

Marks: 100

Credit: 6

Lectures 65

Objective: To develop an understanding among students about identifying, analyzing and managing various types of risk. Besides, the students will be in a position to understand principles of insurance and its usefulness in business along with its regulatory framework.

Unit I:

15 Lectures

Concept of Risk, Types of Risk, Managing Risk, Sources and Measurement of Risk, Risk evaluation and Prediction Disaster Risk Management, Risk Retention and transfer.

Unit II:

15 Lectures

Concept of Insurance, Need for Insurance, Globalization of Insurance Sector, Reinsurance, Co-insurance, Assignment Endowment.

Unit III:

20 Lectures

Nature of Insurance Contract, Principle of utmost Good Faith, Insurable Interest, proximate cause, contribution and subrogation, indemnity, Legal Aspect of insurance contract. Types of insurance: Life and Fire Insurance, Health insurance, Marine Insurance, Automobile Insurance.

Unit IV:

15 Lectures

Control of Malpractices, Negligence, Loss Assessment and Loss Control, Exclusion of Perils, Actuaries, Computation of Insurance Premium.

Regulatory Framework of Insurance: Role, Power and Functions of IRDA, Composition of IRDA, IRDA Act, 1999.

Suggested Readings:

1. George, E. Rajda, Principles of Risk Management and Insurance, Pearson Education.
2. Dorfman, Marks S., Introduction to Risk Management and Insurance, Pearson.
3. All the three modules of Insurance and Risk Management by Institute of Chartered Accountants of India.
4. Gupta P.K. Insurance and Risk Management, Himalay Publishing House.
5. Mishra, M.N. Principles and Practices of Insurance, S. Chand and Sons.
6. Dinsdale, W.A. Elements of Insurance, Pitman
7. Black, K. and H.D. Skipper, Life and Health Insurance, Pearson Education.
8. Crane, F., Insurance Principles and Practices, John Wiley and Sons, New York
9. Vaughan, E.J. and Vaughan T., Fundamentals of Risk & Insurance, Wiley and Sons, New York.
10. Hansell, D.S. Element of Insurance, MacDonalld and Evans Ltd.

Note: Latest edition of test book may be used.

COM-HC-3016: COMPUTER APPLICATIONS IN BUSINESS

Marks: 100

Credit: 6

Lectures: 52, Practical Lab 52

Objectives: To provide computer skills and knowledge for commerce students and to enhance the student understands of usefulness of information technology tools for business operations.

Unit 1: Word Processing

6 Lectures, Practical Lab

6 Introduction to word Processing, Word processing concepts, Use of Templates, Working with word document: Editing text, Find and replace text, Formatting, spell check, Autocorrect, Autotext; Bullets and numbering, Tabs, Paragraph Formatting, Indent, Page Formatting, Header and footer, Tables: Inserting, filling and formatting a table; Inserting Pictures and Video; Mail Merge: including linking with Database; Printing documents

Creating Business Documents using the above facilities

Unit 2: Preparing Presentations

6 Lectures, Practical Lab

6 Basics of presentations: Slides, Fonts, Drawing, Editing; Inserting: Tables, Images, texts, Symbols, Media; Design; Transition; Animation; and Slideshow.

Creating Business Presentations using above facilities

Unit 3: Spreadsheet and its Business Applications

12 Lectures, Practical

Lab 12 Spreadsheet concepts, Managing worksheets; Formatting, Entering data, Editing, and Printing a worksheet; Handling operators in formula, Project involving multiple spreadsheets, Organizing Charts and graphs

Generally used Spreadsheet functions: Mathematical, Statistical, Financial, Logical, Date and Time, Lookup and reference, Database, and Text functions

Unit 4: Creating Business Spreadsheet

12 Lectures, Practical

Lab 12 Creating spreadsheet in the area of: Loan and Lease statement; Ratio Analysis; Payroll statements; Capital Budgeting; Depreciation Accounting; Graphical representation of data; Frequency distribution and its statistical parameters; Correlation and Regression

Unit 5: Database Management System

16 Lectures, Practical Lab 16

Database Designs for Accounting and Business Applications: Reality- Expressing the Application; Creating Initial design in Entity Relationship(ER) Model; Transforming ER Model to Relational data model concepts; Implementing RDM design using an appropriate DBMS.

SQL and Retrieval of Information: Basic Queries in SQL; Embedded Queries in SQL; Insert, Delete and Update statements in SQL

DBMS Software: Environment; Tables; Forms; Queries; Reports; Modules; Applying DBMS in the areas of Accounting, Inventory, HRM and its accounting, Managing the data records of Employees, Suppliers and Customers.

Note:

1. The General Purpose Software referred in this course will be notified by the University Departments every three years. If the specific features, referred in the detailed course above, is not available in that software, to that extent it will be deemed to have been modified.
2. There shall be a practical examination of 100 Marks (Practical-80 Marks, Viva-10 Marks and Work Book- 10 Marks) and duration of Examination shall be 3 Hrs.
3. Teaching arrangement need to be made in the computer Lab
4. There shall be four lectures per class and 4 Practical Lab periods per batch to be taught in computer Lab.

Suggested Readings:The suggested readings and guidelines shall be notified by the university department at least once in three years based on the selected software.

Com-HC-3026: INCOME TAX LAW AND PRACTICE

Marks: 100

Credit: 6

Lectures: 52, Practical lab 26

Objective: To provide basic knowledge and equip students with application of principles and provisions of Income-tax Act, 1961 and the relevant Rules.

Unit 1: Introduction

10 Lectures

Basic concepts: Income, agricultural income, person, assessee, assessment year, previous year, gross total income, total income.

Residential status; Scope of total income on the basis of residential status Exempted income under section 10

Unit 2: Computation of Income under different heads-1

18 Lectures

Income from Salaries; Income from house property

Unit 3: Computation of Income under different heads-2

10 Lectures

Profits and gains of business or profession; Capital gains; Income from other sources

Unit 4: Computation of Total Income and Tax Liability

14 Lectures

Income of other persons included in assessee's total income; Aggregation of income and set-off and carry forward of losses; Deductions from gross total income; Rebates and reliefs
Computation of total income of individuals and firms; Tax liability of an individual and a firm; Five leading cases decided by the Supreme Court

Unit 5: Preparation of Return of Income

Practical Lab 26

Filing of returns: Manually, On-line filing of Returns of Income & TDS; Provision & Procedures of Compulsory On-Line filing of returns for specified assesses, Permanent Account Number (PAN).

Note:

1. There shall be a practical examination of 20 Marks on E-filing of Income Tax Returns using a software utility tool. The student is required to fill appropriate Form and generate the XML file.
2. There shall be 4 Credit Hrs. for Lectures + one Credit hr. (Two Practical Periods per week per batch) for Practical Lab + one credit Hr for Tutorials (per group)
3. Latest edition of text books and Software may be used.

Suggested readings:

1. Singhanian, Vinod K. and Monica Singhanian. *Students' Guide to Income Tax, University Edition*. Taxmann Publications Pvt. Ltd., New Delhi.
2. Ahuja, Girish and Ravi Gupta. *Systematic Approach to Income Tax*. Bharat Law House, Delhi.

Journals

1. *Income Tax Reports*. Company Law Institute of India Pvt. Ltd., Chennai.
2. *Taxman*. Taxman Allied Services Pvt. Ltd., New Delhi.
3. *Current Tax Reporter*. Current Tax Reporter, Jodhpur.

Software

1. Vinod Kumar Singhanian, *e-filing of Income Tax Returns and Computation of Tax*, Taxmann Publication Pvt. Ltd, New Delhi. Latest version
2. 'Excel Utility' available at incometaxindiaefiling.gov.in

COM-HC-3036: MANAGEMENT PRINCIPLES AND APPLICATION

Marks: 100

Credit: 6

Lectures: 65

Objective: The objective of the course is to provide the student with an understanding of basic management concepts, principles and practices.

Unit 1: Introduction

Lectures: 13

- a. Concept: Need for Study, Managerial Functions – An overview; Co-ordination: Essence of Managership
- b. Evolution of the Management Thought, Classical Approach – Taylor, Fayol, Neo-Classical and Human Relations Approaches – Mayo, Hawthorne Experiments, Behavioural Approach, Systems Approach, Contingency Approach – Lawrence & Lorsch, MBO - Peter F. Drucker, Re-engineering - Hammer and Champy, Michael Porter – Five-force analysis, Three generic strategies and value- chain, analysis, Senge's Learning Organisation, 'Fortune at the Bottom of the Pyramid' – C.K. Prahalad.

Unit 2: Planning

Lectures: 13

- a. Types of Plan – An overview to highlight the differences
- b. Strategic planning – Concept, process, Importance and limitations
- c. Environmental Analysis and diagnosis (Internal and external environment) – Definition, Importance and Techniques (SWOT/TOWS/WOTS-UP), Business environment; Concept and Components
- d. Decision-making – concept, importance; Committee and Group Decision-making, Process, Perfect rationality and bounded rationality, Techniques.

Unit 3: Organising

Lectures: 13

Concept and process of organising – An overview, Span of management, Different types of authority (line, staff and functional), Decentralisation, Delegation of authority
Formal and Informal Structure; Principles of Organising; Network Organisation Structure

Unit 4: Staffing and Leading

Lectures: 13

- a. *Staffing*: Concept of staffing, staffing process
- b. *Motivation*: Concept, Importance, extrinsic and intrinsic motivation; Major Motivation theories - Maslow's Need-Hierarchy Theory; Herzberg's Two-factor Theory, Vroom's Expectation Theory.
- c. *Leadership*: Concept, Importance, Major theories of Leadership (Likert's scale theory, Blake and Mouten's Managerial Grid theory, House's Path Goal theory, Fred Fielder's situational Leadership), Transactional leadership, Transformational Leadership, Transforming Leadership.
- d. *Communication*: Concept, purpose, process; Oral and written communication; Formal and informal communication networks, Barriers to communication, Overcoming barriers to communication.

Unit 5: Control

Lectures: 13

- a. *Control*: Concept, Process, Limitations, Principles of Effective Control, Major Techniques of control - Ratio Analysis, ROI, Budgetary Control, EVA, PERT/CPM.
- b. Emerging issues in Management

Suggested Readings:

1. Harold Koontz and Heinz Weihrich, *Essentials of Management: An International and Leadership Perspective*, McGraw Hill Education.
2. Stephen P Robbins and Madhushree Nanda Agrawal, *Fundamentals of Management: Essential Concepts and Applications*, Pearson Education.
3. George Terry, *Principles of Management*, Richard D. Irwin
4. Newman, Summer, and Gilbert, *Management*, PHI
5. James H. Donnelly, *Fundamentals of Management*, Pearson Education.
6. B.P. Singh and A.K. Singh, *Essentials of Management*, Excel Books
7. Griffin, *Management Principles and Application*, Cengage Learning
8. Robert Kreitner, *Management Theory and Application*, Cengage Learning
9. TN Chhabra, *Management Concepts and Practice*, Dhanpat Rai & Co. (Pvt. Ltd.), New Delhi
10. Peter F Drucker, *Practice of Management*, Mercury Books, London

Note: Latest edition of text books may be used.

COM-GE-3046(A): BUSINESS STATISTICS

Marks: 100

Credit: 6

Lectures: 65

Objective: The objective of this course is to familiarise students with the basic statistical tools used for managerial decision-making.

Unit 1: Statistical Data and Descriptive Statistics

(12 Lectures)

a. Nature and Classification of data: univariate, bivariate and multivariate data; time-series and cross-sectional data

b. Measures of Central Tendency

i. Mathematical averages including arithmetic mean, geometric mean and harmonic mean. Properties and applications.

ii. Positional Averages Mode and Median (and other partition values including quartiles, deciles, and percentiles).

c. Measures of Variation: absolute and relative. Range, quartile deviation, mean deviation, standard deviation, and their coefficients, Properties of standard deviation/variance

d. Skewness: Meaning, Measurement using Karl Pearson and Bowley's measures; Concept of Kurtosis

Unit 2: Probability and Probability Distributions

(12 Lectures)

a. Theory of Probability. Approaches to the calculation of probability; Calculation of event probabilities. Addition and multiplication laws of probability (Proof not required); Conditional probability

b. Expectation and variance of a random variable, Probability distribution of random variable.

c. Probability distributions:

i. Binomial distribution: Probability distribution function, Constants, calculation for simple exercise

ii. Poisson distribution: Probability function, (including Poisson approximation to binomial distribution), Constants, Solution of related problems.

iii. Normal distribution: Probability distribution function, Properties of normal curve (Theory Part only)

Unit 3: Simple Correlation and Regression Analysis

(12 Lectures)

a. Correlation Analysis: Meaning of Correlation: simple, multiple and partial; linear and non-linear, Correlation and Causation, Scatter diagram, Pearson's co-efficient of correlation; calculation and properties (Proof not required). Rank Correlation, Interpretation of various values of correlation co-efficient.

b. Regression Analysis: Principle of least squares and regression lines, Regression equations and estimation; Properties of regression coefficients; Relationship between Correlation and Regression coefficients; .

Unit 4: Index Numbers

(12 Lectures)

Meaning and uses of index numbers; Idea of price – relative, Price, Quantity and Value indices. Construction of index numbers: Laspeyere's, Paasche's and Fisher's indices-Aggregative and average of relatives (simple and weighted). Problems in the construction of index numbers, Tests of adequacy of index numbers- Time reversal test and Factor reversal test. Deflating and Construction of consumer price indices, chain base index and limitation of index number.

Unit 5: Time Series Analysis

(7 Lectures)

Components of time series; Additive and multiplicative models; Trend analysis: Fitting of trend line using principle of least squares – linear case. Determination of trend by semi- average and moving average. Uses of Time Series analysis.

UNIT 6: Sampling Concepts, Sampling Distributions, Estimation and testing of Hypothesis (10 Lectures)

Sampling: Populations and samples, Parameters and Statistic, Census vs Sampling. Sampling methods (including Simple Random sampling, Stratified sampling, Systematic sampling, Judgment sampling, and Convenience sampling)

Concept of Sampling distributions and Estimation: Point and Interval estimation of means (large samples) and sample proportion. Characteristics of a good estimation.

Testing of hypothesis- concepts of Null hypothesis, alternative hypothesis, level of significance, test of significance, one- tailed and two- tailed test and errors in testing hypothesis.

Suggested Readings :-

1. Gupta, S.C, Fundamentals of statistics – Himalaya Publishing House.
2. Murray, R Spiegel, Larry J. Stephens , Narinder Kumar. Statistics (Schaum's Outline Series)
3. Hazarika, Padmalochan, Business Statistics – S.Chand
4. Bhowal, M.K. Fundamentals of Business Statistics (Asian Books Private Limited)

COM-GE-3046(B): Operations Research in Business

Marks: 100

Credit: 6

Lectures: 65

Unit I: Introduction to Operation Research: Evolution of Operation Research , Nature and characteristics of O.R , phases of O.R, methodology of O.R, Operation research model, role of computer in Operation Research, 10 Lectures

Unit II: Linear Programming : Concept of Linear Programming, Uses and limitations of Linear Programming, Formulation of L.P problems, Concept of slack variable, Procedure of Graphical Method, Simplex Method (solutions of L.P.P. upto 3 iterations) Maximization Problems. (Simple problems related to commerce and business) 15 Lectures

Unit III: Inventory Control , concepts and benefits of inventory control, Different types of costs in inventory system , Formulation and solution of Economic order quantity (EOQ) model, selective inventory control techniques (ABC Analysis and VED Analysis) 10 Lectures

Unit IV: Study of Replacement: Replacement Problem, Replacement of items whose maintenance cost increases with time and the value of money remains same during the period, Replacement of items whose maintenance cost increases with time and the value of money also changes with time, selection of best item (machine) amongst two 15 Lectures

Unit V: : Project Management:, basic differences between PERT and CPM, phases of project management, PERT / CPM network, rules for network construction , critical path analysis, Float of an Activity and Event , Critical Path, project scheduling with uncertain activity times (only simple numerical examples are needed) 15 Lectures

Recommended books :

1. Operations Research 9th Edition, Kantiswarup, Gupta P.K. & Sultan Chand & Sons Manmohan Operations Research – An introduction 6th Edition , Taha H.A., Hall of India
2. Operations Research Techniques for Management 7th Edition, Kapoor V.K., Sultan Chand & Sons
3. Operations Research 9th Edition, Kanti Swarup, Gupta P.K. & Sultan Chand & Sons
4. Operations Research : Theory and Applications 4th Edition , J.K Sharma

COM-SEC-HC-3054 (A): Entrepreneurship

Marks: 100

Credit: 4

Lectures: 50

Objective: The purpose of the paper is to orient the learner toward entrepreneurship as a career option and creative thinking and behavior.

Contents:

Unit 1: Introduction

Meaning, elements, determinants and importance of entrepreneurship and creative behavior; Entrepreneurship and creative response to the society's problems and at work; Dimensions of entrepreneurship: intrapreneurship, technopreneurship, cultural entrepreneurship, international entrepreneurship, netpreneurship, ecopreneurship, and social entrepreneurship **(10 Lectures)**

Unit 2: Entrepreneurship and Micro, Small and Medium Enterprises

Concept of business groups and role of business houses and family business in India; The contemporary role models in Indian business: their values, business philosophy and behavioural orientations; Conflict in family business and its resolution **(10 Lectures)**

Unit 3: Public and private system of stimulation, support and sustainability of entrepreneurship. Requirement, availability and access to finance, marketing assistance, technology, and industrial accommodation, Role of industries/entrepreneur's associations and self-help groups, The concept, role and functions of business incubators, angel investors, venture capital and private equity fund. **(10 Lectures)**

Unit 4: Sources of business ideas and tests of feasibility.

Significance of writing the business plan/ project proposal; Contents of business plan/ project proposal; Designing business processes, location, layout, operation, planning & control; preparation of project report (various aspects of the project report such as size of investment, nature of product, market potential may be covered); Project submission/ presentation and appraisal thereof by external agencies, such as financial/non-financial institutions **(10 Lectures)**

Unit 5: Mobilising Resources

(10 Lectures)

Mobilising resources for start-up. Accommodation and utilities; Preliminary contracts with the vendors, suppliers, bankers, principal customers; Contract management: Basic start-up problems

Suggested Readings:

1. Kuratko and Rao, *Entrepreneurship: A South Asian Perspective*, Cengage Learning.
2. Robert Hisrich, Michael Peters, Dean Shepherd, *Entrepreneurship*, McGraw-Hill Education
3. Desai, Vasant. *Dynamics of Entrepreneurial Development and Management*. Mumbai, Himalaya Publishing House.
4. Dollinger, Mare J. *Entrepreneurship: Strategies and Resources*. Illinois, Irwin.
5. Holt, David H. *Entrepreneurship: New Venture Creation*. Prentice-Hall of India, New Delhi.
6. Plsek, Paul E. *Creativity, Innovation and Quality*. (Eastern Economic Edition), New Delhi: Prentice-Hall of India. ISBN-81-203-1690-8.
7. Singh, Nagendra P. *Emerging Trends in Entrepreneurship Development*. New Delhi: ASEED.
8. SS Khanka, *Entrepreneurial Development*, S. Chand & Co, Delhi.
9. K Ramachandran, *Entrepreneurship Development*, McGraw-Hill Education
10. SIDBI Reports on Small Scale Industries Sector.

Note: Latest edition of text books may be used.

COM-SEC-HC-3044(B): New Venture Planning

Total marks: 100

Credit: 4

Lectures:50

Objective: The curriculum aims at giving exposure to students regarding different aspects of setting up a new business. After completing the course student should be able to develop an understanding of the process of identifying various sources of new business ideas of products and services. The understanding of this paper will help them to examine, evaluate and approach different sources of finance, the nature of marketing effort required and to develop a comprehensive business plan.

Unit I: Starting New Ventures

Opportunity identification. The search for new ideas, source of innovative ideas. Techniques for generating ideas. Entrepreneurial imagination and creativity. The role of creative thinking. Developing your creativity. Impediments to creativity.

Unit II: Methods to Initiate Ventures

The pathways to New Venture for Entrepreneurs, Creating New Ventures. Acquiring an established Venture; Advantages of acquiring an ongoing Venture. Examination of key issues. Franchising. How a Franchise works. Franchise law; Evaluating the franchising opportunities.

Unit III: Legal Challenges in Setting up Business

Intellectual Property protection: Patents, Trademarks, and Copyrights. Requirements and Procedure for filing a Patent, Trademark and Copyright, Legal acts governing businesses in India. Identifying Form of Organisation; Sole proprietorship, Partnership, Limited Liability Partnership and Company.

Unit-IV: the Search for Entrepreneurial Capital

The Entrepreneur's Search for Capital. The Ventures Capital Market. Criteria for evaluating New –Venture proposals. Evaluating the Venture Capitalist. Financing stages. Alternate Sources of Financing for Indian Entrepreneurs. Bank Funding. Government Policy Packages. State Financial Corporations (SFCs). Business Incubators and Facilitators. Informal risk capital; Angel Investors.

Unit V: The Marketing Aspects of New Ventures

Developing a Marketing Plan: Customer Analysis, Sales Analysis and Competition Analysis. Market Research. Sales Forecasting. Evaluation. Pricing Decision.

Unit VI: Business Plan Preparation for New Ventures

Business Plan; Concept, pitfalls to Avoid in Business Plan. Benefits of a Business Plan. Developing a Well-Conceived Business Plan. Elements of a Business Plan; Executive Summary; Business Description. Marketing; Market niche and Market Shares. Research. Design and Development. Operations. Management, Finance. Critical-Risk. Harvest Strategy. Milestone Schedule.

Suggested Case Studies: Case studies related to business or start ups in e-commerce, services, retailing, travel and hospitality.

COM-HC-4016: COST ACCOUNTING

Marks: 100

Credit: 6

Lectures: 65

Objective: To acquaint the students with basic concepts used in cost accounting, various methods involved in cost ascertainment and cost accounting book keeping systems.

CONTENTS:

Unit 1: Introduction

12

Meaning, objectives and advantages of cost accounting; Difference between cost accounting and financial accounting; Cost concepts and classifications; Elements of cost and preparation of Cost Sheet; Installation of a costing system; Role of a cost accountant in an organisation

Unit 2: Elements of Cost: Material

14

Material/inventory control techniques. Accounting and control of purchases, storage and issue of materials. Methods of pricing of materials issues — FIFO, LIFO, Simple Average, Weighted Average, Replacement, Standard Cost. Treatment of Material Losses, Stores ledger, EOQ, levels of Inventory

Unit 3: Elements of Cost: Labour:

14

Accounting and Control of labour cost. Time keeping and time booking. Concept and treatment of idle time, over time, labour turnover and fringe benefits. Methods of wage payment and the Incentive schemes- Halsey, Rowan, Taylor's Differential piece wage.

Unit 4: Elements of Cost: Overheads

14

Classification, allocation, apportionment and absorption of overheads; Under- and over-absorption; Calculation of Machine Hour Rate; Treatments interest on capital, depreciation, packing expenses, bad debts, research and development expenses.

Unit 5: Methods of Costing

14

Unit costing, Job costing, Contract costing, Process costing (including treatment of process losses, valuation of work in progress).

Unit 6: Book Keeping in Cost Accounting

12

Integral and non-integral systems; Reconciliation of cost and financial accounts.

Suggested Reading:

1. Charles T. Horngren, Srikant M. Datar, Madhav V. Rajan , *Cost Accounting: A Managerial Emphasis, Pearson Education.*
2. Drury, Colin. *Management and Cost Accounting.* Cengage Learning.
3. Jawahar Lal, *Cost Accounting.* McGraw Hill Education
4. Nigam, B.M. Lall and I.C. Jain. *Cost Accounting: Principles and Practice.* PHI Learning
5. Rajiv Goel, *Cost Accounting.* International Book House
6. Singh, Surender. *Cost Accounting,* Scholar Tech Press, New Delhi.
7. Jain, S.P. and K.L. Narang. *Cost Accounting: Principles and Methods.* Kalyani Publishers
8. Arora, M.N. *Cost Accounting – Principles and Practice.* Vikas Publishing House, New Delhi.
9. Maheshwari, S.N. and S.N. Mittal. *Cost Accounting: Theory and Problems.* Shri Mahavir Book Depot, New Delhi.
10. Iyengar, S.P. *Cost Accounting.* Sultan Chand & Sons
11. H.V. Jhamb, *Fundamentals of Cost Accounting,* Ane Books Pvt. Ltd.

Note: Latest edition of text books shall be used.

COM-HC-4026: BUSINESS MATHEMATICS

Marks: 100

Credit: 6

Lectures: 65

Objective : The objective of this course is to familiarize the students with the basic Financial mathematics tools, with an emphasis on applications to business and economic situations.

Unit 1 : Matrices and Determinants

10 Lectures

- Algebra of Matrices, Matrix operation- Business Application, Determinant of a square matrix. Evaluation determinant of order three (Properties of determinants to be excluded). Inverse of a matrix.
- Solution of system of linear equations (having unique solution and involving not more than three variables) using Cremer's Rule.

Unit 2 : Calculus I.

10 Lectures

- Mathematics functions and their types – linear, quadratic, polynomial, exponential and logarithmic functions.
- Concept of limit and continuity of a function.
- Concept of differentiation, Rules of differentiation (upto product rule). Derivatives of e^x , a^x , $\log x$ (only result). Differentiation of simple algebraic functions. Maxima and minima involving second order derivative (relating to cost, revenue and profit).
- Concept of Marginal Analysis- The common marginal concept in economics and their application in Business. Profit Maximisation under Monopoly. Economic Order Quantity.

Unit 3 : Calculus II.

7 Lectures

- Functions of several variables. Concept of partial differentiation. Partial differentiation of simple functions.
- Integration- Preliminary idea and standard forms- integration formulae for e^x , a^x , x^{-1} and x^n ($n \neq -1$) . Integration by substitution (simple cases only).
- Definite Integration- Finding it for simple cases.
- Application of integration to marginal analysis in business.

Unit 4 : Mathematics of Finance. - I

15 Lectures

- Concept of simple and compound interest. Solution of related problems.
- Rates of interest-nominal, effective and their inter-relationships in different compounding situations.
- Compounding and discounting of a sum using different type of rates.
- Types of annuities: ordinary, due, differed, continues, perpetual there future and present values using different types of rates of interest. Depreciation of Assets. Definition of sinking fund (*General annuities to be excluded*).

Unit 5 : Mathematics of Finance. - II

15 Lectures

- Time and work : Simple cases.
- Profit, Loss and discount.
- Shares- Concept of share, face value, Market value, equity shares, preferential shares, dividend, bonus shares. Simple examples.
- Arithmetic and Geometric Progration (AP and GP)-
Basic ideas of A.P. and G.P. Example on commercial application to AP and GP only.
- Ratio and proportion- Finding the missing term of the proportion, amount tribution and merging of two ratios in one.
- Concept of mixture and its examples.

Unit 6 : Linear Programming

8 Lectures

- Linear Programming :
Sketching of graphs of (i) Linear equation $ax + by + c=0$ and (ii) Linear inequalities
- Formulation of linear programming problem (LPP). Graphical solution to LPP

involving not more than two variables.

Suggested Readings :

- 1) Singh J.K. Business Mathematics. Himalaya Publishing House.
- 2) Ayres, Frank Jr. Schaum's Outlines Series: Theory and Problems of Mathematics of Finance McGraw Hill Education.
- 3) Aggarwal, R.S., Quantitative Aptitude, S. Chand.
- 4) Text Book of Business Mathematics, Padmalochan Hazarika, S. Chand.

COM-HC-4036: HUMAN RESOURCE MANAGEMENT

Marks: 100

Credit: 6

Lectures: 65

Objective: The objective of the course is to acquaint students with the techniques and principles to manage human resource of an organisation.

Objective: The objective of the course is to acquaint students with the techniques and principles to manage human resource of an organisation.

Unit 1: Introduction

10 Lectures

Human Resource Management: Concept, Activities and Functions, Concept of Human Capital, Role Status and competencies of HR Manager, HR Policies, HRM vs HRD. Emerging Challenges of Human Resource Management; Empowerment; Downsizing; Human Resource Information System and Human Resource Accounting.

Unit 2: Acquisition of Human Resource

15 Lectures

Human Resource Planning- Quantitative and Qualitative dimensions; job analysis – job description and job specification; Recruitment- Process, Methods, Sources, Selection – Concept and process; test and interview; placement and induction

Unit 3: Training and Development

15 Lectures

Concept and Importance; Identifying Training and Development Needs; Training Programmes, Types, Evaluating Training Effectiveness; Training Process Outsourcing; Management Development; Career Development, Managing employee well being and concept of work life balance and quality of work life.

Unit 4: Performance Appraisal

15 Lectures

Nature, objectives and importance; Modern techniques and systems of performance appraisal; potential appraisal and employee counseling; transfers and promotions; Compensation: concept and policies; job evaluation; methods of wage payments and incentive plans; fringe benefits.

Unit 5: Maintenance

10 Lectures

Employee health and safety; employee welfare; social security; Employer-Employee relations- an overview; concept of redeployment, redundancy, attrition, VRS, downsizing, layoffs and retrenchment, ethics and HRM.

Suggested Readings:

1. Gary Dessler. *A Framework for Human Resource Management*. Pearson Education.
2. DeCenzo, D.A. and S.P. Robbins, *Personnel/Human Resource Management*, Pearson Education.
3. Bohlander and Snell, *Principles of Human Resource Management*, Cengage Learning
4. Ivancevich, John M. *Human Resource Management*. McGraw Hill.
5. Wreather and Davis. *Human Resource Management*. Pearson Education.
6. Robert L. Mathis and John H. Jackson. *Human Resource Management*. Cengage Learning.
7. TN Chhabra, *Human Resource Management*, Dhanpat Rai & Co., Delhi
8. Biswajeet Pattanayak, *Human Resource Management*, PHI Learning
9. Neeru Kapoor, *Human Resource Management*, Taxmann Publication

Note: Latest edition of text books may be used.

COM-GE-4046(A): INDIAN ECONOMY

Marks: 100

Credit: 6

Lectures: 65

Objective: This course seeks to enable the student to grasp the major economic problems in India and their solution.

Unit 1: Basic Issues in Economic Development (10 Lectures)

Concept and Measures of Development and Underdevelopment; Human Development

Unit 2: Basic Features of the Indian Economy at Independence (10 Lectures)

Composition of national income and occupational structure, the agrarian scene and industrial structure

Unit 3: Policy Regimes (10 Lectures)

- a) The evolution of planning and import substituting industrialization.
- b) Economic Reforms since 1991.
- c) Monetary and Fiscal policies with their implications on economy

Unit 4: Growth, Development and Structural Change (15 Lectures)

- a) The experience of Growth, Development and Structural Change in different phases of growth and policy regimes across sectors and regions.
- b) The Institutional Framework: Patterns of assets ownership in agriculture and industry; Policies for restructuring agrarian relations and for regulating concentration of economic power;
- c) Changes in policy perspectives on the role of institutional framework after 1991.
- d) Growth and Distribution; Unemployment and Poverty; Human Development; Environmental concerns.
- e) Demographic Constraints: Interaction between population change and economic development.

Unit 5 (A): Sectoral Trends and Issues (20 Lectures)

- a) *Agriculture Sector:* Agrarian growth and performance in different phases of policy regimes i.e. pre green revolution and the two phases of green revolution; Factors influencing productivity and growth; the role of technology and institutions; price policy, the public distribution system and food security.
- b) *Industry and Services Sector:* Phases of Industrialisation – the rate and pattern of industrial growth across alternative policy regimes; Public sector – its role, performance and reforms; The small scale sector; Role of Foreign capital.
- c) *Financial Sector:* Structure, Performance and Reforms. Foreign Trade and balance of Payments: Structural Changes and Performance of India's Foreign Trade and Balance of Payments; Trade Policy Debate; Export policies and performance; Macro Economic Stabilisation and Structural Adjustment; India and the WTO, Role of FDI, Capital account convertibility,

5(B) Industrialization in North Eastern Region- Types of industries, industrial policies, Act East policy, Cross Border Trade, Border Area Development, Institutions – NEDFI, DONNER, NEC.

Suggested Readings:

1. Mishra and Puri, *Indian Economy*, Himalaya Publishing House
2. IC Dhingra, *Indian Economics*, Sultan Chand & Sons
3. Gaurav Dutt and KPM Sundarum, *Indian Economy*, S. Chand & Company.
4. Bhagwati, J. and Desai, P. *India: Planning for industrialization*, OUP, Ch 2.
5. Patnaik, Prabhat. *Some Indian Debates on Planning*. T. J. Byres (ed.). *The Indian Economy: Major Debates since Independence*, OUP.

6. Ahluwalia, Montek S. *State-level Performance under Economic Reforms in India* in A. O. Krueger. (ed.). *Economic Policy Reforms and the Indian Economy*, The University of Chicago Press.
7. Dreze, Jean and Amartya Sen. *Economic Development and Social Opportunity*. Ch. 2. OUP.
8. Khanna, Sushil. *Financial Reforms and Industrial Sector in India*. *Economic and Political Weekly*. Vol. 34. No. 45.
9. Uma Kapila (ed), “*Indian Economy since Independence*”, Relevant articles.
10. Rangarajan, C. and N. Jadhav. *Issues in Financial Sector Reform*. Bimal Jalan. (ed). *The Indian Economy*. Oxford University Press, New Delhi.

Note: Latest edition of text books may be used.

COM-GE-4046 (B): MICRO FINANCE

Credit 6

Credit: 6

Lectures 65

Course Objective: The course aims to make the students understand the basic concepts of micro-finance and its importance, institution structure, management of micro-finance institutions and microfinance in Indian context.

Course Content:

Unit I: Micro Finance - Meaning and Concept, Nature and Scope, Objectives of micro finance, micro finance and micro credit, Evolution and characteristics of micro finance, Benefits of micro finance, Development of micro finance in India. **13 Lectures**

Unit II: Micro finance Institutions- Structure of micro finance institutions, various models of micro finance institutions and their functions, sources of fund, credit delivery mechanism for micro credit, Non-financial services and MFIs. **13 Lectures**

Unit III: Micro finance in India- Indian financial sector- financial inclusion, micro finance movement in India, demand for and supply of micro financial services, Role of NABARD for micro finance, Problems and Prospects of MF in India. **13 Lectures**

Unit IV: Management of MFIs- Fund Management, Various types of risk in MFIs and their management, Performance Management- measurement of operational efficiency and productivity, Impact Assessment and Social Assessment of MFIs. **13 Lectures**

Unit V: Legal and Regulatory Framework for Micro Finance, Need for Regulation of MF and MFIs, Various Laws governing MF activities in India, The Cooperative society Act., The RBI Act, The Banking Regulation Act, The Micro Finance Institutions (Development and Regulation) Bill 2012. **13 Lectures**

Suggested Books:

1. Micro Finance: Perspectives and Operations, IIBF, Macmillan, 2009.
2. Micro Finance-Redefining the Future, V. Somnath, Excel Books.
3. Fundamentals of Micro Finance, D.Das and R Tiwari, Global Publishing House, Guwahati (India).
4. Understanding Micro Finance, D. Panda, Wiley India Pvt. Ltd., 2009.
5. The Economics of Microfinance, Armendr Z, Beatriz, Morduch and Jonathan, PHI.
6. Micro Finance: Impacts and Insight, Rajgopalan S and Nirali Parikh, ICFAI Press.

COM-SEC-HC-4054(A): E-COMMERCE

Marks: 100

Credit: 4

Lectures: 40, Practical Lab 26

Objectives: To enable the student to become familiar with the mechanism for conducting business transactions through electronic means

Contents

Unit 1: Introduction:

(8 Lectures)

Meaning, nature, concepts, advantages, disadvantages and reasons for transacting online, types of E-Commerce, e-commerce business models (introduction, key elements of a business model and categorizing major E-commerce business models), forces behind e-commerce.

Technology used in E-commerce: The dynamics of world wide web and internet(meaning, evolution and features) ; Designing, building and launching e-commerce website (A systematic approach involving decisions regarding selection of hardware, software, outsourcing vs. in-house development of a website)

Unit 2: Security and Encryption:

(8 Lectures)

Need and concepts, the e-commerce security environment: (dimension, definition and scope of e-security), security threats in the E-commerce environment (security intrusions and breaches, attacking methods like hacking, sniffing, cyber-vandalism etc.), technology solutions (Encryption, security channels of communication, protecting networks and protecting servers and clients),

Unit 3: IT Act 2000 and Cyber Crimes

(8 Lectures)

IT Act 2000: Definitions, Digital signature, Electronic governance, Attribution, acknowledgement and dispatch of electronic records, Regulation of certifying authorities, Digital signatures certificates, Duties of subscribers, Penalties and adjudication, Appellate Tribunal, Offences and Cyber-crimes

Unit 4: E-payment System:

(8 Lectures, 4 Practical Lab)

Models and methods of e-payments (Debit Card, Credit Card, Smart Cards, e-money), digital signatures (procedure, working and legal position), payment gateways, online banking (meaning, concepts, importance, electronic fund transfer, automated clearing house, automated ledger posting), risks involved in e-payments.

Unit 5: On-line Business Transactions:

(8 Lectures, 4 Practical Lab)

Meaning, purpose, advantages and disadvantages of transacting online, E-commerce applications in various industries like {banking, insurance, payment of utility bills, online marketing, e-tailing (popularity, benefits, problems and features), online services (financial, travel and career), auctions, online portal, online learning, publishing and entertainment} Online shopping (amazon, snapdeal, alibaba, flipkart, etc.)

Unit 6: Website designing

(18 Practical Lab)

Introduction to HTML; tags and attributes: Text Formatting, Fonts, Hypertext Links, Tables, Images, Lists, Forms, Frames, Cascading Style Sheets.

Note:

1. There shall be 3 Credit Hrs. for lectures + One Credit hr. (2 Practical periods per week per batch) for Practical Lab

2. Latest edition of text books may be used.

Suggested Readings

1. Kenneth C. Laudon and Carlo Guercio Traver, *E-Commerce*, Pearson Education.
2. David Whiteley, *E-commerce: Strategy, Technology and Applications*, McGraw Hill Education
3. Bharat Bhaskar, *Electronic Commerce: Framework, Technology and Application, 4th Ed.*, McGraw Hill Education
4. PT Joseph, *E-Commerce: An Indian Perspective*, PHI Learning
5. KK Bajaj and Debjani Nag, *E-commerce*, McGraw Hill Education
6. TN Chhabra, *E-Commerce*, Dhanpat Rai & Co.
7. Sushila Madan, *E-Commerce*, Taxmann
8. TN Chhabra, Hem Chand Jain, and Aruna Jain, *An Introduction to HTML*, Dhanpat Rai & Co.

COM-SEC-HC 4054(B): E-Filing of Returns

Marks: 100

Credit: 4

Lectures: 50

Objective: To provide the students the concepts and practical knowledge about electronic filling of returns.

Unit I: Conceptual Framework

Meaning of e-filing; difference between e-filing and regular filing of returns; benefits and limitations of e-filing,. Types of e-filing process; relevant notifications.

Unit II: Income Tax and E-Filing of ITRs

Introduction to income tax – basic terminology, types of assessee, income taxable under different heads. Basics of computation of total income and tax liability, deductions available from gross total income, PAN Card, due date of filing of income tax return.

Instructions for filing out form ITR-1, ITR-2, ITR_3, ITR-4, ITR-4S, ITR-5, ITR-6.

Introduction to income tax Portal; preparation of electronic return (practical workshops).

Unit III: TDS and E-filing of TDS returns

Introduction to the concept of TDS; provision regarding return of TDS; types of forms for filing TDS returns; practical workshop on e-filing of TDS return.

Unit IV: Service Tax and E-filing of Service Tax Returns

Introduction to service tax; relevant notifications regarding e-filing of service tax return; steps for preparing service tax returns; practical workshop on e-filing of service tax returns.

Suggested Readings:

1. Ahuja, Girish and Gupta, Ravi, Systematic Approach to Income Tax, Bharat Law House, Delhi

Softwares:

1. Excel Utility available at incometaxindiafiling.gov.in

Note: Latest edition of text book may be used.

COM-HC-5016: PRINCIPLES OF MARKETING

Marks: 100

Credit: 6

Lectures: 65

Objective: The objective of this course is to provide basic knowledge of concepts, principles, tools and techniques of marketing.

Contents:

Unit 1: Introduction:

13 Lectures

Nature, scope and importance of marketing; Evolution of marketing; Selling vs Marketing; Marketing mix, Marketing environment: concept, importance, and components (Economic, Demographic, Technological, Natural, Socio-Cultural and Legal).

Unit 2:

13 Lectures

a. Consumer Behaviour: Nature and Importance, Consumer buying decision process; Factors influencing consumer buying behaviour.

b. Market segmentation: concept, importance and bases; Target market selection; Positioning concept, importance and bases; Product differentiation vs. market segmentation.

Unit 3: Product:

13 Lectures

Concept and importance, Product classifications; Concept of product mix; Branding, packaging and labeling; Product-Support Services; Product life-cycle; New Product Development Process; Consumer adoption process.

Unit 4:

13 Lectures

a. Pricing: Significance. Factors affecting price of a product. Pricing policies and strategies.

b. Distribution Channels and Physical Distribution: Channels of distribution - meaning and importance; Types of distribution channels; Functions of middle man; Factors affecting choice of distribution channel; Wholesaling and retailing; Types of Retailers; e-tailing, Physical Distribution.

Unit 5:

13 Lectures

a. Promotion: Nature and importance of promotion; Communication process; Types of promotion: advertising, personal selling, public relations & sales promotion, and their distinctive characteristics; Promotion mix and factors affecting promotion mix decisions;

b. Recent developments in marketing: Social Marketing, online marketing, direct marketing, services marketing, green marketing, Rural marketing; Consumerism

Suggested Readings:

1. Kotler, Philip, Gary Armstrong, Prafulla Agnihotri and Ehsanul Haque. *Principles of Marketing*. 13th edition. Pearson Education.
2. Michael, J. Etzel, Bruce J. Walker, William J Stanton and Ajay Pandit. *Marketing: Concepts and Cases*. (Special Indian Edition)., McGraw Hill Education
3. William D. Perreault, and McCarthy, E. Jerome., *Basic Marketing*. Pearson Education.
4. Majaro, Simon. *The Essence of Marketing*. Pearson Education, New Delhi.
5. The Consumer Protection Act 1986.
6. Iacobucci and Kapoor, *Marketing Management: A South Asian Perspective*. Cengage Learning.
7. Dhruv Grewal and Michael Levy, *Marketing*, McGraw Hill Education.
8. Chhabra, T.N., and S. K. Grover. *Marketing Management*. Fourth Edition. Dhanpat Rai & Company.
9. Neeru Kapoor, *Principles of Marketing*, PHI Learning
10. Rajendra Maheshwari, *Principles of Marketing*, International Book House

COM-HC-5026: FUNDAMENTALS OF FINANCIAL MANAGEMENT

Marks: 100

Credit: 6

Lectures: 52, Practical Lab 26

Objective: To familiarize the students with the principles and practices of financial management.

CONTENTS

Unit 1: Introduction

(8 Lectures)

Nature, scope and objective of Financial Management, Time value of money, Risk and return (including Capital Asset Pricing Model), Valuation of securities – Bonds and Equities

Unit 2: Investment Decisions

The Capital Budgeting Process, Cash flow Estimation, Payback Period Method, Accounting Rate of Return, Net Present Value (NPV), Net Terminal Value, Internal Rate of Return (IRR), Profitability Index, Capital budgeting under Risk – Certainty Equivalent Approach and Risk-Adjusted Discount Rate.

(12 Lectures, 16 Practical Lab)

Unit 3: Financing Decisions

Cost of Capital and Financing Decision: Sources of long-term financing Estimation of components of cost of capital. Methods for Calculating cost of equity capital, Cost of Retained Earnings, Cost of Debt and Cost of Preference Capital, Weighted Average cost of capital (WACC) and Marginal cost of capital. Capital structure –Theories of Capital Structure (Net Income, Net Operating Income, MM Hypothesis, Traditional Approach). Operating and financial leverage; Determinants of capital structure

(15 Lectures, 10 Practical Lab)

Unit 4: Dividend Decisions

Theories for Relevance and irrelevance of dividend decision for corporate valuation; Cash and stock dividends; Dividend policies in practice

(12 Lectures)

Unit 5: Working Capital Decisions

Concepts of working capital, the risk-return trade off, sources of short-term finance, working capital estimation, cash management, receivables management, inventory management and payables management.

(15 Lectures)

Note:

- 1. In addition the students will work on Spreadsheet for doing basic calculations in finance (Unit 2 and 3 above) and hence can be used for giving students subject related assignments for their internal assessment.**
- 2. There shall be 4 Credit Hrs. for Lectures + one Credit hr. (Two Practical Periods per week per batch) for Practical Lab + one credit Hr for Tutorials (per group)**
- 3. Latest edition of text books may be used.**

Suggested Readings

1. James C. Van Horne and Sanjay Dhamija, *Financial Management and Policy*, Pearson Education
2. Levy H. and M. Sarnat . *Principles of Financial Management*. Pearson Education
3. Brigham and Houston, *Fundamentals of Financial Management*, Cengage Learning
4. Khan and Jain. *Basic Financial Management*, McGraw Hill Education
5. Prasanna Chandra, *Fundamentals of Financial Management*. McGraw Hill Education
6. Singh, J.K. *Financial Management- text and Problems*. Dhanpat Rai and Company, Delhi.
7. Rustagi, R.P. *Fundamentals of Financial Management*. Taxmann Publication Pvt. Ltd.

8. Singh, Surender and Kaur, Rajeev. *Fundamentals of Financial Management*. Mayur Paperback, New Delhi.
9. Pandey, I.M. *Financial Management*. Vikas Publications.
10. Bhabatosh Banerjee, *Fundamentals of Financial Management*, PHI Learning

COM-DSE-HC-5036(A): MANAGEMENT ACCOUNTING

Marks: 100

Credit: 6

Lectures: 65

Objective: To impart the students, knowledge about the use of financial, cost and other data for the purpose of managerial planning, control and decision making.

COURSE CONTENTS:

Unit 1: Introduction

13

Meaning, Objectives, Nature and Scope of management accounting, Difference between cost accounting and management accounting, Application of Cost concepts for managerial decision making; Concept of Cost control and Cost reduction, Cost management

Unit 2: Financial Statement Analysis:

13

Meaning and objectives of Financial Statement Analysis; Techniques of Financial Statement analysis – Comparative Statement, Common-size Statement and Trend Analysis. Meaning of Accounting Ratio, Classification of Accounting Ratios; objectives of Ratio Analysis; Advantages and Limitations of Ratio Analysis; Precaution to be taken before using Ratios; Computation of various Ratios – Activity Ratios, Liquidity Ratios, Solvency and Leverage Ratios and Profitability Ratios;

Unit 3: Budgetary Control

13

Budgeting and Budgetary Control: Concept of budget, budgeting and budgetary control, objectives, merits, and limitations. Budget administration. Functional budgets. Cash Budget. Fixed and flexible budgets. Preparation of Cash Budget **and** flexible budgets.

Unit 4: Standard Costing

13

Standard Costing and Variance Analysis: Meaning of standard cost and standard costing, advantages, limitations and applications. Variance Analysis – material, labour, overheads and sales variances. Disposition of Variances.

Unit 5: Marginal Costing

13

Absorption versus Variable Costing: Distinctive features and income determination. Cost-Volume-Profit Analysis, Profit / Volume ratio. Break-even analysis-algebraic and graphic methods. Angle of incidence, margin of safety

Suggested Reading:

1. Charles T. Horngren, Gary L. Sundem, Dave Burgstahler, Jeff O. Schatzberg. *Introduction to Management Accounting*, Pearson Education.
2. Anthony A. Atkinson, Robert S. Kaplan, Ella Mae Matsumura, S. Mark Young. *Management Accounting*. Dorling Kindersley(India) Pvt. Ltd.
3. Ronald W. Hilton and David E. Platt. *Managerial Accounting: Creating Value in a Global Business Environment*, Mc Graw Hill Education.
4. Singh, Surender. *Management Accounting*, Scholar Tech Press, New Delhi.
5. Goel, Rajiv, *Management Accounting*. International Book House,
6. Arora, M.N. *Management Accounting*. Vikas Publishing House, New Delhi.
7. Maheshwari, S.N. and S.N. *Management Accounting*. Shree Mahavir Book Depot, New Delhi.
8. Singh, S. K. and Gupta Lovleen. *Management Accounting – Theory and Practice*. Pinnacle Publishing House.
9. Khan, M.Y. and Jain, P.K. *Management Accounting*. McGraw Hill Education
10. H.V. Jhamb, *Fundamentals of Management Accounting*, Ane Books Pvt. Ltd.

COM-DSE-HC-5036(A): ADVANCED FINANCIAL ACCOUNTING

Total: 100

Credit: 6

Lectures: 65

Objective: The course aims to impart advanced knowledge on financial accounting applicable in business of special nature and on Government accounting system.

Unit 1: Royalty

10 Lectures

Royalty accounts: Meaning of Royalty, Minimum Rent and Short working. Accounting Treatment and preparation of Royalty Account (manually and using appropriate accounting software) including impact of Strikes & Lockouts, excluding Sub-lease.

Unit 2: Departmental Accounts: Meaning and objectives; allocation of common expenses; System of preparation of departmental trading and profit and loss accounts (manually and using appropriate accounting software); inter-department transfer. **10 Lectures**

Unit 3: Accounting for Amalgamation and Dissolution of Partnership Firms

Accounting for Dissolution of Partnership Firm including insolvency of partners, Sale to a limited company and piecemeal distribution. Accounting for Amalgamation of Partnership Firms **15 Lectures**

Unit 4: Insurance Claims

Insurance policy for a business firm – Procedure for taking up Insurance Policy for loss stock and loss of profit; Meaning of Insurance claims, procedure to lodge insurance claim; Average clause and indemnity period. Procedure of ascertaining loss of stock and loss of profit; Ascertainment of claims against loss of stock and loss of profit. **15 Lectures**

Unit 5: Government Accounting

Meaning, features and Objectives of Government Accounting; difference between Commercial Accounting and Government Accounting; General Principles of Government Accounting; Demand for Grant, Appropriation Accounts, Re-appropriation; System of financial administration and financial control in India; Accounts keeping of the Government; Classification of Accounts – Consolidated Fund, Contingency Fund and Public Accounts; Government Accounting Standards Advisory Board. **15 Lectures**

Suggested Readings:

- Anthony, R., Hawkins, D., & Merchant, K. A. (2010). *Accounting: Text and Cases*. New York: McGraw-Hill Education.
- Goyal, B. K., & Tiwari, H. N. (2019). *Financial Accounting*. New Delhi: Taxmann Publication.
- Jain, S. P., & Narang, K. L. (2016). *Advanced Accountancy*. New Delhi: Kalyani Publishers.
- Horngren, C. T., Sundem, G. L., Elliott, J. A., & Philbrick, D. (2013). *Introduction to Financial Accounting*. London: Pearson Education.
- Maheshwari, S. N., Maheshwari, S. K., & Maheshwari, S. K. (2018). *Financial Accounting*. New Delhi: Vikas Publishing House Pvt. Ltd.
- Monga, J. R. (2017). *Financial Accounting: Concepts and Applications*. New Delhi: Mayur
- Godwin, N., Alderman, W., & Sanyal, D. (2016). *Financial Accounting*. Boston: Cengage Learning.
- Shukla, M. C., Grewal, T. S., & Gupta, S. C. (2016). *Advanced Accounts*. Vol.-I. New Delhi: S. Chand Publishing.
- Tulsian, P. C. (2007). *Financial Accounting*. New Delhi: Tata McGraw Hill Publishing Co. Ltd.
- Dam, B. B., & Gautam, H. C. (2019). *Advanced Accounting*. Gayatri Publications, Guwahati.

COM-DSE-HC-5036(C): ADVERTISING

Marks: 100

Credit: 6

Lectures: 65

Objective: The objective of this course is to familiarize the students with the basic concepts, tools and techniques of advertising used in marketing.

Unit 1: Introduction: 10

Communication Process; Advertising as a tool of communication; Meaning, nature and importance of advertising; Types of advertising; Advertising objectives. Audience analysis; Setting of advertising budget: Determinants and major methods

Unit 2: Media Decisions: 15

Major media types - their characteristics, internet as an advertising media, merits and demerits; Factors influencing media choice; media selection, media scheduling, Advertising through the Internet-media devices

Unit 3: Message Development; 15

Advertising appeals, Advertising copy and elements, Preparing ads for different media

Unit 4: Measuring Advertising Effectiveness: 15

Evaluating communication and sales effects; Pre- and Post-testing techniques.

Unit 5: 10

a) **Advertising Agency:** Role, types and selection of advertising agency.

b) Social, ethical and legal aspects of advertising in India.

Suggested Readings:

1. George E Belch, Michael A Belch, Keyoor Purani, *Advertising and Promotion : An Integrated Marketing Communications Perspective (SIE)*, McGraw Hill Education
2. S. Wats Dunn, and Arnold M. Barban. *Advertising: Its Role in Marketing*. Dryden Press
3. Burnett, Wells, and Moriatty. *Advertising: Principles and Practice*. 5th ed. Prentice Hall of India, New Delhi.
4. Batra, Myers and Aakers. *Advertising Management*. PHILearning.
5. Terence A. Shimp. *Advertising and Promotion: An IMC Approach*. Cengage Learning.
6. Sharma, Kavita. *Advertising: Planning and Decision Making*, Taxmann Publications
7. Jaishree Jethwaney and Shruti Jain, *Advertising Management*, Oxford University Press, 2012
8. Chunawala and Sethia, *Advertising*, Himalaya Publishing House
9. Ruchi Gupta, *Advertising*, S. Chand & Co.
10. O'Guinn, *Advertising and Promotion: An Integrated Brand Approach*, Cengage Learning.

Note: Latest edition of text books may be used.

COM-DSE-HC-5036 (D): BANKING

Credit 6

Total Marks: 100

Lectures 65

UNIT-I

13

Introduction: Bank-Meaning and functions, Origin and development of banking in India, Types of banks, Structure of commercial banks in India - public and private sector banks, Scheduled and Non-scheduled Banks; E-Banking-meaning, different types of services and products like ATM, debit and credit cards, phone banking, internet banking, EFT-RTGS and NEFT.

UNIT-II

13

Banker –customer relationship; Definition of banker and customer, general relationship, rights and obligations of a banker, Garnishee order. Banking Ombudsman Scheme.

Customers' account with the banker- fixed deposit account, savings account, current account- opening and operation of savings and current account, account facilities available for NRIs, KYC Guidelines

Special types bank customers – minor, illiterate persons, joint account, partnership account, Joint Stock Company.

UNIT-III

13

Employment of bank funds; Liquid assets- significance of liquidity in banking, cash balance, statutory reserve in the RBI; Loans and advances- principles of sound lending, types of credit, cash credit system, overdraft, loan system; Pledge, hypothecation and mortgage, collateral security.

UNIT-IV

13

Negotiable Instruments- Definition, features, types of negotiable instruments, holder and holder in due course, payment in due course; endorsements- meaning, kinds; crossing of cheque- types, significance, payment, collection of cheque, precautions, material alterations, statutory protection to paying and collecting banker.

UNIT-V

13

Banking Regulation Act; requirements as to minimum paid-up capital and reserves, constitution of Board of Directors, loans and advances, licensing of banking companies, accounts and audit, powers of the RBI, Banking Sector Reforms and Governance: prudential norms relating to capital adequacy, income recognition, asset classification.

SUGGESTED READINGS:

1. D.M. Mithani and E. Gordon, Banking and Financial System, Himalaya Publishing House.
2. D. Muraleadharn, Modern Banking, Prentice Hall of India, New Delhi.
3. Indian Institute of Banking and Finance, Principles of Banking, Macmillan.
4. K. C. Sekhar and L.Sekhar, Banking Theory and Finance, Vikas Publishing House.
5. P.N. Varshney, Banking Law & Practice, Sultan Chand & Sons
6. S.N. Maheswari & S.K. Maheswari, Banking Law & Practice, Kalyani Publishers
7. S. Natarajan and R. Parameswaram, Indian Banking, Sultan Chand & Sons.

COM-DSE-HC-5036 (E): COMPUTERISED ACCOUNTING SYSTEM

Marks: 100

Credit: 6

Lectures: 52, Practical Lab: 52

Objectives: This course seeks to enhance the skills needed for computerized accounting system and to enable the students to develop simple accounting applications.

Unit-1: Computerized Accounting: Using Generic Software (12 Lectures, 12 Practical Lab)

Taxation: TDS, VAT and Service Tax

Auditing in Computerized Accounting system: Statutory Audit, Voucher verification, Verification of related party transaction, CAAT: Various Tools

Unit-2: Designing Computerised Accounting System (24 Lectures, 24 Practical Lab)

Designing Computerised Accounting System using a DBMS Package

Creating a voucher entry Form,

Preparing ledgers with SQL, Form, and Report

Preparing Trial Balance with SQL and Report

Unit-3: Designing Accounting Support System (16 Lectures, 16 Practical Lab)

Designing Supplier and customers System for Accounting using Form, Query, Module, and Report; Designing Payroll System for Accounting using Form, Query, Module, and Report

Note:

1. The General Purpose Software referred in this course will be notified by the University Departments every three years. If the specific features, referred in the detailed course above, is not available in that software, to that extent it will be deemed to have been modified.
2. There shall be a practical examination of 100 Marks (Practical-80 Marks, Viva-10 Marks and Work Book- 10 Marks) and duration of Examination shall be 3 Hrs.
3. Teaching arrangements need to be made in the computer Lab
4. There shall be Four Lectures per class and 4 Practical periods per batch to be taught in computer Lab.

Suggested Readings:

The suggested readings and guidelines shall be notified by the university department at least once in three years based on the selected software.

COM-DSE-HC-5036(F): Indian Financial System

Marks: 100

Credit: 6

Lectures: 65

Objective: To provide students the basic knowledge of Indian Financial System and its components, institutions and their functions.

Contents

Unit-1: Introduction

Lectures 10

Financial System-Meaning, Components of Financial system, Functions of Financial System, Financial System and Economic Development, Overview of Indian Financial System.

Unit – 2: Financial markets

Lectures 15

Financial Market- Classifications of Financial Markets; Money market- its constitutions, functions and significance; Capital Market- Primary and secondary market, functions of capital market and its significance.

Unit-3: Financial Institutions

Lectures 15

Banking Financial Institutions- Types of Banks, Functions of Banks, Structure of Indian Banking System; Non-Banking Financial institutions, types and structure; Mutual Funds, Insurance Companies and Pension Funds.

Unit-4: Financial Services

Lectures 10

Meaning, features and importance, Types of Financial Services- Factoring, Leasing, Venture Capital, Consumer Finance and Housing Finance.

Unit-5: Regulatory Institutions

Reserve Bank of India- organization, objectives, Role and Functions; Securities and Exchange Board of India- Organization and objectives; Insurance Regulatory and Development Authority of India; Pension Fund Regulatory and Development Authority.

Lectures 15

Recommended Books:

1. The Indian Financial System by Bharati Pathak, Pearson Education.
2. Financial Institutions and Markets by L M Bhole, Tata MC Graw Hill.
3. Dynamics of Financial Markets and Institutions in India by R M Srivastava and Divya Nigam, Excel Books.
4. Indian Financial System by H R Machiraju, Vikas Publishing House.
5. The Indian Financial System and Development by Vasant Desai, Himalaya Publishing House.
6. Indian Financial System by P N Varshney and D K Mittal, Sultan Chand & Sons.

COM-HC-6016: AUDITING AND CORPORATE GOVERNANCE

Marks: 100

Credit: 6

Lectures: 65

Objective: To provide knowledge of auditing principles, procedures and techniques in accordance with current legal requirements and professional standards and to give an overview of the principles of Corporate Governance and Corporate Social Responsibility

Contents:

Unit 1: Introduction (11 Lectures)

Auditing: Introduction, Meaning, Objectives, Basic Principles and Techniques; Classification of Audit, Audit Planning, Internal Control – Internal Check and Internal Audit; Audit Procedure – Vouching and verification of Assets & Liabilities.

Unit 2: Audit of Companies (11 Lectures)

Audit of Limited Companies: Company Auditor- Qualifications and disqualifications, Appointment, Rotation, Removal, Remuneration, Rights and Duties Auditor's Report- Contents and Types. Liabilities of Statutory Auditors under the Companies Act 2013

Unit 3: Special Areas of Audit (11 Lectures)

Special Areas of Audit: Special features of Cost audit, Tax audit, and Management audit; Recent Trends in Auditing: Basic considerations of audit in EDP Environment; Computer aided audit techniques and tools; Auditing Standards; Relevant Case Studies/Problems;

Unit 4: Corporate Governance (11 Lectures)

Conceptual framework of Corporate Governance: Theories & Models, Broad Committees; Corporate Governance Reforms. Major Corporate Scandals in India and Abroad: Common Governance Problems Noticed in various Corporate Failures. Codes & Standards on Corporate Governance

Unit 5: Business Ethics (10 Lectures)

Morality and ethics, business values and ethics, approaches and practices of business ethics, corporate ethics, ethics program, codes of ethics, ethics committee; Ethical Behaviour: Concepts and advantages; Rating Agencies; Green Governance; Clause 49 and Listing Agreement

Unit 6: Corporate Social Responsibility (CSR): (11 Lectures)

Concept of CSR, Corporate Philanthropy, Strategic Planning and Corporate Social Responsibility; Relationship of CSR with Corporate Sustainability; CSR and Business Ethics, CSR and Corporate Governance; CSR provisions under the Companies Act 2013; CSR Committee; CSR Models, Codes, and Standards on CSR

Suggested Readings:

1. Ravinder Kumar and Virender Sharma, *Auditing Principles and Practice*, PHI Learning
2. Aruna Jha, *Auditing*. Taxmann Publication.
3. A. K. Singh, and Gupta Lovleen. *Auditing Theory and Practice*. Galgotia Publishing Company.
4. Anil Kumar, *Corporate Governance: Theory and Practice*, Indian Book House, New Delhi
5. MC Kuchhal, *Modern Indian Company Law*, Shri Mahaveer Book Depot. (Publishers). (Relevant Chapters)

6. KV Bhanumurthy and Usha Krishna, *Politics, Ethics and Social Responsibility of Business*, Pearson Education
7. Erik Banks, *Corporate Governance: Financial Responsibility, Controls and Ethics*, Palgrave Macmillan
8. N Balasubramanian, *A Casebook on Corporate Governance and Stewardship*, McGraw Hill Education
9. B.N. Ghosh, *Business Ethics and Corporate Governance*, McGraw Hill Education
10. S K Mandal, *Ethics in Business and Corporate Governance*, McGraw Hill Education
11. Bob Tricker, *Corporate Governance-Principles, Policies, and Practice (Indian Edition)*, Oxford University Press
12. Christine Mallin, *Corporate Governance (Indian Edition)*, Oxford University Press
13. Relevant Publications of ICAI on *Auditing (CARO)*
14. Sharma, J.P., *Corporate Governance, Business Ethics, and CSR*, Ane Books Pvt Ltd, New Delhi

Note: Latest edition of text books may be used.

COM-HC-6026: INDIRECT TAX LAWS

Marks: 100

Credit: 6

Lectures: 65

Objective: To provide basic knowledge and equip students with application of principles and provisions of Service Tax, VAT, Central Excise, and Customs Laws.

Contents:

Unit 1: Introduction:

(08 Lectures)

Meaning of Indirect Tax, History of Indirect Taxes in India; VAT – concepts and general principles, Calculation of VAT on Alcohol and Petroleum Products.

Unit 2: Central Excise

(08 Lectures)

Central Excise Law in brief, Excisable goods, Manufacture and Manufacturer, Valuation of Excise-able amount regarding Alcohol and Petroleum Products.

Unit 3: Customs Law

(12 Lectures)

Basic concepts of customs law, Territorial waters, high seas, Types of custom duties – Basic, Countervailing & Anti- Dumping Duty, Safeguard Duty, Valuation, Customs Procedures, Import and Export Procedures, Baggage, Exemptions.

Unit 4: Structure of GST in India:

(19 Lectures)

The Central Goods and Services Tax Act, 2017 and The Assam Goods and Services Tax Act, 2017, History of GST in India, Meaning, Features and Advantages of GST.

Dual GST Model: CGST, SGST, UTGST, IGST, Taxes subsumed by GST, Commodities kept outside the scope of GST. Definition of important terms used in GST Act – concept of place of supply Adjudicating Authority, Agent, Aggregate Turnover, Agriculturist, Business, Business Vertical, Capital Goods, Casual Taxable Person, Goods, Input Tax, Inward Supply, Output Tax, Outward Supply, Place of Business, Services, Supplier.

GST Council and GST Network.

Unit 5: Registration, Levy and Collection of Tax under GST

(18 Lectures)

Concept of Tax Invoice under GST Section 31, Meaning, Eligibility and Conditions for taking Input Tax Credit; Threshold Limits for Registration, Persons liable for Registration, Persons not liable for Registration, Compulsory Registration in Certain Cases, Procedure for Registration, Deemed Registration; Rates structure of GST, Composition Scheme under GST, Assessment (only basic knowledge) Refunds.

Suggested Readings:

1. Singhanian Vinod K. and Monica Singhanian, *Students' Guide to Indirect Taxes*, Taxmann Publications Pvt. Ltd., Delhi.
2. V.S. Datey. *Indirect Tax Law and practice*, Taxmann Publications Pvt. Ltd., Delhi,
2. Sanjeev Kumar. *Systematic Approach to Indirect Taxes*,
3. S. S. Gupta. *Service Tax -How to meet your obligation* Taxmann Publications Pvt. Ltd., Delhi,
4. Grish Ahuja and Ravi Gupta, *Indirect Taxes*, Flair Publication PvtLtd

Note:

1. **This paper will be replaced by the Goods and Service Tax Law whenever this law is enforced.**
2. **Latest edition of text books may be used.**

COM-DSE-HC-6036(A): FUNDAMENTALS OF INVESTMENT

Marks: 100

Credit: 6

Lectures: 65

Objective: To familiarize the students with different investment alternatives, introduce them to the framework of their analysis and valuation and highlight the role of investor protection.

Contents

Unit 1: The Investment Environment (10 Lectures)

The investment decision process, Types of Investments – Commodities, Real Estate and Financial Assets, the Indian securities market, the market participants and trading of securities, security market indices, sources of financial information, Concept of return and risk, Impact of Taxes and Inflation on return.

Unit 2: Fixed Income Securities (15 Lectures)

Bond features, types of bonds, estimating bond yields, Bond Valuation types of bond risks, default risk and credit rating.

Unit 3: Approaches to Equity Analysis (15 Lectures)

Introductions to Fundamental Analysis, Technical Analysis and Efficient Market Hypothesis, dividend capitalisation models, and price-earnings multiple approach to equity valuation.

Unit 4: Portfolio Analysis and Financial Derivatives (15 Lectures)

Portfolio and Diversification, Portfolio Risk and Return; Mutual Funds; Introduction to Financial Derivatives; Financial Derivatives Markets in India

Unit 5: Investor Protection (10 Lectures)

Role of SEBI and stock exchanges in investor protection; Investor grievances and their redressal system, insider trading, investors' awareness and activism

Suggested Readings

1. C.P. Jones, *Investments Analysis and Management*, Wiley, 8th ed.
2. Prasanna Chandra, *Investment Analysis and Portfolio Management*, McGraw Hill Education
3. R.P. Rustogi, *Fundamentals of Investment*, Sultan Chand & Sons, New Delhi.
4. N.D. Vohra and B.R. Bagri, *Futures and Options*, McGraw Hill Education
5. Mayo, *An Introduction to Investment*, Cengage Learning.

COM-DSE-HC-6036(B): CONSUMER AFFAIRS AND CUSTOMER CARE

Marks: 100

Credit: 6

Lectures: 65

Objective: This paper seeks to familiarise the students with of their rights as a consumer, the social framework of consumer rights and legal framework of protecting consumer rights. It also provides an understanding of the procedure of redress of consumer complaints, and the role of different agencies in establishing product and service standards. The student should be able to comprehend the business firms' interface with consumers and the consumer related regulatory and business environment.

Unit 1: Conceptual Framework

13 Lectures Consumer and

Markets: Concept of Consumer, Nature of markets, Concept of Price in Retail and Wholesale, Maximum Retail Price (MRP) and Local Taxes, Fair Price, labeling and packaging

Experiencing and Voicing Dissatisfaction: Consumer Satisfaction/dissatisfaction-Grievances- complaint, Consumer Complaining Behaviour: Alternatives available to Dissatisfied Consumers; Internal and External Complaint handling: Corporate Redress Systems and Public Redress Systems

Unit 2: The Consumer Protection Act, 1986 (CPA)

13 Lecture

Objectives and Basic Concepts: Consumer, goods, service, defect in goods, deficiency in service, spurious goods and services, unfair trade practice, restrictive trade practice.

Organizational set-up under the Consumer Protection Act: Advisory Bodies: Consumer Protection Councils at the Central, State and District Levels, Basic Consumer Rights; Adjudicatory Bodies: District Forums, State Commissions, National Commission: Their Composition, Powers, and Jurisdiction (Pecuniary and Territorial), Role of Supreme Court under the CPA.

Unit 3: Grievance Redress Mechanism under the Consumer Protection Act, 1986: 13 lectures Who can file a complaint? Grounds of filing a complaint; Limitation period; Procedure for filing and hearing of a complaint; Disposal of cases, Relief/Remedy to be provided; Temporary Injunction, Enforcement of order, Appeal, frivolous and vexatious complaints; Offences and penalties.

Seven Leading Cases decided under Consumer Protection Act: Medical Negligence; Banking; Insurance; Housing & Real Estate; Electricity, Water, and Telecom Services; Education; Defective Product; Unfair Trade Practice.

Unit 4: Industry Regulators and Consumer Complaint Redress Mechanism

13 lectures

- i. Banking: RBI and Banking Ombudsman
- ii. Insurance: IRDA and Insurance Ombudsman
- iii. Telecommunication: TRAI
- iv. Food Products: FSSAI (an overview)
- v. Electricity Supply: Electricity Regulatory Commission
- vi. Advertising: ASCI

Unit 5: Consumer Protection in India

13 Lectures Consumer

Movement in India: Evolution of Consumer Movement in India. Formation of consumer organizations and their role in consumer protection, Recent developments in Consumer Protection in India, National Consumer Helpline, Citizens Charter, Product testing.

Quality and Standardization: Voluntary and Mandatory standards; Role of BIS, Indian Standards Mark (ISI), Ag-mark, Hallmarking, Licensing and Surveillance; ISO: An overview

Suggested Readings:

1. Khanna, Sri Ram, Savita Hanspal, Sheetal Kapoor, and H.K. Awasthi. *Consumer Affairs*” (2007) Delhi University Publication. 334 pp.
2. Aggarwal, V. K. (2003). *Consumer Protection: Law and Practice*. 5th ed. Bharat Law House, Delhi, or latest edition.
3. Girimaji, Pushpa (2002). *Consumer Right for Everyone* Penguin Books.
4. Nader, Ralph (1973). *The Consumer and Corporate Accountability*. USA, Harcourt Brace Jovanovich, Inc.
5. Sharma, Deepa (2011). *Consumer Protection and Grievance-Redress in India: A Study of Insurance Industry* (LAP LAMBERT Academic Publishing GmbH & Co.KG, Saarbrucken, Germany. 263 pp.
6. Empowering Consumers e-book, www.consumeraffairs.nic.in
7. ebook, www.bis.org
8. *The Consumer Protection Act, 1986*

Articles

1. Verma, D. P. S. (2002). Developments in Consumer Protection in India. *Journal of Consumer Policy*. Vol. 25. No. pp 107–123.
2. Verma, D.P.S. (2002). Regulating Misleading Advertisements, Legal Provisions and Institutional Framework. *Vikalpa*. Vol. 26. No. 2. pp.51-57.
3. Ralph L. Day and Laird E. Landon, Jr. (1997). Towards a Theory of Consumer Complaining Behaviour. Ag Woodside, et al. (eds.). *Consumer and Industrial Buying Behaviour*. New York; North Holland pp. 425-37.
4. George, S. Day and A. Aaker (1970). A Guide to consumerism. *Journal of Marketing*. Vol. 34. pp 12-19.
5. Sharma, Deepa (2003). New measures for Consumer Protection in India. *The Indian Journal of Commerce*. Vol.56. No.4. pp. 96-106
6. Sharma, Deepa (2011). Consumer Grievance Redress by Insurance Ombudsman. *BIMAQUEST*. Vol.11. pp.29-47.

Periodicals

1. Consumer Protection Judgments (CPJ) (Relevant cases reported in various issues)
2. Recent issues of magazines: *Insight*, published by CERC, Ahmedabad ‘*Consumer Voice*’, Published by VOICE Society, New Delhi.
3. *Upbhokta Jagran*, Ministry of Consumer Affairs, Govt, of India. New Delhi.

Websites: www.ncdrc.nic.in

www.fcamin.nic.in

www.consumeraffairs.nic.in

www.iso.org.in www.bis.org

www.ascionline.org.in www.trai.gov.in

www.irda.gov.in

www.derc.gov.in www.rbi.org.in

www.fssai.gov.in [www.consumer-](http://www.consumer-voice.org)

[voice.org](http://www.consumer-voice.org)

COM-DSE-HC-6036(C): ADVANCED CORPORATE ACCOUNTING

Total: 100

Credit: 6

Lectures: 65

Objectives: The course aims to help the learners to acquire advanced knowledge of corporate accounting and to learn the techniques of preparing accounts and statements under various corporate situations.

Unit 1:

15 Lectures

(i) Accounting Standards:

Overview of Accounting Standards in India - Applicability, Interpretation, Scope and Compliance of Ind AS; International Financial Reporting Standards - Ind AS vs. IFRS; National and International Accounting Authorities; Adoption and Convergence of International Financial Reporting Standards (IFRS) in India.

(ii) Corporate Annual Report

Meaning, usefulness, statutory provisions, contents and disclosure of corporate information – mandatory and voluntary; Analysis with Case Study. E-filing of annual reports of companies and XBRL Filing with specific practical exercises.

Unit 2: Winding up of Companies

10 Lectures

Meaning and modes of winding up; Types of winding up; Procedures of winding up; Contributories; Preferential payments; Voluntary winding up; Preparation of Liquidator's Final Statement of Account; Preparation of Statement of Affairs.

Unit 3: Accounts of Banking Companies

10 Lectures

Statutory books to be maintained; Special features of Bank book keeping. Advances – its classification and provisions to be made against advances; Rebate on Bills Discounted, Income recognition; Preparation and presentation of Financial Statements of banking companies.

Unit 4: Accounts of Insurance Companies

15 Lectures

Books maintained by a life insurance companies and general insurance companies. Accounts of Life insurance company – Revenue Account and Profit and loss Account and ascertainment of profit under Life insurance business; preparation of Balance Sheet using appropriate software; Accounts of general insurance business – Revenue Account, Profit and Loss Account and Balance Sheet of insurance companies.

Unit 5: Investment Accounts

15 Lectures

Meaning of Investment Accounts; cum-interest, ex-interest, cum-dividend and ex-dividend. Accounting for fixed interest earning securities and variable earning securities, bonus shares and right shares.

Profit and Loss prior to incorporation: Meaning of profit or loss prior to incorporation; accounting treatment of profit or loss prior to incorporation.

Suggested Readings:

1. Goyal, V. K., & Goyal, R. (2013). *Corporate Accounting*. New Delhi: Phi Learning.
2. Jain, S. P., & Narang, K. L. (2016). *Corporate Accounting*. New Delhi: Kalyani Publishers.
3. Goyal, B. K. (2019). *Fundamentals of Corporate Accounting*. New Delhi: Taxmann Publications.
4. Maheshwari, S. N., Maheshwari, S. K., & Maheshwari, S. K. (2009). *Corporate Accounting*. New Delhi: Vikas Publishing House Pvt. Ltd.
5. Monga, J. R. (2019). *Fundamentals of Corporate Accounting*. New Delhi: Scholar Tech Press.
6. Shukla, M. C., Grewal, T. S., & Gupta, S. C. (2016). *Advanced Accounts*. Vol.-I. New Delhi: S. Chand Publishing.
7. Mukherjee, A., & Hanif, M. (2005). *Corporate Accounting*. New Delhi: Tata McGraw Hill Education.

8. Sehgal, A. (2011). *Fundamentals of Corporate Accounting*. New Delhi: Taxmann Publications.
9. Tulsian, P. C., & Tulsian, B. (2010). *Corporate Accounting*. New Delhi: S. Chand Publishing.
10. K. R. Das and K. M. Sinha *Corporate Accounting*, Manab Publications,
11. B. B., & Gautam, H. C. (2019). *Advanced Corporate Accounting*, Gayatri Publications Guwahati.
12. *Compendium of Statements and Standards of Accounting*. The Institute of Chartered Accountants of India, New Delhi.www.icaai.org

COM-DSE-HC-6036(D): INTERNATIONAL BUSINESS

Marks: 100

Credit: 6

Lectures: 65

Objective: The objective of the course is to familiarise the students with the concepts, importance and dynamics of international business and India's involvement with global business. The course also seeks to provide theoretical foundations of international business to the extent these are relevant to the global business operations and developments.

Unit 1:

13 Lectures

- a. *Introduction to International Business:* Globalisation and its importance in world economy; Impact of globalization; International business vs. domestic business: Complexities of international business; Modes of entry into international business.
- b. *International Business Environment:* National and foreign environments and their components - economic, cultural and political-legal environments

Unit –II

13 Lectures

- a. *Theories of International Trade* – an overview (Classical Theories, Product Life Cycle theory, Theory of National Competitive Advantage); Commercial Policy Instruments - tariff and non-tariff measures – difference in Impact on trade, types of tariff and non tariff barriers (Subsidy, Quota and Embargo in detail) ; Balance of payment account and its components.
- b. *International Organizations and Arrangements:* WTO – Its objectives, principles, organizational structure and functioning; An overview of other organizations – UNCTAD;; Commodity and other trading agreements (OPEC).

Unit –III

13 Lectures

- a. *Regional Economic Co-operation:* Forms of regional groupings; Integration efforts among countries in Europe, North America and Asia (NAFTA, EU , ASEAN and SAARC) .
- b. *International Financial Environment:* International financial system and institutions (IMF and World Bank – Objectives and Functions) ; Foreign exchange markets and risk management; Foreign investments - types and flows; Foreign investment in Indian perspective

Unit –IV

13 Lectures

- a. Organisational structure for international business operations; International business negotiations.
- b. *Developments and Issues in International Business:* Outsourcing and its potentials for India; Role of IT in international business; International business and ecological considerations.

Unit –V

13 Lectures

- a. Foreign Trade Promotion Measures and Organizations in India; Special economic zones (SEZs) and export oriented units (EOUs), ; Measures for promoting foreign investments into and from India; Indian joint ventures and acquisitions abroad.
- b. Financing of foreign trade and payment terms – sources of trade finance (Banks, factoring, forfaiting, Banker's Acceptance and Corporate Guarantee) and forms of payment (Cash in advance, Letter of Credit, Documentary Collection, Open Account)

Suggested Readings:

1. Charles W.L. Hill and Arun Kumar Jain, *International Business*. New Delhi: McGraw Hill Education
2. Daniels John, D. Lee H. Radenbaugh and David P. Sullivan. *International Business*. Pearson Education
3. Johnson, Derbe., and Colin Turner. *International Business - Themes & Issues in the Modern Global Economy*. London: Roultedge.
4. Sumati Varma, *International Business*, Pearson Education.
5. Cherunilam, Francis. *International Business: Text and Cases*. PHI Learning
6. Michael R. Czinkota. et al. *International Business*. Fortforth: The Dryden Press.
7. Bennett, Roger. *International Business*. Pearson Education.
8. Peng and Srivastav, *Global Business*, Cengage Learning

Note: Latest edition of text books may be used.

COM-DSE-HC-6036(E): INDUSTRIAL RELATIONS AND LABOUR LAWS

Marks: 100

Credit: 6

Lectures: 65

Objective: To enable the students to learn the concepts of industrial relations including trade unions, collective bargaining, discipline and various labour enactments.

Contents:

Unit 1: Industrial Relations (IR)

Concept of Industrial Relations; Nature of Industrial Relations; Objectives of IR; Factors affecting IR in changing Environment, Evolution of IR in India; Role of State; Trade Union; Employers' Organisation; Human Resource Management and IR Role of ILO in Industrial Relations, International Dimensions of IR

Unit 2: Trade Union

Trade Union: Origin and growth, unions after Independence, unions in the era of liberalisation; Factors Affecting Growth of Trade Unions in India, Multiplicity & Recognition of Trade Unions; Major Provisions of Trade Union Act 1926

Unit 3: Collective Bargaining and Workers' Participation in Management

a) Collective Bargaining: Meaning, Nature, Types, Process and Importance of Collective Bargaining, pre-requisites, issues involved; Status of Collective Bargaining in India, Functions and role of Trade Unions in collective bargaining

b) Workers' Participation in Management: Concept, practices in India, Works Committees, Joint management councils; Participative Management and co-ownership; Productive Bargaining and Gain Sharing

Unit 4: Discipline and Grievance Redressal

Discipline: Causes of indiscipline, Maintenance of discipline and misconduct; Highlights of domestic enquiries; Principle of Natural Justice; Labour turnover; Absenteeism; Grievance: Meaning of Grievance, Grievance redressal machinery in India, Grievance handling procedure; salient features of Industrial Employment (Standing orders) Act 1946

Unit 5:

a) **The Industrial Disputes Act, 1947:** Definitions of Industry, workman, and Industrial Dispute; Authorities under the Act: Procedure, Powers and Duties of Authorities; Strikes and Lock outs; Lay-off and Retrenchment: Provisions relating to Layoff, Retrenchment, and closure

b) **The Factories Act, 1948:** Provisions relating to Health, Safety, Welfare facilities, working hours, Employment of young persons, Annual Leave with wages

Suggested Readings:

1. PK Padhi, *Industrial Relations and Labour Law*, PHI Learning
2. Arun Monappa, *Industrial Relations and Labour Law*, McGraw Hill Education
3. SC Srivastav, *Industrial Relations and Labour Law*, Vikas Publishing House
4. C.S Venkata Ratnam, *Industrial Relations*, Oxford University Press
5. P.L. Malik's *Handbook of Labour and Industrial Law, Vol 1 and 2*, Eastern Book Company
6. JP Sharma, *Simplified Approach to Labour Laws*, Bharat Law House (P) Ltd

Note: Latest edition of text books may be used.

COM-DSE-HC-6036(F): BUSINESS RESEARCH METHODS AND PROJECT WORK

Marks: 100

Credit: 6

Lectures: 65

Objective: This course aims at providing the general understanding of business research and the methods of business research. The course will impart learning about how to collect, analyze, present and interpret data.

Section A: Business Research Methods

50 Marks

Unit 1: Introduction 10 Lectures

Meaning of research; Scope of Business Research; Purpose of Research – Exploration, Description, Explanation; Unit of Analysis – Individual, Organization, Groups, and Data Series; Conception, Construct, Attributes, Variables, and Hypotheses

Unit 2: Research Process 10 Lectures

An Overview; Problem Identification and Definition; Selection of Basic Research Methods- Field Study, Laboratory Study, Survey Method, Observational Method, Existing Data Based Research, Longitudinal Studies, Panel Studies

Unit 3: Measurement and Hypothesis Testing 19 Lectures **Measurement:** Definition; Designing and writing items; Uni-dimensional and Multi-dimensional scales; Measurement Scales- Nominal, Ordinal, Interval, Ratio; Ratings and Ranking Scale, Thurstone, Likert and Semantic Differential scaling, Paired Comparison; Sampling –Steps, Types, Sample Size Decision; Secondary data sources
Hypothesis Testing: Tests concerning means and proportions; ANOVA, Chi-square test and other Non-parametric tests

Testing the assumptions of Classical Normal Linear Regression

Section B: Project Report

Marks 50

Unit 4: Report Preparation 26 Lectures

Meaning, types and layout of research report; Steps in report writing; Citations, Bibliography and Annexure in report; JEL Classification

Note:

1. There shall be a written examination of 50% Marks on the basis of Unit 1: to III.
2. The student will write a project report under the supervision of a faculty member assigned by the college/institution based on field work. The Project Report carries 50% Marks and will be evaluated by University appointed examiners.

Gauhati University

Syllabus for B.Sc.(Honors) Chemistry

Choice Based Credit System (CBCS)

Course effective from academic year 2019-20

*This is approved in the Academic Council held
on 08/11/2019*



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Gauhati University

Guwahati::Assam

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Preamble

The choice based credit system is naturally the next logical step in a credit based semester system. This makes the system the more learner-centric. A CBCS offers the student a diversity of courses to choose from and the autonomy to decide on the place, pace and the time of learning.

The Gauhati University has decided to introduce the CBCS system at the under graduate level from the session 2019-20. The CBCS syllabus for the B.Sc. (Honours) is prepared in the model of syllabus prepared by the UGC.

A student opting for honours course in chemistry must have and passed the Mathematics as a subject in the Senior Secondary level examination.

Course Structure	
Course	*Credits
	Theory+ Practical
I. Core Course (14 Papers)	14×4= 56
Core Course Practical / Tutorial* (14 Papers)	14×2= 28
II. Elective Course (8 Papers)	4×4=16
A.1. Discipline Specific Elective (4 Papers)	
A.2. Discipline Specific Elective Practical/Tutorial*(4 Papers)	4×2=8
B.1. Generic Elective/ Interdisciplinary (4 Papers)	4×4=16
B.2. Generic Elective Practical/ Tutorial* (4 Papers)	4×2=8
III. Ability Enhancement Courses	2×4=8
1. Ability Enhancement Compulsory (2 Papers of 2 credit each) Environmental Studies English/MIL Communication	
2. Ability Enhancement Elective (Skill Based) (Minimum 2) (2 Papers of 2 credit each)	2×4=8
Total	148

***Core and DSE courses without practicals will have tutorial and have credit distribution of : 5 credits for theory and 1 credit for tutorial, total 6 credits, same as the papers with practical**

Structure of BSc Honours(Chemistry) Programme

Semester	Type	Core	AECC	SEC	DSE	GEN
	Credits	14 × 6 = 84	2 × 4 = 8	2 × 4 = 8	4 × 6 = 24	4 × 6 = 24
I	CHE-HC-1016	ENG-AE-1014				XXX-HG-1XX6
	CHE-HC-1026					
II	CHE-HC-2016	ENV-AE-2014				XXX-HG-2XX6
	CHE-HC-2026					
III	CHE-HC-3016			CHE-SE-3YY4†		XXX-HG-3XX6
	CHE-HC-3026					
	CHE-HC-3036					
IV	CHE-HC-4016			CHE-SE-4YY4†		XXX-HG-4XX6
	CHE-HC-4026					
	CHE-HC-4036					
V	CHE-HC-5016				CHE-HE-5YY6‡	
	CHE-HC-5026				CHE-HE-5YY6‡	
VI	CHE-HC-6016				CHE-HE-6YY6‡	
	CHE-HC-6016				CHE-HE-6YY6‡	

SCHEME FOR CHOICE BASED CREDIT SYSTEM IN B. Sc. Honours (Chemistry)

SEMESTER	COURSE CODE	COURSE NAME	Credits
I	ENG-AE-1014	English Communications	4
	CHE-HC-1016	Inorganic Chemistry-I	4+2=6
		Inorganic Chemistry-I Lab	
	CHE-HC-1026	Physical Chemistry-I	4+2=6
		Physical Chemistry-I Lab	
AAA-HG-1YY6*	GE-1	4+2/5+1=6	
	Generic Elective -1 Practical/Tutorial		
Total Credits in Semester I			22
II	Ability Enhancement Compulsory Course-II**	Environmental Studies	4
	CHE-HC-2016	Organic Chemistry-I	4+2=6
		Organic Chemistry-I Lab	
	CHE-HC-2026	Physical Chemistry-II	4+2=6
		Physical Chemistry-II Lab	
AAA-HG-2YY6*	GE-2	4+2/5+1=6	
	Generic Elective -2 Practical/Tutorial		
Total Credits in Semester II			22
III	CHE-HC-3016	Inorganic Chemistry-II	4+2=6
		Inorganic Chemistry-II Lab	
	CHE-HC-3026	Organic Chemistry-II	4+2=6
		Organic Chemistry-II Lab	
	CHE-HC-3036	Physical Chemistry-III	4+2=6
		Physical Chemistry-III Lab	
CHE-SE-3YY4†	SEC-1	4	
AAA-HG-3YY6*	GE-3	4+2/5+1=6	
	Generic Elective -3 Practical/Tutorial		
Total Credits in Semester III			28
IV	CHE-HC-4016	Inorganic Chemistry-III	4+2=6
		Inorganic Chemistry-III Lab	
	CHE-HC-4026	Organic Chemistry-III	4+2=6
		Organic Chemistry-III Lab	
	CHE-HC-4036	Physical Chemistry-IV	4+2=6
		Physical Chemistry-IV Lab	
CHE-SE-4YY4†	SEC -2	4	
AAA-HG-4YY6*	GE-4	4+2/5+1=6	
	Generic Elective -4 Practical		
Total Credits in Semester IV			28
V	CHE-HC-5016	Organic Chemistry-IV	4+2=6

		Organic Chemistry-IV Lab	
	CHE-HC-5026	Physical Chemistry-V Physical Chemistry-V Lab	4+2=6
	CHE-HE-5YY6‡	DSE-1 DSE-1 Lab	4+2=6
	CHE-HE-5YY6‡	DSE-2 DSE-2 Lab	4+2=6
Total Credits in Semester V			24
VI	CHE-HC-6016	Inorganic Chemistry-IV Inorganic Chemistry-IV Lab	4+2=6
	CHE-HC-6026	Organic Chemistry-V Organic Chemistry-V Lab	4+2=6
	CHE-HE-6YY6‡	DSE-3 DSE-3 Lab	4+2=6
	CHE-HE-6YY6‡	DSE-4 DSE-3 Lab/tutorial	4+2=6
Total Credits in Semester VI			24
Grand Total Credits			148

***Generic Electives (Other Discipline) - GE 1 to GE 4**

1. Mathematics
2. Physics
3. Economics
4. Computer Science
5. Zoology
6. Botany
7. Statistics
8. Geology
9. Biotechnology
10. Anthropology

*** a) Generic Electives (GE) are to be taken preferably from Physics and Mathematics disciplines.**

b) Students can choose minimum of two GE papers from two different disciplines or four papers from one discipline.

c) Some Universities in India require at least two mathematics papers to be studied by the student for admission into M. Sc. (Chemistry).

‡ Discipline Specific Elective Papers: (Credit: 06 each) (4 papers to be selected)-

DSE for Semester V

DSE-1(Any One from the following)

1. CHE-HE-5016: Applications of Computers in Chemistry (4) + Lab (2)
2. CHE-HE-5026: Analytical Methods in Chemistry (4) + Lab (2)
3. CHE-HE-5036: Molecular Modelling & Drug Design (4) + Lab (2)

DSE-2(Any One from the following)

4. CHE-HE-5046: Novel Inorganic Solids (4) + Lab (2)
5. CHE-HE-5056: Polymer Chemistry (4) + Lab (2)
6. CHE-HE-5066: Instrumental Methods of Analysis (4) + Lab (2)

DSE for Semester VI

DSE-3(Any One from the following)

7. CHE-HE-6016: Green Chemistry (4) + Lab (2)
8. CHE-HE-6026: Industrial Chemicals & Environment (4) + Lab (2)
9. CHE-HE-6036: Inorganic Materials of Industrial Importance (4) + Lab (2)

DSE-4(Any One from the following)

10. CHE-HE-6046: Research Methodology for Chemistry (5) + Tutorials (1)
11. CHE-HE-6056: Dissertation

† **Skill Enhancement Courses (04 papers) (Credit: 04 each)**

SEC for Semester III

Any One from the following

1. AAA-SE-3014 : English (Syllabus will be available on the GU website)
2. CHE-SE-3024: IT Skills for Chemists
3. CHE-SE-3034: Basic Analytical Chemistry
4. CHE-SE-3044: Chemical Technology & Society
5. CHE-SE-3054: Chemoinformatics
6. CHE-SE-3064: Business Skills for Chemists
7. CHE-SE-3074: Intellectual Property Rights

SEC for Semester IV

Any One from the following

8. CHE-SE-4014: Analytical Clinical Biochemistry
9. CHE-SE-4024: Green Methods in Chemistry
10. CHE-SE-4034: Pharmaceutical Chemistry
11. CHE-SE-4044: Chemistry of Cosmetics & Perfumes
12. CHE-SE-4054: Pesticide Chemistry
13. CHE-SE-4064: Fuel Chemistry

****Ability Enhancement Compulsory Courses (02 papers) (Credit: 04 each)**

AECC for Semester I

1. ENG-AE-1014: English Communications (<https://sites.google.com/a/gauhati.ac.in/syllabus-ug-cbcs/aecc/english-a>)

AECC for Semester II

2. ENV-AE-2014: Environmental Studies (Syllabus will be available on the GU website)
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CORE COURSE (HONOURS IN CHEMISTRY)

Semester I

CHE-HC-1016: INORGANIC CHEMISTRY-I

(Credits: Theory-04, Lab-02)

Theory: 60 Lectures

Course Objectives: This course aims at giving students theoretical understanding about the basic constituents of matter – atoms, ions and molecules in terms of their electronic structure and reactivity. Structure and bonding in/of these are to be dealt with basic quantum chemistry treatment. Reactivity of chemical species based on their electron transfer affinity is introduced. Further, periodic classification of elements in the periodic table and changes in properties along the periods and groups to be studied in detail. Accompanying laboratory course is designed for students to have hands-on experience of basic quantitative analytical techniques related to volumetric titrations.

Learning Outcome: On successful completion, students would have clear understanding of the concepts related to atomic and molecular structure, chemical bonding, periodic properties and redox behaviour of chemical species. Students will also have hands on experience of standard solution preparation in different concentration units and learn volumetric estimation through acid-base and redox reactions.

Atomic Structure:

Bohr's theory, its limitations and atomic spectrum of hydrogen atom. Wave mechanics: de Broglie equation, Heisenberg's Uncertainty Principle and its significance, Schrödinger's wave equation, significance of ψ and ψ^2 . Quantum numbers and their significance. Normalized and orthogonal wave functions. Sign of wave functions. Radial and angular wave functions for hydrogen atom. Radial and angular distribution curves. Shapes of *s*, *p*, *d* and *f* orbitals. Contour boundary and probability diagrams. Pauli's Exclusion Principle, Hund's rule of maximum multiplicity, Aufbau's principle and its limitations, Variation of orbital energy with atomic number.

(14 Lectures)

Periodicity of Elements:

s, *p*, *d*, *f* block elements, the long form of periodic table. Detailed discussion of the following properties of the elements, with reference to *s* & *p*-block.

- Effective nuclear charge, shielding or screening effect, Slater rules, variation of effective nuclear charge in periodic table.
- Atomic radii (van der Waals)
- Ionic and crystal radii.
- Covalent radii (octahedral and tetrahedral)
- Ionization enthalpy, Successive ionization enthalpies and factors affecting ionization energy. Applications of ionization enthalpy.
- Electron gain enthalpy, trends of electron gain enthalpy.
- Electronegativity, Pauling's/ Mulliken's/ Allred Rachow's/ and Mulliken-Jaffé's electronegativity scales. Variation of electronegativity with bond order, partial charge, hybridization, group electronegativity. Sanderson's electron density ratio.

(16 Lectures)

Chemical Bonding:

(i) *Ionic bond*: General characteristics, types of ions, size effects, radius ratio rule and its limitations. Packing of ions in crystals. Born-Landé equation with derivation and importance of Kapustinskii expression for lattice energy. Madelung constant, Born-Haber cycle and its application, Solvation energy.

(ii) *Covalent bond*: Lewis structure, Valence Bond theory (Heitler-London approach). Energetics of hybridization, equivalent and non-equivalent hybrid orbitals. Bent's rule, Resonance and resonance energy, Molecular orbital theory. Molecular orbital diagrams of diatomic and simple polyatomic molecules N_2 , O_2 , C_2 , B_2 , F_2 , CO , NO , and their ions; HCl , BeF_2 , CO_2 , (idea of s-p mixing and orbital interaction to be given). Formal charge, Valence shell electron pair repulsion theory (VSEPR), shapes of simple molecules and ions containing lone pairs and bond pairs of electrons, multiple bonding (σ and π bond approach) and bond lengths.

Covalent character in ionic compounds, polarizing power and polarizability. Fajan's rules and consequences of polarization.

Ionic character in covalent compounds: Bond moment and dipole moment. Percentage ionic character from dipole moment and electronegativity difference.

(iii) *Metallic Bond*: Qualitative idea of valence bond and band theories. Semiconductors and insulators, defects in solids.

(iv) *Weak Chemical Forces*: van der Waals forces, ion-dipole forces, dipole-dipole interactions, induced dipole interactions, Instantaneous dipole-induced dipole interactions. Repulsive forces, Hydrogen bonding (theories of hydrogen bonding, valence bond treatment) Effects of chemical force, melting and boiling points, solubility energetics of dissolution process.

(26 Lectures)

Oxidation-Reduction:

Redox equations, Standard Electrode Potential and its application to inorganic reactions. Principles involved in volumetric analysis to be carried out in class.

(4 Lectures)

Recommended Books:

1. Lee, J. D. Concise Inorganic Chemistry, 5th Ed., Oxford University Press, 2008.
2. Douglas, B.E. and Mc Daniel, D.H., Concepts and Models of Inorganic Chemistry, 3rd Ed. Wiley India, 2006.
3. Cotton, F.A., Wilkinson, G. and Gaus, P. L., Basic Inorganic Chemistry, 3rd Ed., Wiley, 2007.
4. Cotton, F.A. & Wilkinson, G, Advanced Inorganic Chemistry. 6th Ed., Wiley-VCH, 2007.
5. Atkins, P.W. & Paula, J. Physical Chemistry, 11th Ed., Oxford University Press, 2018.
6. Housecroft, C. E. and Sharpe, A. G. Inorganic Chemistry, 5th Ed., Pearson, 2018.
7. Day, M.C. and Selbin, J. Theoretical Inorganic Chemistry, Literary Licensing, LLC, 2012.

LAB

60 Lectures

(A) Titrimetric Analysis

- (i) Calibration and use of common laboratory apparatus
- (ii) Preparation of solutions of different Molarity/Normality of titrants

(B) Acid-Base Titrations

- (i) Estimation of carbonate and hydroxide present together in mixture.
- (ii) Estimation of carbonate and bicarbonate present together in a mixture.
- (iii) Estimation of free alkali present in different soaps/detergents

(C) Oxidation-Reduction Titrimetry

- (i) Estimation of Fe(II) and oxalic acid using standardized KMnO_4 solution.
- (ii) Estimation of oxalic acid and sodium oxalate in a given mixture.
- (ii) Estimation of Fe(II) with $\text{K}_2\text{Cr}_2\text{O}_7$ using internal (diphenylamine, anthranilic acid) and external indicator.

Recommended Books:

1. Mendham, J. et al.: Vogel's Text Book of Quantitative Chemical Analysis; 6th Ed. Pearson Education, 2009.

CHE-HC-1026: PHYSICAL CHEMISTRY I

(Credits: Theory-04, Lab-02)

Theory: 60 Lectures

Course objective: This course contains states of matter- gaseous, liquid and solid states along with ionic equilibria. A small unit of molecular and crystal symmetry is also there in the course.

Learning outcome: In gaseous state unit the students will learn the kinetic theory of gases, ideal gas and real gases. In liquid state unit, the students are expected to learn the qualitative treatment of the structure of liquid along with the physical properties of liquid, viz, vapour pressure, surface tension and viscosity. In the molecular and crystal symmetry unit they will be introduced to the elementary idea of symmetry which will be useful to understand solid state chemistry and group theory in some higher courses. In solid state unit the students will learn the basic solid state chemistry application of x-ray crystallography for the determination of some very simple crystal structures. The students will also learn another important topic "ionic equilibria" in this course.

Gaseous state:

Kinetic molecular model of a gas: postulates and derivation of the kinetic gas equation; collision frequency; collision diameter; mean free path and viscosity of gases, including their temperature and pressure dependence, relation between mean free path and coefficient of viscosity, calculation of σ from η ; variation of viscosity with temperature and pressure.

Maxwell distribution and its use in evaluating molecular velocities (average, root meansquare and most probable) and average kinetic energy.

Behaviour of real gases: Deviations from ideal gas behaviour, compressibility factor, Z, and its variation with pressure for different gases. Causes of deviation from ideal behaviour. Van der Waals equation of state, its derivation and application in explaining real gas behaviour, mention of other equations of state (Berthelot, Dieterici); virial equation of state; van der Waals equation expressed in virial form and calculation of Boyle temperature. Isotherms of real gases and their comparison with van der Waals isotherms, continuity of states, critical state, relation between critical constants and van der Waals constants, law of corresponding states.

(18 Lectures)

Liquid state:

Qualitative treatment of the structure of the liquid state; Radial distribution function; physical properties of liquids; vapour pressure, surface tension and coefficient of viscosity, and their determination. Effect of addition of various solutes on surface tension and viscosity. Explanation of cleansing action of detergents. Temperature variation of viscosity of liquids and comparison with that of gases.

Qualitative discussion of structure of water.

(6 Lectures)

Molecular and Crystal Symmetry

Elementary ideas of symmetry, symmetry elements and symmetry operations, qualitative idea of point and space groups, seven crystal systems and fourteen Bravais lattices.

(6 Lectures)

Solid state:

Nature of the solid state, law of constancy of interfacial angles, law of rational indices, Miller indices,; X-ray diffraction, Bragg's law, a simple account of rotating crystal method and powder pattern method. Analysis of powder diffraction patterns of NaCl, CsCl and KCl. Defects in crystals. Liquid crystals (Introductory idea)

(10 Lectures)

Ionic equilibria:

Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water. Ionization of weak acids and bases, pH scale, common ion effect; dissociation constants of mono-, di- and triprotic acids (exact treatment).

Salt hydrolysis-calculation of hydrolysis constant, degree of hydrolysis and pH for different salts. Buffer solutions; derivation of Henderson equation and its applications; buffer capacity, buffer range, buffer action and applications of buffers in analytical chemistry and biochemical processes in the human body.

Solubility and solubility product of sparingly soluble salts – applications of solubility product principle. Qualitative treatment of acid – base titration curves (calculation of pH at various stages). Theory of acid–base indicators; selection of indicators and their limitations.

Multistage equilibria in polyelectrolyte systems; hydrolysis and hydrolysis constants.

(20 Lectures)

Recommended Books:

1. Atkins, P. W. & Paula, J. de Atkin's Physical Chemistry Ed., Oxford University Press (2006).
2. Ball, D. W. Physical Chemistry Thomson Press, India (2007).
3. Castellan, G. W. Physical Chemistry 4th Ed. Narosa (2004).
4. Mortimer, R. G. Physical Chemistry 3rd Ed. Elsevier: NOIDA, UP (2009).
5. Puri, B. R.; Sharma, L. R.; Pathania, M. S. Principles of Physical Chemistry, Vishal Publishing Co. (2017)
6. Kapoor, K. L. A Textbook of Physical Chemistry (Volume 1) McGraw Hill Education; Sixth edition (2019)

LAB

60 Lectures

1. Surface tension measurements.

- a. Determine the surface tension by (i) drop number (ii) drop weight method.
- b. Study the variation of surface tension of detergent solutions with concentration.

2. Viscosity measurement using Ostwald's viscometer.

- a. Determination of viscosity of aqueous solutions of (i) polymer (ii) ethanol and (iii) sugar at room temperature.
- b. Study the variation of viscosity of sucrose solution with the concentration of solute.

3. Indexing of a given powder diffraction pattern of a cubic crystalline system.

4. pH metry

- a. Study the effect on pH of addition of HCl/NaOH to solutions of acetic acid, sodium acetate and their mixtures.
- b. Preparation of buffer solutions of different pH
 - i. Sodium acetate-acetic acid
 - ii. Ammonium chloride-ammonium hydroxide
- c. pH metric titration of (i) strong acid vs. strong base, (ii) weak acid vs. strong base.
- d. Determination of dissociation constant of a weak acid.

Recommended Books

1. Khosla, B. D.; Garg, V. C. & Gulati, A. *Senior Practical Physical Chemistry*, R. Chand & Co.: New Delhi (2011).
2. Garland, C. W.; Nibler, J. W. & Shoemaker, D. P. *Experiments in Physical Chemistry 8th Ed.*; McGraw-Hill: New York (2003).
3. Halpern, A. M. & McBane, G. C. *Experimental Physical Chemistry 3rd Ed.*; W.H. Freeman & Co.: New York (2003).

Semester II

CHE-HC-2016: ORGANIC CHEMISTRY I

(Credits: Theory-04, Lab-02)

Theory: 60 Lectures

Course Objectives: This course is inducted to apprise students with introduction to organic compounds, electron displacement, type of reagents and reaction intermediates. The chemistry of aliphatic and aromatic hydrocarbon, conformational analysis of cycloalkanes and basic stereochemical phenomena are included.

Students are expected to learn different classes learn, explain, describe and analyze different classes of organic compounds, their reactivities and mechanisms along with stereo chemical considerations.

Learning Outcome: Students will be able to identify different classes of organic compounds, describe their reactivity and explain/analyze their chemical and stereo chemical aspects.

Basics of Organic Chemistry

Organic Compounds: Classification, and Nomenclature, Hybridization, Shapes of molecules, Influence of hybridization on bond properties.

Electronic Displacements: Inductive, electromeric, resonance and mesomeric effects, hyperconjugation and their applications; Dipole moment; Organic acids and bases; their relative strength.

Homolytic and Heterolytic fission with suitable examples. Curly arrow rules, formal charges; Electrophiles and Nucleophiles; Nucleophilicity and basicity; Types, shape and their relative stability of Carbocations, Carbanions, Free radicals and Carbenes.

Introduction to types of organic reactions and their mechanism: Addition, Elimination and Substitution reactions.

(8 Lectures)

Stereochemistry:

Fischer Projection, Newmann and Sawhorse Projection formulae and their interconversions; Geometrical isomerism: cis-trans and, syn-anti isomerism E/Z notations with C.I.P rules.

Optical Isomerism: Optical Activity, Specific Rotation, Chirality/Asymmetry, Enantiomers, Molecules with two or more chiral-centres, Distereoisomers, meso structures, Racemic mixture and resolution. Relative and absolute configuration: D/L and R/S designations.

(16 Lectures)

Chemistry of Aliphatic Hydrocarbons

A. Carbon-Carbon sigma bonds

Chemistry of alkanes: Formation of alkanes, Wurtz Reaction, Wurtz-Fittig Reactions, Free radical substitutions: Halogenation -relative reactivity and selectivity.

B. Carbon-Carbon pi bonds:

Formation of alkenes and alkynes by elimination reactions, Mechanism of E1, E2, E1cb reactions. Saytzeff and Hofmann eliminations.

Reactions of alkenes: Electrophilic additions and their mechanisms (Markownikoff/ Anti Markownikoff addition), mechanism of oxymercuration-demercuration, hydroborationoxidation, ozonolysis, reduction (catalytic and chemical), syn and anti-hydroxylation (oxidation). 1,2-and 1,4-addition reactions in conjugated dienes and, Diels-Alder reaction; Allylic and benzylic bromination and mechanism, e.g. propene, 1-butene, toluene, ethyl benzene.

Reactions of alkynes: Acidity, Electrophilic and Nucleophilic additions. Hydration to form carbonyl compounds, Alkylation of terminal alkynes.

C. Cycloalkanes and Conformational Analysis

Types of cycloalkanes and their relative stability, Baeyer strain theory, Conformation analysis of alkanes: Relative stability: Energy diagrams of cyclohexane: Chair, Boat and Twist boat forms; Relative stability with energy diagrams.

(24 Lectures)

Aromatic Hydrocarbons

Aromaticity: Hückel's rule, aromatic character of arenes, cyclic carbocations/carbanions and heterocyclic compounds with suitable examples. Electrophilic aromatic substitution: halogenation, nitration, sulphonation and Friedel-Craft's alkylation/acylation with their mechanism. Directing effects of the groups.

(12 Lectures)

Recommended Books:

1. Morrison, R. N. & Boyd, R. N. *Organic Chemistry*, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
2. Finar, I. L. *Organic Chemistry* (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
3. Eliel, E. L. & Wilen, S. H. *Stereochemistry of Organic Compounds*, Wiley: London, 1994.
4. Nasipuri, D. *Stereochemistry of Organic Compounds*, Wiley Eastern Limited.
5. Kalsi, P. S. *Stereochemistry Conformation and Mechanism*, New Age International, 2005.
6. Subrata Sen Gupta, *Basic Stereochemistry of Organic Molecules*, Oxford Higher Education.
7. Dhillon, R. S.; Singh, I. P. & Baskar, C. *Stereochemistry*, Narosa.
8. Loudon, G. M. *Organic Chemistry*, Oxford.

9. Sykes, P. *A guidebook to Mechanism in Organic Chemistry*, Pearson Education, 2003.
 10. Clayden, J., Greeves, N. & Warren, S. *Organic Chemistry*, Second edition, Oxford University Press, 2012.
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LAB

60 Lectures

1. Checking the calibration of the thermometer
2. Purification of organic compounds by crystallization using the following solvents:
 - a. Water
 - b. Alcohol
 - c. Alcohol-Water
3. Determination of the melting points of above compounds and unknown organic Compounds.
4. Effect of impurities on the melting point – mixed melting point of two unknown organic Compounds.
5. Determination of boiling point of liquid compounds. (boiling point lower than and more than 100 °C by distillation and use of thiele tube method)
6. Chromatography
 - a. Separation of a mixture of two amino acids by ascending and horizontal paper chromatography
 - b. Separation of a mixture of two sugars by ascending paper chromatography
 - c. Separation of a mixture of o- and p-nitrophenol or o- and p-aminophenol by thin layer chromatography (TLC)

Recommended Books

1. Mann, F.G. & Saunders, B.C. *Practical Organic Chemistry*, Pearson Education (2009).
 2. Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R. *Practical Organic Chemistry, 5th Ed.*, Pearson (2012)
 3. Vogel, A. I. *Elementary Practical Organic Chemistry, Part 2: Qualitative Organic Analysis*, CBS Publishers and Distributors.
 4. Bhattacharyya, R. C, *A Manual of Practical Chemistry*.
 5. Dutta, S, *B. Sc. Honours Practical Chemistry*, Bharati Book Stall.
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CHE-HC-2026: PHYSICAL CHEMISTRY II

(Credits: Theory-04, Lab-02)

Theory: 60 Lectures

Course Objective: In this course the chemical thermodynamics, chemical equilibrium, solutions and colligative properties will be taught to the students. Another unit of this course is systems of variable compositions.

Learning Outcome: In this course the students are expected to learn laws of thermodynamics, thermochemistry, thermodynamic functions, relations between thermodynamic properties, Gibbs Helmholtz equation, Maxwell relations etc. Moreover the students are expected to learn partial molar quantities, chemical equilibrium, solutions and colligative properties. After completion of this course, the students will be able to understand the chemical systems from thermodynamic point of view.

Chemical Thermodynamics:

Intensive and extensive variables; state and path functions; isolated, closed and open systems; zeroth law of thermodynamics.

First law: Concept of heat, q , work, w , internal energy, U , and statement of first law; enthalpy, H , relation between heat capacities, calculations of q , w , U and H for reversible, irreversible and free expansion of gases (ideal and van der Waals) under isothermal and adiabatic conditions. Law of equipartition of energy, degrees of freedom and molecular basis of heat capacities.

Thermochemistry: Heats of reactions: standard states; enthalpy of formation of molecules and ions and enthalpy of combustion and its applications; calculation of bond energy, bond dissociation energy and resonance energy from thermochemical data, effect of temperature (Kirchhoff's equations) and pressure on enthalpy of reactions. Adiabatic flame temperature, explosion temperature.

Second Law: Concept of entropy; thermodynamic scale of temperature, statement of the second law of thermodynamics; molecular and statistical interpretation of entropy. Calculation of entropy change for reversible and irreversible processes.

Third Law: Statement of third law, concept of residual entropy, calculation of absolute entropy of molecules.

Free Energy Functions: Gibbs and Helmholtz energy; variation of S , G , A with T , V , P ; spontaneous process-enthalpy change, entropy change and free energy change considerations. Relation between Joule-Thomson coefficient and other thermodynamic parameters; inversion temperature; Gibbs-Helmholtz equation; Maxwell relations; thermodynamic equation of state.

(36 Lectures)

Systems of Variable Composition:

Partial molar quantities, dependence of thermodynamic parameters on composition; Gibbs-Duhem equation, chemical potential of ideal mixtures, change in thermodynamic functions in mixing of ideal gases.

(8 Lectures)

Chemical Equilibrium:

Criteria of thermodynamic equilibrium, degree of advancement of reaction, chemical equilibria in ideal gases, concept of fugacity. Thermodynamic derivation of relation between Gibbs free energy of reaction and reaction quotient. Coupling of exoergic and endoergic reactions. Equilibrium constants and their quantitative dependence on temperature, pressure and concentration. Free energy of mixing and spontaneity; thermodynamic derivation of relations between the various equilibrium constants K_p , K_c and K_x . Le Chatelier principle (quantitative treatment); equilibrium between ideal gases and a pure condensed phase.

(8 Lectures)

Solutions and Colligative Properties:

Dilute solutions; lowering of vapour pressure, Raoult's and Henry's Laws and their applications. Excess thermodynamic functions.

Thermodynamic derivation using chemical potential to derive relations between the four colligative properties [(i) relative lowering of vapour pressure, (ii) elevation of boiling point, (iii) Depression of freezing point, (iv) osmotic pressure] and amount of solute. Applications in calculating molar masses of normal, dissociated and associated solutes in solution.

(8 Lectures)

Recommended Books

1. Peter, A. & Paula, J. de. *Physical Chemistry 9th Ed.*, Oxford University Press (2011).
2. Castellan, G. W. *Physical Chemistry 4th Ed.*, Narosa (2004).
3. Engel, T. & Reid, P. *Physical Chemistry 3rd Ed.*, Prentice-Hall (2012).
4. McQuarrie, D. A. & Simon, J. D. *Molecular Thermodynamics* Viva Books Pvt. Ltd.: New Delhi (2004).
5. Assael, M. J.; Goodwin, A. R. H.; Stamatoudis, M.; Wakeham, W. A. & Will, S. *Commonly Asked Questions in Thermodynamics*. CRC Press: NY (2011).
6. Levine, I. N. *Physical Chemistry 6th Ed.*, Tata Mc Graw Hill (2010).
7. Metz, C.R. *2000 solved problems in chemistry*, Schaum Series (2006)
8. Puri, B. R.; Sharma, L. R.; Pathania, M. S. *Principles of Physical Chemistry*, Vishal Publishing Co.; 47th Ed. (2017)
9. Kapoor, K. L. *A Textbook of Physical Chemistry (Volume 2)* McGraw Hill Education; Sixth edition (2019)

LAB

60 Lectures

Thermochemistry

(a) Determination of heat capacity of a calorimeter for different volumes using change of enthalpy data of a known system (method of back calculation of heat capacity of calorimeter from known enthalpy of solution or enthalpy of neutralization).

(b) Determination of heat capacity of the calorimeter and enthalpy of neutralization of hydrochloric acid with sodium hydroxide.

(c) Calculation of the enthalpy of ionization of ethanoic acid.

(d) Determination of heat capacity of the calorimeter and integral enthalpy (endothermic and exothermic) solution of salts.

(e) Determination of basicity/proticity of a polyprotic acid by the thermochemical method in terms of the changes of temperatures observed in the graph of temperature versus time for different additions of a base. Also calculate the enthalpy of neutralization of the first step.

(f) Determination of enthalpy of hydration of copper sulphate.

(g) Study of the solubility of benzoic acid in water and determination of ΔH .

Any other experiment carried out in the class.

Recommended Books

1. Khosla, B. D.; Garg, V. C. & Gulati, A., *Senior Practical Physical Chemistry*, R. Chand & Co.: New Delhi (2011).
2. Athawale, V. D. & Mathur, P. *Experimental Physical Chemistry* New Age International: New Delhi (2001).

Semester III

CHE-HC-3016: INORGANIC CHEMISTRY-II

(Credits: Theory-04, Lab-02)

Theory: 60 Lectures

Course Objective: *This course starts with the basic principles of metallurgy so as to acquaint the students with the application of the redox chemistry they have learnt in the earlier course on inorganic chemistry. Concepts of protonic and non-protonic acids and bases are introduced for students to appreciate different types of chemical reactions. Periodic behavior of s and p block elements related to their electronic structure and their reactivity is included to acquaint students with the principles governing their reactivity. This course further intend to apprise students about the variety of compounds of the main group elements including oxides, hydrides, nitrides, interhalogens, noble gases and inorganic polymers. As part of the accompanying lab course, experiments involving iodo- and iodi-metric titrations are included for the students to explore other varieties of redox titration. Preparation of simple inorganic compounds is introduced to give hands-on experience of inorganic synthesis.*

Learning Outcome: *On successful completion of this course students would be able to apply theoretical principles of redox chemistry in the understanding of metallurgical processes.*

Students will be able to identify the variety of s and p block compounds and comprehend their preparation, structure, bonding, properties and uses. Experiments in this course will boost their quantitative estimation skills and introduce the students to preparative methods in inorganic chemistry.

General Principles of Metallurgy

Chief modes of occurrence of metals based on standard electrode potentials. Ellingham diagrams for reduction of metal oxides using carbon and carbon monoxide as reducing agent. Electrolytic Reduction, Hydrometallurgy. Methods of purification of metals: Electrolytic Kroll process, Parting process, van Arkel-de Boer process and Mond's process, Zone refining.

(6 Lectures)

Acids and Bases

Brönsted-Lowry concept of acid-base reactions, solvated proton, relative strength of acids, types of acid-base reactions, levelling solvents, Lewis acid-base concept, Classification of Lewis acids, Hard and Soft Acids and Bases (HSAB) Application of HSAB principle.

(8 Lectures)

Chemistry of s and p Block Elements:

Inert pair effect, Relative stability of different oxidation states, diagonal relationship and anomalous behaviour of first member of each group. Allotropy and catenation. Complex formation tendency of s and p block elements.

Hydrides and their classification ionic, covalent and interstitial. Basic beryllium acetate and nitrate.

Study of the following compounds with emphasis on structure, bonding, preparation, properties and uses. Boric acid and borates, boron nitrogen compounds, boranes, carboranes and graphitic compounds, silanes, oxides and oxoacids of nitrogen, phosphorus and chlorine. Peroxo acids of sulphur, interhalogen compounds, polyhalide ions, pseudohalogens and basic properties of halogens.

(30 Lectures)

Noble Gases:

Occurrence and uses, rationalization of inertness of noble gases, Clathrates; preparation and properties of XeF₂, XeF₄ and XeF₆; Nature of bonding in noble gas compounds (Valence bond treatment and MO treatment for XeF₂). Molecular shapes of noble gas compounds (VSEPR theory).

(8 Lectures)

Inorganic Polymers:

Types of inorganic polymers, comparison with organic polymers, synthesis, structural aspects and applications of silicones and siloxanes. Silicates – clays and zeolites, polyphosphazenes, metal-organic framework compounds (MOFs).

(8 Lectures)

Recommended Books:

1. Lee, J. D., Concise Inorganic Chemistry, 5th Ed., Oxford University Press, 2008.
2. Douglas, B.E. and Mc Daniel, D.H., Concepts and Models of Inorganic Chemistry, 3rd Ed. Wiley India, 2006.
3. Greenwood, N.N. & Earnshaw, A., Chemistry of the Elements, 2nd Ed., Elsevier India, 2010.

4. Cotton, F.A., Wilkinson, G. and Gaus, P. L., Basic Inorganic Chemistry, 3rd Ed., Wiley, 2007.
 5. Cotton, F.A. & Wilkinson, G, Advanced Inorganic Chemistry. 6th Ed., Wiley-VCH, 2007.
 6. Miessler, G. L. & Tarr, D. A., Inorganic Chemistry 4th Ed., Pearson, 2010.
 7. Weller, M., Armstrong, F., Rourke, J. & Overton, T., Inorganic Chemistry 6th Ed. 2015.
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LAB

60 Lectures

(A) Iodo / Iodimetric Titrations

- (i) Estimation of Cu(II) and $K_2Cr_2O_7$ using sodium thiosulphate solution (Iodimetrically).
- (ii) Estimation of (i) arsenite and (ii) antimony in tartar-emetic iodimetrically
- (iii) Estimation of available chlorine in bleaching powder iodometrically.

(B) Inorganic preparations

- (i) Cuprous Chloride, CuCl
- (ii) Preparation of manganese(III) phosphate, $MnPO_4 \cdot H_2O$
- (iii) Preparation of aluminium potassium sulphate $KAl(SO_4)_2 \cdot 12H_2O$ (Potash alum) or Chrome alum.

Recommended Books:

1. Mendham, J. et al.: Vogel's Text Book of Quantitative Chemical Analysis ; 6th Ed. Pearson Education, 2009.
 2. Marr, G. and Rockett, R.W. *Practical Inorganic Chemistry*, Van Nostrand Reinhold. 1972.
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CHE-HC-3026: ORGANIC CHEMISTRY-II

(Credits: Theory-04, Practicals-02)

Theory: 60 Lectures

Course Objectives: This course is intended to apprise students about different classes of organic compounds, including halogenated hydrocarbons, alcohols, phenols, epoxides, carbonyl compounds and carboxylic and sulfonic acids.

Students are expected to learn and differentiate between various organic functional groups; explain, analyze and design transformations between different functional groups.

Learning Outcome: Students will be able to describe and classify organic compounds in terms of their functional groups and reactivity.

Chemistry of Halogenated Hydrocarbons:

Alkyl halides: Methods of preparation, nucleophilic substitution reactions – S_N1, S_N2 and S_Ni mechanisms with stereochemical aspects and effect of solvent etc.; nucleophilic substitution vs. elimination.

Aryl halides: Preparation, including preparation from diazonium salts. nucleophilic aromatic substitution; S_NAr, Benzyne mechanism. Relative reactivity of alkyl, allyl/benzyl, vinyl and aryl halides towards nucleophilic substitution reactions.

Organometallic compounds of Mg and Li – Use in synthesis of organic compounds.

(16 Lectures)

Alcohols, Phenols, Ethers and Epoxides:

Alcohols: preparation, properties and relative reactivity of 1°, 2°, 3° alcohols, Bouveault-Blanc Reduction; Preparation and properties of glycols: Oxidation by periodic acid and lead tetraacetate, Pinacol-Pinacolone rearrangement;

Phenols: Preparation and properties; Acidity and factors effecting it, Ring substitution reactions, Reimer-Tiemann and Kolbe's-Schmidt Reactions, Fries and Claisen rearrangements with mechanism;

Ethers and Epoxides: Preparation and reactions with acids. Reactions of epoxides with alcohols, ammonia derivatives and LiAlH₄

(16 Lectures)

Carbonyl Compounds:

Preparation, properties, structure and reactivity;

Nucleophilic additions, Nucleophilic addition-elimination reactions with ammonia derivatives with mechanism; Mechanisms of Aldol and Benzoin condensation, Knoevenagel condensation, Claisan-Schmidt, Perkin, Cannizzaro and Wittig reaction, Beckmann and Benzil-Benzilic acid rearrangements, haloform reaction and Baeyer Villiger oxidation, α -substitution reactions, oxidations and reductions (Clemmensen, Wolff-Kishner, LiAlH₄, NaBH₄, MPV, PDC and PGC);

Addition reactions of unsaturated carbonyl compounds: Michael addition.

Active methylene compounds: Keto-enol tautomerism. Preparation and synthetic applications of diethyl malonate and ethyl acetoacetate.

(14 Lectures)

Carboxylic Acids and their Derivatives:

Preparation, physical properties and reactions of monocarboxylic acids: Typical reactions of dicarboxylic acids, hydroxy acids and unsaturated acids: succinic/phthalic, lactic, malic, tartaric, citric, maleic and fumaric acids;

Preparation and reactions of acid chlorides, anhydrides, esters and amides; Comparative study of nucleophilic substitution at acyl group -Mechanism of acidic and alkaline hydrolysis of esters, Claisen condensation, Dieckmann and Reformatsky reactions, Hofmannbromamide degradation and Curtius rearrangement.

(10 Lectures)

Sulphur containing compounds:

Preparation and reactions of thiols, thioethers and sulphonic acids.

(4 Lectures)

Recommended Books:

1. Morrison, R. T. & Boyd, R. N. *Organic Chemistry*, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
2. Finar, I. L. *Organic Chemistry (Volume 1)*, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
3. Graham Solomons, T.W. *Organic Chemistry*, John Wiley & Sons, Inc.
4. Clayden, J., Greeves, N. & Warren, S. *Organic Chemistry*, Second edition, Oxford University Press, 2012.
5. Keeler, J., Wothers, P. *Chemical Structure and Reactivity – An Integrated approach*, Oxford University Press.
6. Smith, J. G. *Organic Chemistry*, Tata McGraw-Hill Publishing Company Limited.
7. Carey, F. A.; Sundberg, R. J. *Advanced Organic Chemistry: Reactions and Synthesis (Part B)*, Springer.

LAB

60 Lectures

1. Test of functional groups like alcohols, phenols, carbonyl and carboxylic acid group.
2. Organic preparations:
 - i. Acetylation of one of the following compounds: amines (aniline, *o*-, *m*-, *p*-toluidines *o*-, *m*-, *p*-anisidine) and phenols (β -naphthol, vanillin, salicylic acid) by any one method:
 - a. Using conventional method.
 - b. Using green approach
 - ii. Benzoylation of one of the following amines (aniline, *o*-, *m*-, *p*-toluidines and *o*-, *m*-, *p*-anisidine) and one of the following phenols (β -naphthol, resorcinol, *p*-cresol) by Schotten-Baumann reaction.
 - iii. Oxidation of ethanol/ isopropanol (Iodoform reaction).
 - iv. Bromination of any one of the following:
 - a. Acetanilide by conventional methods
 - b. Acetanilide using green approach (Bromate-bromide method)
 - v. Nitration of any one of the following:
 - a. Acetanilide/nitrobenzene by conventional method
 - b. Salicylic acid by green approach (using ceric ammonium nitrate).

- vi. Selective reduction of *meta* dinitrobenzene to *m*-nitroaniline.
- vii. Reduction of *p*-nitrobenzaldehyde by sodium borohydride.
- viii. Hydrolysis of amides and esters.
- ix. Semicarbazone of any one of the following compounds: acetone, ethyl methyl ketone, cyclohexanone, benzaldehyde.
- x. *S*-Benzylisothiuronium salt of one each of water soluble and water insoluble acids (benzoic acid, oxalic acid, phenyl acetic acid and phthalic acid).
- xi. Aldol condensation using either conventional or green method.
- xii. Benzil-Benzilic acid rearrangement.

The above preparations should be done using 0.5-1g of the organic compound. The solid samples must be collected and may be used for recrystallization, melting point and TLC.

Recommended Books

1. Mann, F.G. & Saunders, B.C. *Practical Organic Chemistry*, Pearson Education (2009)
2. Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R. *Practical Organic Chemistry, 5th Ed.*, Pearson (2012)
3. Ahluwalia, V.K. & Aggarwal, R. *Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis*, University Press (2000).
4. Ahluwalia, V.K. & Dhingra, S. *Comprehensive Practical Organic Chemistry: Qualitative Analysis*, University Press (2000).
5. Vogel, A. I. *Elementary Practical Organic Chemistry, Part 1: Small scale Preparations*, CBS Publishers and Distributors.

CHE-HC-3036: PHYSICAL CHEMISTRY-III

(Credits: Theory-04, Lab-02)

Theory: 60 Lectures

Course Objective: The aim of this course is to teach students four important topics of physical chemistry- phase equilibria, chemical kinetics, surface chemistry and catalysis. Phase equilibria and chemical kinetics will be discussed in detail but surface chemistry and catalysis will be introduced to the students.

Learning Outcome: The students are expected to learn phase rule and its application in some specific systems. They will also learn rate laws of chemical transformation, experimental methods of rate law determination, steady state approximation etc. in chemical kinetics unit. After attending this course the students will be able to understand different types of surface adsorption processes and basics of catalysis including enzyme catalysis, acid base catalysis and particle size effect on catalysis.

Phase Equilibria:

Concept of phases, components and degrees of freedom, derivation of Gibbs Phase Rule for nonreactive and reactive systems; Clausius-Clapeyron equation and its applications to solid-liquid, liquid-vapour and solid-vapour equilibria, phase diagram for one component systems, with applications.

Phase diagrams for systems of solid-liquid equilibria involving eutectic, congruent and incongruent melting points, solid solutions.

Binary solutions: Gibbs-Duhem-Margules equation, its derivation and applications to fractional distillation of binary miscible liquids (ideal and nonideal), azeotropes, lever rule, partial miscibility of liquids, CST, miscible pairs, steam distillation.

Nernst distribution law: its derivation and applications.

(28 Lectures)

Chemical Kinetics

Order and molecularity of a reaction, rate laws in terms of the advancement of a reaction, differential and integrated form of rate expressions up to second order reactions, experimental methods of the determination of rate laws, kinetics of complex reactions (integrated rate expressions up to first order only): (i) Opposing reactions (ii) parallel reactions and (iii) consecutive reactions and their differential rate equations (iv) chain reactions.

Temperature dependence of reaction rates; Arrhenius equation; activation energy. Collision theory of reaction rates, Lindemann mechanism, qualitative treatment of the theory of absolute reaction rates.

Reaction mechanism- steady-state approximation and rate determining step approximation methods.

(18 Lectures)

Catalysis:

Types of catalyst, specificity and selectivity, mechanisms of catalyzed reactions at solid surfaces; effect of particle size and efficiency of nanoparticles as catalysts. Enzyme catalysis, Michaelis-Menten mechanism, acid-base catalysis.

(8 Lectures)

Surface chemistry:

Physical adsorption, chemisorption, adsorption isotherms, nature of adsorbed state.

(6 Lectures)

Recommended Books:

1. Peter Atkins & Julio De Paula, *Physical Chemistry 9th Ed.*, Oxford University Press(2010).
2. Castellan, G. W. *Physical Chemistry*, 4th Ed., Narosa (2004).
3. McQuarrie, D. A. & Simon, J. D., *Molecular Thermodynamics*, Viva Books Pvt. Ltd.:New Delhi (2004).
4. Engel, T. & Reid, P. *Physical Chemistry 3rd Ed.*, Prentice-Hall (2012).
5. Assael, M. J.; Goodwin, A. R. H.; Stamatoudis, M.; Wakeham, W. A. & Will, S. *Commonly Asked Questions in Thermodynamics*. CRC Press: NY (2011).
6. Zundhal, S.S. *Chemistry concepts and applications* Cengage India (2011).
7. Ball, D. W. *Physical Chemistry* Cengage India (2012).
8. Mortimer, R. G. *Physical Chemistry 3rd Ed.*, Elsevier: NOIDA, UP (2009).
9. Levine, I. N. *Physical Chemistry 6th Ed.*, Tata McGraw-Hill (2011).
10. Metz, C. R. *Physical Chemistry 2nd Ed.*, Tata McGraw-Hill (2009).

11. Puri, B. R.; Sharma, L. R.; Pathania, M. S. Principles of Physical Chemistry, Vishal Publishing Co.; 47th Ed. (2017)
 12. Kapoor, K. L. A Textbook of Physical Chemistry (Volume 5) McGraw Hill Education; 5th edition (2017)
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LAB

60 Lectures

- I. Determination of critical solution temperature and composition of the phenol-water system and to study the effect of impurities on it.
- II. Phase equilibria: Construction of the phase diagram using cooling curves or ignition tube method:
 - a. simple eutectic and
 - b. congruently melting systems.
- III. Distribution of acetic/ benzoic acid between water and cyclohexane.
- IV. Study the equilibrium of at least one of the following reactions by the distribution method:
 - (i) $I_2(aq) + I^- \rightarrow I_3(aq)$
 - (ii) $Cu^{2+}(aq) + nNH_3 \rightarrow Cu(NH_3)_n$
- V. Study the kinetics of the following reactions.
 1. Initial rate method: Iodide-persulphate reaction
 2. Integrated rate method:
 - a. Acid hydrolysis of methyl acetate with hydrochloric acid.
 - b. Saponification of ethyl acetate.
 3. Compare the strengths of HCl and H₂SO₄ by studying kinetics of hydrolysis of methyl acetate.
- VI. Adsorption
 - I. Verify the Freundlich and Langmuir isotherms for adsorption of acetic acid on activated charcoal.

Recommended Books:

1. Khosla, B. D.; Garg, V. C. & Gulati, A. *Senior Practical Physical Chemistry*, R. Chand & Co.: New Delhi (2011).
 2. Garland, C. W.; Nibler, J. W. & Shoemaker, D. P. *Experiments in Physical Chemistry 8th Ed.*; McGraw-Hill: New York (2003).
 3. Halpern, A. M. & McBane, G. C. *Experimental Physical Chemistry 3rd Ed.*; W.H. Freeman & Co.: New York (2003).
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Semester IV

CHE-HC-4016: INORGANIC CHEMISTRY-III

(Credits: Theory-04, Lab-02)

Theory: 60 Lectures

Course Objective: This course introduces students to coordination chemistry. Various aspects like nomenclature, structure, bonding, variety and reactivity of the coordination compounds are included for the students to appreciate.

Bioinorganic chemistry is included in this course to acquaint students on the useful and harmful aspects of metals in biological systems.

Through the accompanying lab course, experiments related to gravimetric analysis, synthesis of coordination compounds and separation of metal ions using chromatography is included. This will broaden the experimental skills of the students where students will learn about various aspects of experiment design depending upon the requirements like synthesis, estimation or separation.

Learning Outcome: On successful completion, students will be able name coordination compounds according to IUPAC, explain bonding in this class of compounds, understand their various properties in terms of CFSE and predict reactivity. Students will be able to appreciate the general trends in the properties of transition elements in the periodic table and identify differences among the rows.

Through the experiments students not only will be able to prepare, estimate or separate metal complexes/compounds but also will be able to design experiments independently which they should be able to apply if and when required.

Coordination Chemistry:

Coordination compounds, types of ligands, Werner's theory, IUPAC nomenclature and isomerism in coordination compounds. Stereochemistry of complexes with 4 and 6 coordination numbers.

Valence bond theory (inner and outer orbital complexes), electroneutrality principle and back bonding. Crystal field theory, measurement of $10 Dq$ (Δ_o), CFSE in weak and strong fields, pairing energies, factors affecting the magnitude of $10 Dq$ (Δ_o , Δ_t). Octahedral vs. tetrahedral coordination, tetragonal distortions from octahedral geometry Jahn-Teller theorem, square planar geometry. Qualitative aspects of ligand field and MO Theory. Chelate effect, polynuclear complexes, labile and inert complexes.

(26 Lectures)

Transition Elements:

General group trends with special reference to electronic configuration, colour, variable valency, magnetic and catalytic properties, ability to form complexes. Stability of various oxidation states and e.m.f. (Latimer & Frost diagrams). Difference between the first, second and third transition series.

Chemistry of Ti, V, Cr Mn, Fe and Co (Chemistry of first -row transition elements) in various oxidation states as halides, oxides, hydroxides.

(18 Lectures)

Lanthanoids and Actinoids:

Electronic configuration, oxidation states, colour, spectral and magnetic properties, lanthanide contraction, separation of lanthanides (ion-exchange method only).

(6 Lectures)

Bioinorganic Chemistry:

Metal ions present in biological systems, classification of elements according to their action in biological system. Geochemical effect on the distribution of metals. Sodium / K-pump, carbonic anhydrase and carboxypeptidase. Excess and deficiency of some trace metals. Toxicity of metal ions (Hg, Pb, Cd and As), reasons for toxicity, Use of chelating agents in medicine.

Iron and its application in bio-systems, Haemoglobin; Storage and transfer of iron.

(10 Lectures)

Recommended Books:

1. Cotton, F.A., Wilkinson, G. and Gaus, P. L., Basic Inorganic Chemistry, 3rd Ed., Wiley, 2007.
2. Huheey, J. E., Keiter, E. A., Keiter, R. L., Medhi, O. K., Inorganic Chemistry: Principles of Structure and Reactivity, 4th Ed., Pearson Education India, 2006.
3. Lippard, S.J. & Berg, J.M. Principles of Bioinorganic Chemistry, Panima Publishing Company, 1994.
4. Cotton, F.A. & Wilkinson, G, Advanced Inorganic Chemistry. 6th Ed., Wiley-VCH, 2007.
5. Basolo, F, and Pearson, R.C., Mechanisms of Inorganic Chemistry, John Wiley & Sons, NY, 1967.
6. Greenwood, N.N. & Earnshaw, A., Chemistry of the Elements, 2nd Ed., Elsevier India, 2010.

LAB

60 Lectures

Gravimetric Analysis:

- i. Estimation of nickel(II) using dimethylglyoxime (DMG).
- ii. Estimation of copper as CuSCN
- iii. Estimation of iron as Fe₂O₃ by precipitating iron as Fe(OH)₃.
- iv. Estimation of Al (III) by precipitating with oxine and weighing as Al(oxine)₃ (aluminium oxinate).

Inorganic Preparations:

- i. Tetraamminecopper(II) sulphate, [Cu(NH₃)₄]SO₄.H₂O
- ii. *Cis* and *trans* K[Cr(C₂O₄)₂.(H₂O)₂] Potassium dioxalatodiaquachromate (III)
- iii. Tetraamminecarbonatocobalt (III) ion
- iv. Potassium tris(oxalato)ferrate(III)

Chromatography of metal ions

Principles involved in chromatographic separations. Paper chromatographic separation of following metal ions:

- i. Ni(II) and Co(II)
- ii. Fe(III) and Al(III)

Recommended Book:

1. Mendham, J. et al.: Vogel's Textbook of Quantitative Chemical Analysis ; 6th Ed. Pearson Education, 2009.

2. Marr, G. and Rockett, R.W. *Practical Inorganic Chemistry*, Van Nostrand Reinhold. 1972.
 3. *Inorganic Syntheses*, Vol. 1-10.
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CHE-HC-4026: ORGANIC CHEMISTRY-III

(Credits: Theory-04, Lab-02)

Theory: 60 Lectures

Course Objectives: The course intrudes students to different classes of N-based compounds, including alkaloids and terpenoids and their potential application.

Students are expected to learn about different classes of N-based compounds; their structures, synthesis and reactivity.

Learning Outcome: Students shall demonstrate the ability to identify and classify different types of N-based derivatives, alkaloids and hetrocyclic compounds/explain their structure mechanism and reactivity/critically examine their synthesis and reactions mechanism.

Nitrogen Containing Functional Groups

Preparation and important reactions of nitro and compounds, nitriles and isonitriles

Amines: Effect of substituent and solvent on basicity; Preparation and properties: Gabriel phthalimide synthesis, Carbylamine reaction, Mannich reaction, Hoffmann's exhaustive methylation, Hofmann-elimination reaction; Distinction between 1°, 2° and 3° amines with Hinsberg reagent and nitrous acid.

Diazonium Salts: Preparation and their synthetic applications.

(18 Lectures)

Polynuclear Hydrocarbons

Reactions of naphthalene phenanthrene and anthracene Structure, Preparation and structure elucidation and important derivatives of naphthalene and anthracene; Polynuclear hydrocarbons.

(8 Lectures)

Heterocyclic Compounds

Classification and nomenclature, Structure, aromaticity in 5-numbered and 6-membered rings containing one heteroatom;

Synthesis, reactions and mechanism of substitution reactions of:

Furan, Pyrrole (Paal-Knorr synthesis, Knorr pyrrole synthesis, Hantzsch synthesis), Thiophene, Pyridine (Hantzsch synthesis), Pyrimidine.

Indole: Fischer indole synthesis and Madelung synthesis).

Quinoline and isoquinoline: Skraup synthesis, Friedlander's synthesis, Knorr quinoline synthesis, Doebner- Miller synthesis, Bischler-Napieralski reaction, Pictet-Spengler reaction, Pomeranz-Fritsch reaction

(22 Lectures)

Alkaloids

Natural occurrence, General structural features, Isolation and their physiological action Hoffmann's exhaustive methylation, Emde's modification, Structure elucidation and synthesis of Nicotine. Medicinal importance of Nicotine, Hygrine, Quinine, Morphine, Cocaine, and Reserpine.

(6 Lectures)

Terpenes

Occurrence, classification, isoprene rule; Elucidation of structure and synthesis of Citral, Neral and α -terpineol.

(6 Lectures)

Recommended Books:

1. Morrison, R. T. & Boyd, R. N. *Organic Chemistry*, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
 2. Finar, I. L. *Organic Chemistry (Volume 1)*, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
 3. Finar, I. L. *Organic Chemistry (Volume 2: Stereochemistry and the Chemistry of Natural Products)*, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
 4. Graham Solomons, T.W. *Organic Chemistry*, John Wiley & Sons, Inc.
 5. Kalsi, P. S. *Textbook of Organic Chemistry 1st Ed.*, New Age International (P) Ltd. Pub.
 6. Clayden, J.; Greeves, N.; Warren, S.; Wothers, P.; *Organic Chemistry*, Oxford University Press.
 7. Singh, J.; Ali, S.M. & Singh, J. *Natural Product Chemistry*, Prajati Parakashan (2010). (2010).
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LAB

60 Lectures

1. Detection N, S, halogens in organic compounds.
2. Functional group test for nitro, amine and amide groups.
3. Qualitative analysis of unknown organic compounds containing simple functional groups (alcohols, carboxylic acids, phenols and carbonyl compounds)

Recommended Books

1. Mann, F.G. & Saunders, B.C. *Practical Organic Chemistry*, Pearson Education (2009)
2. Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R. *Practical Organic*

- Chemistry, 5th Ed.*, Pearson (2012)
- Ahluwalia, V.K. & Aggarwal, R. *Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis*, University Press (2000).
 - Ahluwalia, V.K. & Dhingra, S. *Comprehensive Practical Organic Chemistry: Qualitative Analysis*, University Press (2000).
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CHE-HC-4036: PHYSICAL CHEMISTRY-IV

(Credits: Theory-04, Lab-02)

Theory: 60 Lectures

Course Objective: The aim of this course is to introduce students with primarily two areas of physical chemistry- electrochemistry and electrical and magnetic properties of atoms and molecules. It contains three units- conductance, electrochemistry and electrical & magnetic properties of atoms and molecules.

Learning Outcome: In this course the students will learn theories of conductance and electrochemistry. Students will also understand some very important topics such as solubility and solubility products, ionic products of water, conductometric titrations etc. The students are also expected to understand the various parts of electrochemical cells along with Faraday's Laws of electrolysis. The students will also gain basic theoretical idea of electrical & magnetic properties of atoms and molecules.

Conductance

Arrhenius theory of electrolytic dissociation. Conductivity, equivalent and molar conductivity and their variation with dilution for weak and strong electrolytes. Molar conductivity at infinite dilution. Kohlrausch law of independent migration of ions. Debye-Hückel-Onsager equation, Wien effect, Debye-Falkenhagen effect, Walden's rules.

Ionic velocities, mobilities and their determinations, transference numbers and their relation to ionic mobilities, determination of transference numbers using Hittorf and Moving Boundary methods. Applications of conductance measurement: (i) degree of dissociation of weak electrolytes, (ii) ionic product of water (iii) solubility and solubility product of sparingly soluble salts, (iv) conductometric titrations, and (v) hydrolysis constants of salts.

(20 Lectures)

Electrochemistry

Quantitative aspects of Faraday's laws of electrolysis, rules of oxidation/reduction of ions based on half-cell potentials.

Chemical cells, reversible and irreversible cells with examples. Electromotive force of a cell and its measurement, Nernst equation; Standard electrode (reduction) potential and its application to different kinds of half-cells. Application of EMF measurements in determining (i) free energy, enthalpy and entropy of a cell reaction, (ii) equilibrium constants, and (iii) pH values, using hydrogen, quinone-hydroquinone, glass and SbO/Sb₂O₃ electrodes. Concentration cells with and without transference, liquid junction potential; determination of activity coefficients and transference numbers. Qualitative discussion of potentiometric

titrations (acid-base, redox, precipitation). Applications of electrolysis in metallurgy and industry.

(28 Lectures)

Electrical & Magnetic Properties of Atoms and Molecules

Basic ideas of electrostatics, Electrostatics of dielectric media, Clausius-Mosotti equation, Lorenz-Laurentz equation, Dipole moment and molecular polarizabilities and their measurements. Diamagnetism, paramagnetism, magnetic susceptibility and its measurement, molecular interpretation.

(12 Lectures)

Recommended Books:

1. Atkins, P.W & Paula, J.D. *Physical Chemistry*, 9th Ed., Oxford University Press (2011).
2. Castellan, G. W. *Physical Chemistry 4th Ed.*, Narosa (2004).
3. Mortimer, R. G. *Physical Chemistry 3rd Ed.*, Elsevier: NOIDA, UP (2009).
4. Barrow, G. M., *Physical Chemistry 5th Ed.*, Tata McGraw Hill: New Delhi (2006).
5. Engel, T. & Reid, P. *Physical Chemistry 3rd Ed.*, Prentice-Hall (2012).
6. Rogers, D. W. *Concise Physical Chemistry* Wiley (2010).
7. Silbey, R. J.; Alberty, R. A. & Bawendi, M. G. *Physical Chemistry 4th Ed.*, John Wiley & Sons, Inc. (2005).
8. Puri, B. R.; Sharma, L. R.; Pathania, M. S. Principles of Physical Chemistry, Vishal Publishing Co.; 47th Ed. (2017)
9. Kapoor, K. L. A Textbook of Physical Chemistry (Volume 1) McGraw Hill Education; Sixth edition (2019)

LAB

60 Lectures

Conductometry

- I. Determination of cell constant
- II. Determination of equivalent conductance, degree of dissociation and dissociation constant of a weak acid.
- III. Perform the following conductometric titrations:
 - i. Strong acid vs. strong base
 - ii. Weak acid vs. strong base
 - iii. Mixture of strong acid and weak acid vs. strong base
 - iv. Strong acid vs. weak base

Potentiometry

- I Perform the following potentiometric titrations:
 - i. Strong acid vs. strong base
 - ii. Weak acid vs. strong base
 - iii. Dibasic acid vs. strong base
 - iv. Potassium dichromate vs. Mohr's salt

Recommended Books:

1. Khosla, B. D.; Garg, V. C. & Gulati, A. *Senior Practical Physical Chemistry*, R.

- Chand & Co.: New Delhi (2011).
- Garland, C. W.; Nibler, J. W. & Shoemaker, D. P. *Experiments in Physical Chemistry 8th Ed.*; McGraw-Hill: New York (2003).
 - Halpern, A. M. & McBane, G. C. *Experimental Physical Chemistry 3rd Ed.*; W.H. Freeman & Co.: New York (2003).
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Semester V

CHE-HC-5016: ORGANIC CHEMISTRY-IV

(Credits: Theory-04, Lab-02)

Theory: 60 Lectures

Course Objectives: This course introduces students to nucleic acids, amino acids and pharmaceutical compounds.

Students will be familiarized with the importance of nucleic acids, amino acids and develop basic understanding of enzymes, bioenergetics and pharmaceutical compounds.

Learning Outcome: Students will be able to explain/describe the important features of nucleic acids, amino acids and enzymes and develop their ability to examine their properties and applications.

Nucleic Acids

Components of nucleic acids; Nucleosides and nucleotides;

Synthesis and reactions of: Adenine, Guanine, Cytosine, Uracil and Thymine;
Polynucleotides: DNA and RNA

(9 Lectures)

Amino Acids, Peptides and Proteins

Amino acids, Peptides and their classification.

α -Amino Acids - Synthesis, ionic properties and reactions. Zwitterions, pK_a values, isoelectric point and electrophoresis;

Study of peptides: determination of their primary structures-end group analysis, methods of peptide synthesis. Synthesis of peptides using N-protecting, C-protecting and C-activating groups -Solid-phase synthesis

(16 Lectures)

Enzymes

Introduction, classification and characteristics of enzymes. Salient features of active site of enzymes.

Mechanism of enzyme action (taking trypsin as example), factors affecting enzyme action, coenzymes and cofactors and their role in biological reactions, specificity of enzyme action

(including stereospecificity), enzyme inhibitors and their importance, phenomenon of inhibition (competitive, uncompetitive and non-competitive inhibition including allosteric inhibition).

(8 Lectures)

Lipids

Introduction to oils and fats; common fatty acids present in oils and fats, Hydrogenation of fats and oils, saponification value, acid value, iodine number, rancidity.

(6 Lectures)

Concept of Energy in Biosystems

Cells obtain energy by the oxidation of foodstuff (organic molecules).

Introduction to metabolism (catabolism, anabolism).

ATP: The universal currency of cellular energy, ATP hydrolysis and free energy change.

Agents for transfer of electrons in biological redox systems: NAD⁺, FAD.

Conversion of food to energy: Outline of catabolic pathways of carbohydrate- glycolysis, fermentation, Krebs cycle.

Overview of catabolic pathways of fat and protein.

Interrelationship in the metabolic pathways of protein, fat and carbohydrate.

Calorific value of food, standard calorie content of food types.

(9 Lectures)

Pharmaceutical Compounds: Structure and Importance

Classification, structure and therapeutic uses of antipyretics: Paracetamol (with synthesis), Analgesics: Ibuprofen (with synthesis), Antimalarials: Chloroquine (with synthesis). An elementary treatment of Antibiotics and detailed study of chloramphenicol, Medicinal values of curcumin (turmeric), azadirachtin (neem), vitamin C and antacid (ranitidine).

(12 Lectures)

Recommended Books:

1. Berg, J.M., Tymoczko, J.L. and Stryer, L. (2006) Biochemistry. VIth Edition. W.H. Freeman and Co.
2. Nelson, D.L., Cox, M.M. and Lehninger, A.L. (2009) Principles of Biochemistry. IV Edition. W.H. Freeman and Co.
3. Murray, R.K., Granner, D.K., Mayes, P.A. and Rodwell, V.W. (2009) Harper's Illustrated Biochemistry. XXVIII edition. Lange Medical Books/ McGraw-Hill.

LAB

60 Lectures

1. Estimation of glycine by Sorenson's formalin method.
2. Study of the titration curve of glycine.
3. Estimation of proteins by Lowry's method.
4. Study of the action of salivary amylase on starch at optimum conditions.
5. Effect of temperature on the action of salivary amylase.
6. Saponification value of an oil or a fat.
7. Determination of Iodine number of an oil/ fat.
8. Isolation and characterization of DNA from onion/ cauliflower/peas.

Recommended Books:

1. Arthur, I. V. *Quantitative Organic Analysis*, Pearson.
2. Plummer, D. T. *An Introduction to Practical Biochemistry*, 3rd Edition, McGraw Hill.

CHE-HC-5026: PHYSICAL CHEMISTRY V**(Credits: Theory-04, Lab-02)****Theory: 60 Lectures**

Course Objective: The aim of this course is to introduce the students with three important areas- quantum chemistry, molecular spectroscopy and photochemistry. In quantum chemistry unit the students will be taught the postulates of quantum mechanics and the application of quantum mechanical ideas in some simple systems such as particle in a box, rigid rotor, simple harmonic oscillator etc. In spectroscopy unit, rotational, vibrational, Raman, electronic, spin resonance, and electronic spectroscopy will be introduced.

Learning Outcome: After completion of this course the students are expected to understand the application of quantum mechanics in some simple chemical systems such as hydrogen atom or hydrogen like ions. The students will also learn chemical bonding in some simple molecular systems. They will be able to understand the basics of various kinds of spectroscopic techniques and photochemistry.

Quantum Chemistry:

Postulates of quantum mechanics, quantum mechanical operators, Schrödinger equation and its application to free particle and “particle-in-a-box” (rigorous treatment), quantization of energy levels, zero-point energy Extension to two and three dimensional boxes, separation of variables, degeneracy.

Qualitative treatment of simple harmonic oscillator model of vibrational motion: Setting up of Schrödinger equation and discussion of solution and wavefunctions. Vibrational energy of diatomic molecules and zero-point energy.

Angular momentum: Commutation rules, quantization of square of total angular momentum and z-component.

Rigid rotator model of rotation of diatomic molecule. Schrödinger equation, transformation to spherical polar coordinates. Separation of variables. Spherical harmonics. Discussion of solution.

Qualitative treatment of hydrogen atom and hydrogen-like ions: setting up of Schrödinger equation in spherical polar coordinates, radial part, quantization of energy (only final energy expression). Average and most probable distances of electron from nucleus.

Setting up of Schrödinger equation for many-electron atoms (He, Li). Need for approximation methods. Statement of variation theorem and application to simple systems (particle-in-a-box, harmonic oscillator, hydrogen atom).

Chemical bonding: Covalent bonding, valence bond and molecular orbital approaches, LCAO-MO treatment of H_2^+ . Bonding and antibonding orbitals. Qualitative extension to H_2 . Comparison of LCAO-MO and VB treatments of H_2 (only wavefunctions, detailed solution not required) and their limitations. Refinements of the two approaches (Configuration Interaction for MO, ionic terms in VB). Qualitative description of LCAO-MO treatment of homonuclear and heteronuclear diatomic molecules (HF, LiH). Localised and non-localised molecular orbitals treatment of triatomic (BeH_2 , H_2O) molecules. Qualitative MO theory and its application to AH_2 type molecules.

(24 Lectures)

Molecular Spectroscopy:

Interaction of electromagnetic radiation with molecules and various types of spectra; Born-Oppenheimer approximation.

Rotation spectroscopy: Selection rules, intensities of spectral lines, determination of bond lengths of diatomic and linear triatomic molecules, isotopic substitution.

Vibrational spectroscopy: Classical equation of vibration, computation of force constant, amplitude of diatomic molecular vibrations, anharmonicity, Morse potential, dissociation energies, fundamental frequencies, overtones, hot bands, degrees of freedom for polyatomic molecules, modes of vibration, concept of group frequencies. Vibration-rotation spectroscopy: diatomic vibrating rotator, P, Q, R branches.

Raman spectroscopy: Qualitative treatment of Rotational Raman effect; Effect of nuclear spin, Vibrational Raman spectra, Stokes and anti-Stokes lines; their intensity difference, rule of mutual exclusion.

Electronic spectroscopy: Franck-Condon principle, electronic transitions, singlet and triplet states, fluorescence and phosphorescence, dissociation and predissociation, calculation of electronic transitions of polyenes using free electron model.

(24 Lectures)

Photochemistry

Characteristics of electromagnetic radiation, Lambert-Beer's law and its limitations, physical significance of absorption coefficients. Laws, of photochemistry, quantum yield, actinometry, examples of low and high quantum yields, photochemical equilibrium and the differential rate of photochemical reactions, photosensitised reactions, quenching. Role of photochemical reactions in biochemical processes, photostationary states, chemiluminescence.

(12 Lectures)

Recommended Books:

1. Banwell, C. N. & McCash, E. M. Fundamentals of Molecular Spectroscopy 4th Ed. Tata McGraw-Hill: New Delhi (2006).
2. Chandra, A. K. Introductory Quantum Chemistry Tata McGraw-Hill (2001).
3. House, J. E. Fundamentals of Quantum Chemistry 2nd Ed. Elsevier: USA (2004).
4. Lowe, J. P. & Peterson, K. Quantum Chemistry, Academic Press (2005).
5. Kakkar, R. Atomic & Molecular Spectroscopy, Cambridge University Press (2015).

6. Kapoor, K. L. A Textbook of Physical Chemistry (Volume 4) McGraw Hill Education; 5th edition (2017)
 7. Sen, B. K. Quantum Chemistry- Including Spectroscopy, Kalyani Publishers; 4th edition (2011)
 8. McQuarrie, D. A. Quantum Chemistry, Viva Books (2016)
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LAB

60 Lectures

UV/Visible spectroscopy

- I. Study the 200-500 nm absorbance spectra of KMnO_4 and $\text{K}_2\text{Cr}_2\text{O}_7$ (in 0.1 M H_2SO_4) and determine the λ_{max} values. Calculate the energies of the two transitions in different units (J molecule^{-1} , kJ mol^{-1} , cm^{-1} , eV).
- II. Study the pH-dependence of the UV-Vis spectrum (200-500 nm) of $\text{K}_2\text{Cr}_2\text{O}_7$.
- III. Record the 200-350 nm UV spectra of the given compounds (acetone, acetaldehyde, 2-propanol, acetic acid) in water. Comment on the effect of structure on the UV spectra of organic compounds.

Colourimetry

- I. Verify Lambert-Beer's law and determine the concentration of $\text{CuSO}_4/\text{KMnO}_4/\text{K}_2\text{Cr}_2\text{O}_7$ in a solution of unknown concentration
- II. Determine the concentrations of KMnO_4 and $\text{K}_2\text{Cr}_2\text{O}_7$ in a mixture.
- III. Study the kinetics of iodination of propanone in acidic medium.
- IV. Determine the amount of iron present in a sample using 1,10-phenanthroline.
- V. Determine the dissociation constant of an indicator (phenolphthalein).
- VI. Study the kinetics of interaction of crystal violet/ phenolphthalein with sodium hydroxide.
- VII. Analysis of the given vibration-rotation spectrum of $\text{HCl}(\text{g})$

Recommended Books

1. Khosla, B. D.; Garg, V. C. & Gulati, A., *Senior Practical Physical Chemistry*, R. Chand & Co.: New Delhi (2011).
 2. Garland, C. W.; Nibler, J. W. & Shoemaker, D. P. *Experiments in Physical Chemistry 8th Ed.*; McGraw-Hill: New York (2003).
 3. Halpern, A. M. & McBane, G. C. *Experimental Physical Chemistry 3rd Ed.*; W.H. Freeman & Co.: New York (2003).
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Semester VI

CHE-HC-6016: INORGANIC CHEMISTRY-IV

(Credits: Theory-04, Lab-02)

Theory: 60 Lectures

Course Objective: The unit on reaction mechanism is included for the students to get acquainted with the kinetic and thermodynamic factors governing the reaction path and stability of inorganic compounds.

Organometallic compounds are introduced so as to apprise students about the importance of metal carbon bond to form complexes and their application as catalysts. Students are expected to learn factors leading to stability of organometallic compounds, their synthesis, reactivity and uses.

Qualitative inorganic analysis is included to give students an idea and hands on experience of application of inorganic chemistry. Students should learn how differential reactivity under different conditions of pH can be used to identify variety of ions in a complex mixture.

Experiments related to synthesis and characterization of coordination compounds are included to supplement their theoretical knowledge.

Learning Outcome: By studying this course the students will be expected to learn about how ligand substitution and redox reactions take place in coordination complexes.

Students will also learn about organometallic compounds, comprehend their bonding, stability, reactivity and uses. They will be familiar with the variety of catalysts based on transition metals and their application in industry.

On successful completion, students in general will be able to appreciate the use of concepts like solubility product, common ion effect, pH etc. in analysis of ions and how a clever design of reactions, it is possible to identify the components in a mixture.

With the experiments related to coordination compound synthesis, calculation of $10Dq$, controlling factors etc. will make the students appreciate the concepts of theory in experiments.

Mechanism of Inorganic Reactions

Introduction to inorganic reaction mechanisms. Substitution reactions in square planar complexes, Trans-effect, theories of trans effect, Mechanism of nucleophilic substitution in square planar complexes, Thermodynamic and Kinetic stability, Kinetics of octahedral substitution, Ligand field effects and reaction rates, Mechanism of substitution in octahedral complexes. Electron transfer reactions.

(18 Lectures)

Organometallic Compounds

Definition and classification of organometallic compounds on the basis of bond type.

Concept of hapticity of organic ligands.

Metal carbonyls: 18 electron rule, electron count of mononuclear, polynuclear and substituted metal carbonyls of 3d series. General methods of preparation (direct combination, reductive carbonylation, thermal and photochemical decomposition) of mono and binuclear carbonyls of 3d series. Structures of mononuclear and binuclear carbonyls of Cr, Mn, Fe, Co and Ni using VBT. π -acceptor behaviour of CO (MO diagram of CO to be discussed), synergic effect and use of IR data to explain extent of back bonding. Zeise's salt: Preparation and structure, evidences of synergic effect and comparison of synergic effect with that in carbonyls.

Metal Alkyls: Important structural features of methyl lithium (tetramer) and trialkyl aluminium (dimer), concept of multicentre bonding in these compounds. Role of triethylaluminium in polymerisation of ethene (Ziegler – Natta Catalyst). Species present in ether solution of Grignard reagent and their structures, Schlenk equilibrium.

Ferrocene: Preparation and reactions (acetylation, alkylation, metallation, Mannich

condensation). Structure and aromaticity. Comparison of aromaticity and reactivity with that of benzene.

(22 Lectures)

Transition Metals in Catalysis

Study of the following industrial processes and their mechanism:

1. Alkene hydrogenation (Wilkinson's Catalyst)
2. Hydroformylation (Co catalysts)
3. Wacker Process
4. Synthetic gasoline (Fischer Tropsch reaction)
5. Synthesis gas by metal carbonyl complexes

(10 Lectures)

Theoretical Principles in Qualitative Inorganic Analysis (H₂S Scheme)

Basic principles involved in analysis of cations and anions and solubility products, common ion effect. Principles involved in separation of cations into groups and choice of group reagents. Interfering anions (fluoride, borate, oxalate and phosphate) and need to remove them after Group II.

(10 Lectures)

Recommended Books:

1. Vogel, A.I. *Qualitative Inorganic Analysis*, Longman, 1972.
2. Svehla, G. & Sivasankar, B., *Vogel's Qualitative Inorganic Analysis*, 7th Ed., Prentice Hall, 2012.
3. Cotton, F.A., Wilkinson, G. and Gaus, P. L., *Basic Inorganic Chemistry*, 3rd Ed., Wiley, 2007.
4. Cotton, F.A. & Wilkinson, G, *Advanced Inorganic Chemistry*. 6th Ed., Wiley-VCH, 2007.
5. Huheey, J. E., Keiter, E. A., Keiter, R. L., Medhi, O. K., *Inorganic Chemistry: Principles of Structure and Reactivity*, 4th Ed., Pearson Education India, 2006.
6. Sharpe, A.G. *Inorganic Chemistry*, 4th Indian Reprint (Pearson Education) 2005
7. Douglas, B.E. and Mc Daniel, D.H., *Concepts and Models of Inorganic Chemistry*, 3rd Ed. Wiley India, 2006.
8. Greenwood, N.N. & Earnshaw, A., *Chemistry of the Elements*, 2nd Ed., Elsevier India, 2010.
9. Lee, J. D., *Concise Inorganic Chemistry*, 5th Ed., Oxford University Press, 2008.
10. Powell, P. *Principles of Organometallic Chemistry*, Chapman and Hall, 1988.
11. Shriver, D.D. & Atkins, P., *Inorganic Chemistry 2nd Ed.*, Oxford University Press, 1994.
12. Basolo, F. & Person, R. *Mechanisms of Inorganic Reactions: Study of Metal Complexes in Solution* 2nd Ed., John Wiley & Sons Inc; NY.
13. Purcell, K.F. & Kotz, J.C., *Inorganic Chemistry*, W.B. Saunders Co. 1977
14. Miessler, G. L. & Tarr, D. A., *Inorganic Chemistry* 4th Ed., Pearson, 2010.
15. Crabtree, Robert H. *The Organometallic Chemistry of the Transition Metals. j* New York, NY: John Wiley, 2000.
16. Spessard, Gary O., & Gary L. Miessler. *Organometallic Chemistry*. Upper Saddle River, NJ: Prentice-Hall, 1996.

LAB

60 Lectures

- Qualitative semimicro analysis of mixtures containing 3 anions and 3 cations. Emphasis should be given to the understanding of the chemistry of different reactions. The following radicals are suggested: CO_3^{2-} , NO_2^- , S^{2-} , SO_3^{2-} , $\text{S}_2\text{O}_3^{2-}$, CH_3COO^- , F^- , Cl^- , Br^- , I^- , NO_3^- , BO_3^{3-} , $\text{C}_2\text{O}_4^{2-}$, PO_4^{3-} , NH_4^+ , K^+ , Pb^{2+} , Cu^{2+} , Cd^{2+} , Bi^{3+} , Sn^{2+} , Sb^{3+} , Fe^{3+} , Al^{3+} , Cr^{3+} , Zn^{2+} , Mn^{2+} , Co^{2+} , Ni^{2+} , Ba^{2+} , Sr^{2+} , Ca^{2+} , Mg^{2+}
- Mixtures should preferably contain one interfering anion, **or** insoluble component (BaSO_4 , SrSO_4 , PbSO_4 , CaF_2 or Al_2O_3) **or** combination of anions e.g. CO_3^{2-} and SO_3^{2-} , NO_2^- and NO_3^- , Cl^- and Br^- , Cl^- and I^- , Br^- and I^- , NO_3^- and Br^- , NO_3^- and I^- .
- Spot tests should be done whenever possible.
- Synthesis of ammine complexes of Ni(II) and their ligand exchange reactions involving bidentate ligands like acetylacetone, dimethylglyoxime, glycine, etc.
- Preparation of acetylacetonato complexes of $\text{Cu}^{2+}/\text{Fe}^{3+}$.
- Controlled synthesis of two copper oxalate hydrate complexes: kinetic vs. thermodynamic factors.
- Determination of ϵ_{max} value from UV-visible spectra of complexes.
- Measurement of 10 Dq by spectrophotometric method, verification of spectrochemical series.

Recommended Books

1. Vogel's *Qualitative Inorganic Analysis*, Revised by G. Svehla.
2. Marr, G. and Rockett, R.W. *Practical Inorganic Chemistry*, Van Nostrand Reinhold. 1972.

CHE-HC-6026: ORGANIC CHEMISTRY-V

(Credits: Theory-04, Lab -02)

Theory: 60 Lectures

(24 Lectures)

Course Objectives: This is a basic course in organic spectroscopy and provides introduction to carbohydrate chemistry, dyes and polymers.

Students are expected to learn about the different spectroscopic techniques and their applications in organic chemistry. Students shall be apprised with carbohydrate chemistry, dyes and polymers and their structure, reactivity and chemical properties.

Learning Outcome: Students will be able to explain/describe basic principles of different spectroscopic techniques and their importance in chemical/organic analysis. Students shall be able to classify/identify/critically examine carbohydrates, polymers and dye materials.

Spectroscopy

Introduction to absorption and emission spectroscopy.

UV Spectroscopy: Types of electronic transitions, λ_{max} , Chromophores and Auxochromes, Bathochromic and Hypsochromic shifts, Intensity of absorption; Application of Woodward

Rules for calculation of λ_{\max} for the following systems: α,β unsaturated aldehydes, ketones, carboxylic acids and esters; Conjugated dienes: alicyclic, homoannular and heteroannular; Extended conjugated systems (aldehydes, ketones and dienes); distinction between cis and trans isomers.

IR Spectroscopy: Fundamental and non-fundamental molecular vibrations; IR absorption positions of O, N and S containing functional groups; Effect of H-bonding, conjugation, resonance and ring size on IR absorptions; Fingerprint region and its significance; application in functional group analysis.

NMR Spectroscopy: Basic principles of Proton Magnetic Resonance, chemical shift and factors influencing it; Spin – Spin coupling and coupling constant; Anisotropic effects in alkene, alkyne, aldehydes and aromatics, Interpretation of NMR spectra of simple compounds.

Electron Spin Resonance (ESR) spectroscopy: Its principle, hyperfine structure, ESR of simple radicals.

Applications of IR, UV and NMR for identification of simple organic and inorganic molecules.

(24 Lectures)

Carbohydrates

Occurrence, classification and their biological importance.

Monosaccharides: Constitution and absolute configuration of glucose and fructose, epimers and anomers, mutarotation, determination of ring size of glucose and fructose, Haworth projections and conformational structures; Interconversions of aldoses and ketoses; Killiani-Fischer synthesis and Ruff degradation;

Disaccharides – Structure elucidation of maltose, lactose and sucrose.

Polysaccharides – Elementary treatment of starch, cellulose and glycogen.

(16 Lectures)

Dyes

Classification, Colour and constitution; Mordant and Vat Dyes; Synthesis and applications of: Azo dyes – Methyl Orange and Congo Red (mechanism of Diazo Coupling); Triphenyl Methane Dyes -Malachite Green, Rosaniline and Crystal Violet; Phthalein Dyes – Phenolphthalein and Fluorescein; Natural dyes synthesis of Alizarin and Indigotin; Edible Dyes with examples.

(8 Lectures)

Polymers

Introduction and classification.

Number average molecular weight, Weight average molecular weight, Degree of polymerization, Polydispersity Index.

Polymerisation reactions -Addition and condensation -Mechanism of cationic, anionic and free radical addition polymerization; Preparation and applications of plastics – thermosetting (phenol-formaldehyde, Polyurethanes) and thermosoftening (PVC, polythene);

Fabrics – natural and synthetic (acrylic, polyamido, polyester); Rubbers – natural and synthetic: Buna-S, Chloroprene and Neoprene; Vulcanization; Polymer additives;

Introduction to liquid crystal polymers; Biodegradable and conducting polymers with examples.

(12 Lectures)

Recommended Books:

1. Banwell, C. N. & Mc.Cash, E. M. *Fundamentals of Molecular Spectroscopy*, 4th Edition, McGraw Hill.
 2. Pavia, Lampman, Kriz & Vyvyan, *Introduction to Spectroscopy*, 5th Edition, CENGAGE Learning.
 3. Silverstein, R. M.; Webster, F. X.; Kiemle, D. J. & Bryce, D. L. *Spectrometric Identification of Organic Compounds*, 8th Edition, Wiley.
 4. Kemp, W. *Organic Spectroscopy*, Palgrave.
 5. Kalsi, P. S. *Textbook of Organic Chemistry 1st Ed.*, New Age International (P) Ltd. Pub.
 6. Morrison, R. T. & Boyd, R. N. *Organic Chemistry*, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
 7. Billmeyer, F. W. *Textbook of Polymer Science*, John Wiley & Sons, Inc.
 8. Gowariker, V. R.; Viswanathan, N. V. & Sreedhar, J. *Polymer Science*, New Age International (P) Ltd. Pub.
 9. Finar, I. L. *Organic Chemistry (Volume 2: Stereochemistry and the Chemistry of Natural Products)*, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
 10. Graham Solomons, T.W. *Organic Chemistry*, John Wiley & Sons, Inc.
 11. Clayden, J.; Greeves, N.; Warren, S.; Wothers, P.; *Organic Chemistry*, Oxford University Press.
 12. Singh, J.; Ali, S.M. & Singh, J. *Natural Product Chemistry*, Prajati Prakashan (2010).
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LAB

60 Lectures

1. Extraction of caffeine from tea leaves.
2. Preparation of sodium polyacrylate.
3. Preparation of urea formaldehyde.
4. Analysis of Carbohydrate: aldoses and ketoses, reducing and non-reducing sugars
5. Qualitative analysis of unknown organic compounds containing monofunctional groups (carbohydrates, aryl halides, aromatic hydrocarbons, nitro compounds, amines and amides) and simple bifunctional groups, for e.g. salicylic acid, cinnamic acid, nitrophenols etc.
6. Identification of simple organic compounds by IR spectroscopy and NMR spectroscopy (Spectra to be provided).
7. Preparation of methyl orange.

Recommended Books:

1. Vogel, A.I. *Quantitative Organic Analysis*, Part 3, Pearson (2012).

2. Mann, F.G. & Saunders, B.C. *Practical Organic Chemistry*, Pearson Education (2009)
 3. Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R. *Practical Organic Chemistry, 5th Ed.*, Pearson (2012)
 4. Ahluwalia, V.K. & Aggarwal, R. *Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis*, University Press (2000).
 5. Ahluwalia, V.K. & Dhingra, S. *Comprehensive Practical Organic Chemistry: Qualitative Analysis*, University Press (2000).
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CHEMISTRY-Discipline Specific Electives (DSE)

CHE-HE-5016: APPLICATIONS OF COMPUTERS IN CHEMISTRY

(Credits: Theory-04, Lab -02)

Theory: 60 Lectures

Course Objective: This course intends to make learners familiar with basics of computer language, computer programming, handling of experimental data, curve fitting etc to analyze experimental results. This basic knowledge will help the students to perform and interpret results of various chemistry practicals.

Learning Outcome: After the completion of this course it will help the student to interpret laboratory data, curve fitting of experimental work, also perform quantum mechanical calculations for various molecular models.

Basics:

Constants, variables, bits, bytes, binary and ASCII formats, arithmetic expressions, hierarchy of operations, inbuilt functions. Elements of the BASIC language. BASIC keywords and commands. Logical and relative operators. Strings and graphics. Compiled versus interpreted languages. Debugging. Simple programs using these concepts. Matrix addition and multiplication. Statistical analysis.

Numerical methods:

Roots of equations: Numerical methods for roots of equations: Quadratic formula, iterative method, Newton-Raphson method, Binary bisection and Regula-Falsi.

Differential calculus: Numerical differentiation.

Integral calculus: Numerical integration (Trapezoidal and Simpson's rule), probability distributions and mean values.

Simultaneous equations: Matrix manipulation: addition, multiplication. Gauss-Siedal method.

Interpolation, extrapolation and curve fitting: Handling of experimental data.

Conceptual background of molecular modelling: Potential energy surfaces. Elementary ideas of molecular mechanics and practical MO methods.

Recommended Books:

1. Harris, D. C. *Quantitative Chemical Analysis*. 6th Ed., Freeman (2007) Chapters 3-5.
 2. Levie, R. de, *How to use Excel in analytical chemistry and in general scientific data analysis*, Cambridge Univ. Press (2001) 487 pages.
 3. Noggle, J. H. *Physical chemistry on a Microcomputer*. Little Brown & Co. (1985).
 4. Venit, S.M. *Programming in BASIC: Problem solving with structure and style*. Jaico Publishing House: Delhi (1996).
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LAB

60 Lectures

Computer programs based on numerical methods for

1. Roots of equations: (e.g. volume of van der Waals gas and comparison with ideal gas, pH of a weak acid).
2. Numerical differentiation (e.g., change in pressure for small change in volume of a van der Waals gas, potentiometric titrations).
3. Numerical integration (e.g. entropy/ enthalpy change from heat capacity data), probability distributions (gas kinetic theory) and mean values.
4. Matrix operations. Application of Gauss-Siedel method in colourimetry.
5. Simple exercises using molecular visualization software.

Recommended Books:

1. McQuarrie, D. A. *Mathematics for Physical Chemistry* University Science Books (2008).
 2. Mortimer, R. *Mathematics for Physical Chemistry*. 3rd Ed. Elsevier (2005).
 3. Steiner, E. *The Chemical Maths Book* Oxford University Press (1996).
 4. Yates, P. *Chemical Calculations*. 2nd Ed. CRC Press (2007).
 5. Harris, D. C. *Quantitative Chemical Analysis*. 6th Ed., Freeman (2007) Chapters 3-5.
 6. Levie, R. de, *How to use Excel in analytical chemistry and in general scientific data analysis*, Cambridge Univ. Press (2001) 487 pages.
 7. Noggle, J. H. *Physical Chemistry on a Microcomputer*. Little Brown & Co. (1985).
 8. Venit, S.M. *Programming in BASIC: Problem solving with structure and style*. Jaico Publishing House: Delhi (1996).
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CHE-HE-5026: ANALYTICAL METHODS IN CHEMISTRY

(Credits: Theory-04, Lab -02)

Theory: 60 Lectures

Course Objective: This is an elective course designed to complement the needs of students who wish to learn more about the qualitative/quantitative characterization and separation techniques. The content of this course aims to cover some of the widely used instrumental techniques for characterization of samples. Experiments included aim at giving students hands on experience using different instrumental techniques and chemical analysis.

Learning outcome: On successful completion students will be have theoretical understanding about choice of various analytical techniques used for qualitative and quantitative characterization of samples. At the same time through the experiments students will gain hands on experience of the discussed techniques. This will enable students to take judicious decisions while analyzing different samples.

Qualitative and quantitative aspects of analysis:

Sampling, evaluation of analytical data, errors, accuracy and precision, methods of their expression, normal law of distribution if indeterminate errors, statistical test of data; F, Q and t test, rejection of data, and confidence intervals.

(5 Lectures)

Optical methods of analysis:

Origin of spectra, interaction of radiation with matter, fundamental laws of spectroscopy and selection rules, validity of Beer-Lambert's law.

UV-Visible Spectrometry: Basic principles of instrumentation (choice of source, monochromator and detector) for single and double beam instrument;

Basic principles of quantitative analysis: estimation of metal ions from aqueous solution, geometrical isomers, keto-enol tautomers. Determination of metal complex composition using Job's method of continuous variation and mole ratio method.

Infrared Spectroscopy: Basic principles of instrumentation (choice of source, monochromator & detector) for continuous wave and Fourier transform spectrometers; sampling techniques.

Structure elucidation through interpretation of data. Effect and importance of isotope substitution.

Flame Atomic Absorption and Emission Spectrometry: Basic principles of instrumentation (choice of source, monochromator, and detector, choice of flame and Burner designs. Techniques of atomization and sample introduction. Method of background correction, sources of chemical interferences and their method of removal. Techniques for the quantitative estimation of trace level of metal ions from water samples.

(25 Lectures)

Thermal methods of analysis:

Theory of thermogravimetry (TG), basic principle of instrumentation.
Techniques for quantitative estimation of Ca and Mg from their mixture.

(5 Lectures)

Electroanalytical methods:

Classification of electroanalytical methods, basic principle of pH metric, potentiometric and conductometric titrations. Techniques used for the determination of equivalence points. Techniques used for the determination of pKa values.

(10 Lectures)

Separation techniques:

Solvent extraction: Classification, principle and efficiency of the technique.

Mechanism of extraction: extraction by solvation and chelation.

Technique of extraction: batch, continuous and counter current extractions.

Qualitative and quantitative aspects of solvent extraction: extraction of metal ions from aqueous solution, extraction of organic species from the aqueous and nonaqueous media.

Chromatography: Classification, principle and efficiency of the technique.

Mechanism of separation: adsorption, partition & ion exchange.

Development of chromatograms: frontal, elution and displacement methods.

Qualitative and quantitative aspects of chromatographic methods of analysis: IC, GLC, GPC, TLC and HPLC.

Stereoisomeric separation and analysis: Measurement of optical rotation, calculation of Enantiomeric excess (ee)/ diastereomeric excess (de) ratios and determination of enantiomeric composition using NMR, Chiral solvents and chiral shift reagents. Chiral chromatographic techniques using chiral columns (GC and HPLC).

Role of computers in instrumental methods of analysis.

(15 Lectures)

Recommended Books:

1. Mendham, J. et al.: Vogel's Text Book of Quantitative Chemical Analysis ; 6th Ed. Pearson Education, 2009.
2. Willard, Hobert H. et al.: Instrumental Methods of Analysis, 7th Ed. CBS Publishers & Distributors, 2004.
3. Christian, Gary D: Analytical Chemistry, 6th Ed. Wiley India (P) Ltd., 2004.
4. Harris, Daniel C: Exploring Chemical Analysis, 4th Ed. W. H. Freeman, 2008.

5. Khopkar, S.M.: Basic Concepts of Analytical Chemistry, 3rd Ed. New Age, International Publisher, 2009.
 6. Skoog, D.A. Holler F.J. and Nieman, T.A. Principles of Instrumental Analysis, 6th Ed. Thomson Asia Pvt. Ltd. Singapore.
 7. Mikes, O. and Chalmes, R.A. Laboratory Hand Book of Chromatographic & Allied Methods, Elles Harwood Ltd. London.1979
 8. Ditts, R.V. *Analytical Chemistry: Methods of separation*. Van Nostrand, New York, 1974.
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LAB

60 Lectures

1. Separation Techniques

I. Chromatography:

(a) Separation of mixtures

(i) Paper chromatographic separation of Fe^{3+} , Al^{3+} , and Cr^{3+} .

(ii) Separation and identification of the monosaccharides present in the given mixture (glucose & fructose) by paper chromatography. Reporting the R_f values.

(b) Separate a mixture of Sudan yellow and Sudan Red by TLC technique and identify them on the basis of their R_f values.

(c) Chromatographic separation of the active ingredients of plants, flowers and juices by TLC

II. Solvent Extractions:

(i) To separate a mixture of Ni^{2+} & Fe^{2+} by complexation with DMG and extracting the Ni^{2+} - DMG complex in chloroform, and determine its concentration by spectrophotometry.

(ii) Solvent extraction of zirconium with amberliti LA-1, separation from a mixture of irons and gallium.

3. Determine the pH of the given aerated drinks fruit juices, shampoos and soaps.

4. Determination of Na, Ca, Li in cola drinks and fruit juices using fame photometric techniques.

5. Analysis of soil:

(i) Determination of pH of soil.

(ii) Total soluble salt

(iii) Estimation of calcium, magnesium, phosphate, nitrate

6. Ion exchange:

(i) Determination of exchange capacity of cation exchange resins and anion exchange resins.

- (ii) Separation of metal ions from their binary mixture.
- (iii) Separation of amino acids from organic acids by ion exchange chromatography.

7. Spectrophotometry

- (i) Determination of pKa values of indicator using spectrophotometry.
- (ii) Structural characterization of compounds by infrared spectroscopy.
- (iii) Determination of dissolved oxygen in water.
- (iv) Determination of chemical oxygen demand (COD).
- (v) Determination of Biological oxygen demand (BOD).
- (vi) Determine the composition of the Ferric-salicylate/ ferric-thiocyanate complex by Job's method.

Recommended Books:

1. Vogel, Arthur I: A Test book of Quantitative Inorganic Analysis (Rev. by G.H. Jeffery and others) 5th Ed. The English Language Book Society of Longman .
2. Willard, Hobert H. et al.: Instrumental Methods of Analysis, 7th Ed. Wardsworth Publishing Company, Belmont, California, USA, 1988.
3. Christian, Gary D; Analytical Chemistry, 6th Ed. John Wiley & Sons, New York, 2004.
4. Harris, Daniel C: Exploring Chemical Analysis, Ed. New York, W.H. Freeman, 2001.
5. Khopkar, S.M. Basic Concepts of Analytical Chemistry. New Age, International Publisher, 2009.
6. Skoog, D.A. Holler F.J. and Nieman, T.A. Principles of Instrumental Analysis, Thomson Asia Pvt. Ltd. Singapore.
7. Mikes, O. & Chalmes, R.A. Laboratory Hand Book of Chromatographic & Allied Methods, Elles Harwood Ltd. London.
9. Ditts, R.V. *Analytical Chemistry: Methods of separation*. Van Nostrand, New York, 1974.

CHE-HE-5036: MOLECULAR MODELLING & DRUG DESIGN

(Credits: Theory-04, Lab -02)

Theory: 60 Lectures

Course Objective: The course introduces students to the basic principles of computer assisted drug design, modelling and the important theoretical concepts and programming.

Learning Outcome: Students will be able to identify basic components of computer and programming as applied to computer assisted design and modelling of molecules.

Introduction to Molecular Modelling:

Introduction. Useful Concepts in Molecular Modelling: Coordinate Systems. Potential Energy Surfaces. Molecular Graphics. Surfaces. Computer Hardware and Software. The Molecular Modelling Literature.

(10 Lectures)

Force Fields:

Fields. Bond Stretching. Angle Bending. Introduction to nonbonded interactions. Electrostatic interactions. van der Waals Interactions. Hydrogen bonding in Molecular Mechanics. Force Field Models for the Simulation of Liquid Water.

(14 Lectures)

Energy Minimization and Computer Simulation:

Minimization and related methods for exploring the energy surface. Non-derivative method, First and second order minimization methods. Computer simulation methods. Simple thermodynamic properties and Phase Space. Boundaries. Analyzing the results of a simulation and estimating Errors.

(12 Lectures)

Molecular Dynamics & Monte Carlo Simulation:

Molecular Dynamics Simulation Methods. Molecular Dynamics using simple models. Molecular Dynamics with continuous potentials. Molecular Dynamics at constant temperature and pressure. Metropolis method. Monte Carlo simulation of molecules. Models used in Monte Carlo simulations of polymers.

(12 Lectures)

Structure Prediction and Drug Design:

Structure prediction - Introduction to comparative Modeling. Sequence alignment. Constructing and evaluating a comparative model. Predicting protein structures by 'Threading', Molecular docking. Structure based de novo ligand design,

Drug Discovery – Chemoinformatics – QSAR.

(12 Lectures)

Recommended Books:

1. A.R. Leach, Molecular Modelling Principles and Application, Longman, 2001.
 2. J.M. Haile, Molecular Dynamics Simulation Elementary Methods, John Wiley and Sons, 1997.
 3. Satya Prakash Gupta, QSAR and Molecular Modeling, Springer - Anamaya Publishers, 2008.
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LAB

60 Lectures

i. Compare the optimized C-C bond lengths in ethane, ethene, ethyne and benzene. Visualize the molecular orbitals of the ethane σ bonds and ethene, ethyne, benzene and pyridine π bonds.

- ii. (a) Perform a conformational analysis of butane. (b) Determine the enthalpy of isomerization of *cis* and *trans* 2-butene.
- iii. Visualize the electron density and electrostatic potential maps for LiH, HF, N₂, NO and CO and comment. Relate to the dipole moments. Animate the vibrations of these molecules.
- iv. (a) Relate the charge on the hydrogen atom in hydrogen halides with their acid character. (b) Compare the basicities of the nitrogen atoms in ammonia, methylamine, dimethylamine and trimethylamine.
- v. (a) Compare the shapes of the molecules: 1-butanol, 2-butanol, 2-methyl-1-propanol, and 2-methyl-2-propanol. Note the dipole moment of each molecule. (b) Show how the shapes affect the trend in boiling points: (118 °C, 100 °C, 108 °C, 82 °C, respectively).
- vi. Build and minimize organic compounds of your choice containing the following functional groups. Note the dipole moment of each compound: (a) alkyl halide (b) aldehyde (c) ketone (d) amine (e) ether (f) nitrile (g) thiol (h) carboxylic acid (i) ester (j) amide.
- vii. (a) Determine the heat of hydration of ethylene. (b) Compute the resonance energy of benzene by comparison of its enthalpy of hydrogenation with that of cyclohexene.
- viii. Arrange 1-hexene, 2-methyl-2-pentene, (*E*)-3-methyl-2-pentene, (*Z*)-3-methyl-2-pentene, and 2,3-dimethyl-2-butene in order of increasing stability.
- ix. (a) Compare the optimized bond angles H₂O, H₂S, H₂Se. (b) Compare the HAH bond angles for the second row dihydrides and compare with the results from qualitative MO theory.

Note: Software: ChemSketch, ArgusLab (www.planaria-software.com), TINKER 6.2 (dasher.wustl.edu/ffe), WebLab Viewer, Hyperchem, or any similar software.

Recommended Books:

1. A.R. Leach, Molecular Modelling Principles and Application, Longman, 2001.
 2. J.M. Haile, Molecular Dynamics Simulation Elementary Methods, John Wiley and Sons, 1997.
 3. Satya Prakash Gupta, QSAR and Molecular Modeling, Springer - Anamaya Publishers, 2008.
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CHE-HE-5046: NOVEL INORGANIC SOLIDS

(Credits: Theory-04, Lab -02)

Theory: 60 Lectures

Course Objective: *This introductory course intends to make learners familiar with a wide variety of technologically important and emerging materials. It will prepare the learners for studying materials further at the master's level. Prior completion of one introductory UG level course on inorganic and physical chemistry will be essential.*

Learning outcome: *After the completion of this course it will also be possible for the students to opt for studying an interdisciplinary master's programme with an emphasis on the synthesis and applications of various materials or take up a job in the materials production and/or processing industry.*

Synthesis and modification of inorganic solids:

Conventional heat and beat methods, Co-precipitation method, Sol-gel methods, Hydrothermal method, Ion-exchange and Intercalation methods.

(10 Lectures)

Inorganic solids of technological importance:

Solid electrolytes – Cationic, anionic, mixed Inorganic pigments – coloured solids, white and black pigments.

Molecular material and fullerides, molecular materials & chemistry – one-dimensional metals, molecular magnets, metal containing liquid crystals.

(10 Lectures)

Nanomaterials:

Overview of nanostructures and nanomaterials: classification.

Preparation of gold and silver metallic nanoparticles, self-assembled nanostructures-control of nanoarchitecture-one dimensional control. Carbon nanotubes and inorganic nanowires. Bio-inorganic nanomaterials, DNA and nanomaterials, natural and artificial nanomaterials, bionano composites.

(10 Lectures)

Introduction to engineering materials for mechanical construction:

Composition, mechanical and fabricating characteristics and applications of various types of cast irons, plain carbon and alloy steels, copper, aluminium and their alloys like duralumin, brasses and bronzes cutting tool materials, super alloys thermoplastics, thermosets and composite materials.

(10 Lectures)

Composite materials:

Introduction, limitations of conventional engineering materials, role of matrix in composites, classification, matrix materials, reinforcements, metal-matrix composites, polymer-matrix composites, fibre-reinforced composites, environmental effects on composites, applications of composites.

(10 Lectures)

Speciality polymers:

Ceramics & Refractory: Introduction, classification, properties, raw materials, manufacturing and applications.

(10 Lectures)

Recommended Books:

1. Shriver & Atkins. Inorganic Chemistry, Peter Atkins, Tina Overton, Jonathan Rourke, Mark Weller and Fraser Armstrong, 5th Edition, Oxford University Press (2011-2012)
2. Smart, L. E., Moore, E. A., Solid State Chemistry: An Introduction, 4th Ed., CRC Press, 2012.
3. Poole, C. P., Ovens, F. J., Introduction to Nanotechnology, Wiley India, 2009.

4. Murty, B. S., Shankar, P., Raj, B., Rath, B. B., Murday, J. Textbook of Nanoscience and Nanotechnology, Springer, 2013.
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LAB

60 Lectures

1. Determination of cation exchange capacity.
2. Synthesis of oxides by ceramic method.
3. Synthesis of hydrogel by co-precipitation method.
4. Synthesis of silver and gold metal nanoparticles.

Recommended Book:

1. Fahlman, B. D., Materials Chemistry, Springer (2011).
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CHE-HE-5056: POLYMER CHEMISTRY

(Credits: Theory-06, Lab -02)

Theory: 60 Lectures

Course objective: This is an introductory level course in polymer chemistry. The aim of the course is to introduce the theory and applications of polymer chemistry to the students. Some industrially important polymers and conducting polymers, a promising class of polymeric materials for next generation devices will also be introduced in this course.

Learning outcome: After completion of this course the students will learn the definition and classifications of polymers, kinetics of polymerization, molecular weight of polymers, glass transition temperature, and polymer solutions etc. They also learn the brief introduction of preparation, structure and properties of some industrially important and technologically promising polymers.

Introduction and history of polymeric materials:

Different schemes of classification of polymers, Polymer nomenclature, Molecular forces and chemical bonding in polymers, Texture of Polymers.

(4 Lectures)

Functionality and its importance:

Criteria for synthetic polymer formation, classification of polymerization processes, Relationships between functionality, extent of reaction and degree of polymerization. Bifunctional systems, Poly-functional systems.

(8 Lectures)

Kinetics of Polymerization:

Mechanism and kinetics of step growth, radical chain growth, ionic chain (both cationic and anionic) and coordination polymerizations, Mechanism and kinetics of copolymerization, polymerization techniques.

(8 lectures)

Crystallization and crystallinity:

Determination of crystalline melting point and degree of crystallinity, Morphology of crystalline polymers, Factors affecting crystalline melting point.

(4 Lectures)

Nature and structure of polymers-Structure Property relationships.

(2 Lectures)

Determination of molecular weight of polymers (M_n , M_w , etc) by end group analysis, viscometry, light scattering and osmotic pressure methods. Molecular weight distribution and its significance. Polydispersity index.

(8 Lectures)

Glass transition temperature (T_g) and determination of T_g, Free volume theory,

WLF equation, Factors affecting glass transition temperature (T_g).

(8 Lectures)

Polymer Solution – Criteria for polymer solubility, Solubility parameter,

Thermodynamics of polymer solutions, entropy, enthalpy, and free energy change of mixing of polymers solutions, Flory- Huggins theory, Lower and Upper critical solution temperatures.

(8 Lectures)

Properties of Polymers (Physical, thermal, Flow & Mechanical Properties).

Brief introduction to preparation, structure, properties and application of the following polymers: polyolefins, polystyrene and styrene copolymers, poly(vinyl chloride) and related polymers, poly(vinyl acetate) and related polymers, acrylic polymers, fluoro polymers, polyamides and related polymers. Phenol formaldehyde resins (Bakelite, Novalac), polyurethanes, silicone polymers, polydienes, Polycarbonates, Conducting Polymers, [polyacetylene, polyaniline, poly(p-phenylene sulphide polypyrrole, polythiophene)].

(10 Lectures)

Recommended Books:

1. *Seymour's Polymer Chemistry*, Marcel Dekker, Inc.
 2. G. Odian: *Principles of Polymerization*, John Wiley.
 3. F.W. Billmeyer: *Text Book of Polymer Science*, John Wiley.
 4. P. Ghosh: *Polymer Science & Technology*, Tata McGraw-Hill.
 5. R.W. Lenz: *Organic Chemistry of Synthetic High Polymers*.
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LAB

60 Lectures

1. Polymer synthesis

1. Free radical solution polymerization of styrene (St) / Methyl Methacrylate (MMA) /Methyl Acrylate (MA) / Acrylic acid (AA).
 - a. Purification of monomer
 - b. Polymerization using benzoyl peroxide (BPO) / 2,2'-azo-bis-isobutyronitrile (AIBN)
2. Preparation of nylon 66/6
 1. Interfacial polymerization, preparation of polyester from isophthaloyl chloride (IPC) and phenolphthalein
 - a. Preparation of IPC
 - b. Purification of IPC
 - c. Interfacial polymerization
 3. Redox polymerization of acrylamide
 4. Precipitation polymerization of acrylonitrile
 5. Preparation of urea-formaldehyde resin
 6. Preparations of novalac resin/resold resin.
 7. Microscale Emulsion Polymerization of Poly(methylacrylate).

Polymer characterization

1. Determination of molecular weight by viscometry:
 - (a) Polyacrylamide-aq.NaNO₂ solution
 - (b) (Poly vinyl propylidene (PVP) in water
2. Determination of the viscosity-average molecular weight of poly(vinyl alcohol) (PVOH) and the fraction of "head-to-head" monomer linkages in the polymer.
3. Determination of molecular weight by end group analysis: Polyethylene glycol (PEG) (OH group).
4. Testing of mechanical properties of polymers.
5. Determination of hydroxyl number of a polymer using colorimetric method.

Polymer analysis

1. Estimation of the amount of HCHO in the given solution by sodium sulphite method
2. Instrumental Techniques
3. IR studies of polymers
4. DSC analysis of polymers
5. Preparation of polyacrylamide and its electrophoresis

*at least 7 experiments to be carried out.

Recommended Books:

1. Malcolm P. Stevens, Polymer Chemistry: An Introduction, 3rd Ed.
2. Harry R. Allcock, Frederick W. Lampe and James E. Mark, Contemporary Polymer Chemistry, 3rd ed. Prentice-Hall (2003)
3. Fred W. Billmeyer, Textbook of Polymer Science, 3rd ed. Wiley-Interscience (1984)
4. Joel R. Fried, Polymer Science and Technology, 2nd ed. Prentice-Hall (2003)

5. Petr Munk and Tejraj M. Aminabhavi, Introduction to Macromolecular Science, 2nd ed. John Wiley & Sons (2002)
 6. L. H. Sperling, Introduction to Physical Polymer Science, 4th ed. John Wiley & Sons (2005)
 7. Malcolm P. Stevens, Polymer Chemistry: An Introduction, 3rd ed. Oxford University Press (2005)
 8. Seymour/ Carraher's Polymer Chemistry, 9th ed. by Charles E. Carraher, Jr. (2013).
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CHE-HE-5066: INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS

(Credits: Theory-04, Lab-02)

Theory: 60 Lectures

Course Objective: Students shall be introduced to the fundamental concepts/theory and application of different analytical techniques, as applied to chemistry.

Learning Outcome: Students shall be able to explain the theoretical basis of different analytical techniques, identify the experimental requirements and compare/analyze the data/results thereof.

Introduction to spectroscopic methods of analysis:

Recap of the spectroscopic methods covered in detail in the core chemistry syllabus: Treatment of analytical data, including error analysis. Classification of analytical methods and the types of instrumental methods. Consideration of electromagnetic radiation.

(4 Lectures)

Molecular spectroscopy:

Infrared spectroscopy:

Interactions with molecules: absorption and scattering. Means of excitation (light sources), separation of spectrum (wavelength dispersion, time resolution), detection of the signal (heat, differential detection), interpretation of spectrum (qualitative, mixtures, resolution), advantages of Fourier Transform (FTIR). Samples and results expected. Applications: Issues of quality assurance and quality control, Special problems for portable instrumentation and rapid detection.

UV-Visible/ Near IR – emission, absorption, fluorescence and photoacoustic. Excitation sources (lasers, time resolution), wavelength dispersion (gratings, prisms, interference filters, laser, placement of sample relative to dispersion, resolution), Detection of signal (photocells, photomultipliers, diode arrays, sensitivity and S/N), Single and Double Beam instruments, Interpretation (quantification, mixtures, absorption vs. fluorescence and the use of time, photoacoustic, fluorescent tags).

(16 Lectures)

Separation techniques

Chromatography: Gas chromatography, liquid chromatography, supercritical fluids, Importance of column technology (packing, capillaries), Separation based on increasing number of factors (volatility, solubility, interactions with stationary phase, size, electrical field), Detection: simple vs. specific (gas and liquid), Detection as a means of further analysis (use of tags and coupling to IR and MS), Electrophoresis (plates and capillary) and use with DNA analysis.

Immunoassays and DNA techniques

Mass spectroscopy: Making the gaseous molecule into an ion (electron impact, chemical ionization), Making liquids and solids into ions (electrospray, electrical discharge, laser desorption, fast atom bombardment), Separation of ions on basis of mass to charge ratio, Magnetic, Time of flight, Electric quadrupole. Resolution, time and multiple separations, Detection and interpretation (how this is linked to excitation).

(16 Lectures)

Elemental analysis:

Mass spectrometry (electrical discharges).

Atomic spectroscopy: Atomic absorption, Atomic emission, and Atomic fluorescence
Excitation and getting sample into gas phase (flames, electrical discharges, plasmas),
Wavelength separation and resolution (dependence on technique), Detection of radiation
(simultaneous/scanning, signal noise), Interpretation (errors due to molecular and ionic
species, matrix effects, other interferences).

(8 Lectures)

NMR spectroscopy: Principle, Instrumentation, Factors affecting chemical shift, Spincoupling, Applications.

(4 Lectures)

Electroanalytical Methods: Potentiometry & Voltammetry

(4 Lectures)

Radiochemical Methods

(4 Lectures)

X-ray analysis and electron spectroscopy (surface analysis)

(4 Lectures)

Recommended books:

1. Principles of Instrumental Analysis - 6th Edition by Douglas A. Skoog, F. James Holler, and Stanley Crouch (ISBN 0-495-01201-7).
2. Instrumental Methods of Analysis, 7th ed, Willard, Merritt, Dean, Settle.
3. P.W. Atkins: Physical Chemistry.
4. G.W. Castellan: Physical Chemistry.
5. C.N. Banwell: Fundamentals of Molecular Spectroscopy.
6. Brian Smith: Infrared Spectral Interpretations: A Systematic Approach.
7. W.J. Moore: Physical Chemistry.

LAB

60 Lectures

1. Safety Practices in the Chemistry Laboratory
2. Determination of the isoelectric pH of a protein.
3. Titration curve of an amino acid.
4. Determination of the void volume of a gel filtration column.

5. Determination of a Mixture of Cobalt and Nickel (UV/Vis spec.)
6. Study of Electronic Transitions in Organic Molecules (i.e., acetone in water)
7. IR Absorption Spectra (Study of Aldehydes and Ketones)
8. Determination of Calcium, Iron, and Copper in Food by Atomic Absorption
9. Quantitative Analysis of Mixtures by Gas Chromatography (i.e., chloroform and carbon tetrachloride)
10. Separation of Carbohydrates by HPLC
11. Determination of Caffeine in Beverages by HPLC
12. Potentiometric Titration of a Chloride-Iodide Mixture
13. Cyclic Voltammetry of the Ferrocyanide/Ferricyanide Couple
14. Nuclear Magnetic Resonance
15. Use of fluorescence to do “presumptive tests” to identify blood or other body fluids.
16. Use of “presumptive tests” for anthrax or cocaine
17. Collection, preservation, and control of blood evidence being used for DNA testing
18. Use of capillary electrophoresis with laser fluorescence detection for nuclear DNA (Y chromosome only or multiple chromosome)
19. Use of sequencing for the analysis of mitochondrial DNA
20. Laboratory analysis to confirm anthrax or cocaine
21. Detection in the field and confirmation in the laboratory of flammable accelerants or explosives
22. Detection of illegal drugs or steroids in athletes
23. Detection of pollutants or illegal dumping
24. Fibre analysis

At least 10 experiments to be performed.

Recommended Books:

1. Principles of Instrumental Analysis - 6th Edition by Douglas A. Skoog, F. James Holler and Stanley Crouch (ISBN 0-495-01201-7).
2. Instrumental Methods of Analysis, 7th ed, Willard, Merritt, Dean, Settle.

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CHE-HE-6016 : GREEN CHEMISTRY

(Credits: Theory-04, Lab-02)

Theory: 60 Lectures

Course Objective: The learners will be taught about the emerging discipline of green chemistry particularly to differentiate as to how the principles of green chemistry may be applied to organic synthesis.

Learning Outcome: Apart from introducing learners to the principles of green chemistry, this course will make them conversant with applications of green chemistry to organic synthesis. Students will be prepared for taking up entry level jobs in the chemical industry. They also will have the option of studying further in the area.

Introduction to Green Chemistry

What is Green Chemistry? Need for Green Chemistry. Goals of Green Chemistry. Limitations/ Obstacles in the pursuit of the goals of Green Chemistry.

(4 Lectures)

Principles of Green Chemistry and Designing a Chemical synthesis

Twelve principles of Green Chemistry with their explanations and examples; Designing a Green Synthesis using these principles; Prevention of Waste/ byproducts; maximum incorporation of the materials used in the process into the final products (Atom Economy); prevention/ minimization of hazardous/ toxic products; designing safer chemicals – different basic approaches to do so; selection of appropriate auxiliary substances (solvents, separation agents), green solvents, solventless processes, immobilized solvents and ionic liquids; energy requirements for reactions - use of microwaves, ultrasonic energy; selection of starting materials; avoidance of unnecessary derivatization – careful use of blocking/protecting groups; use of catalytic reagents (wherever possible) in preference to stoichiometric reagents; designing of biodegradable products; prevention of chemical accidents; strengthening/ development of analytical techniques to prevent and minimize the generation of hazardous substances in chemical processes.

(24 Lectures)

Examples of Green Synthesis/ Reactions

1. Green Synthesis of the following compounds: adipic acid, catechol, BHT, methyl methacrylate, urethane, citral, ibuprofen, paracetamol, furfural.
2. Microwave assisted reactions in water: Oxidation of toluene, alcohols. Microwave assisted reactions in organic solvents: Esterification, Fries rearrangement, Diels-Alder Reaction. Microwave assisted solid state reactions: Deacetylation, Deprotection. Saponification of esters, Alkylation of reactive methylene compounds, reductions, benzimidazoles.
3. Selective methylation of active methylene group using dimethylcarbonate: Solid-state polymerization of amorphous polymers using diphenylcarbonate; Use of “Clayan”, a nonmetallic oxidative reagent for various reactions; Free Radical Bromination; Role of Tellurium in organic syntheses; Biocatalysis in organic syntheses.

(24 Lectures)

Future Trends in Green Chemistry

Oxidation reagents and catalysts; Biomimetic, multifunctional reagents; Solventless reactions; Green chemistry in sustainable development.

(8 Lectures)

Recommended Books:

1. V.K. Ahluwalia & M.R. Kidwai: New Trends in Green Chemistry, Anamalaya Publishers (2005).
2. P.T. Anastas & J.K. Warner: Oxford Green Chemistry- Theory and Practical, University Press (1998).
3. A.S. Matlack: Introduction to Green Chemistry, Marcel Dekker (2001).
4. M.C. Cann & M.E. Connely: Real-World cases in Green Chemistry, American Chemical Society, Washington (2000).
5. M.A. Ryan & M. Tinnesand, Introduction to Green Chemistry, American Chemical Society, Washington (2002).

LAB

60 Lectures

1. Safer starting materials

The Vitamin C clock reaction using Vitamin C tablets, tincture of iodine, hydrogen peroxide and liquid laundry starch.

- (i) Effect of concentration on clock reaction
- (ii) Effect of temperature on clock reaction.

2. Using renewable resources

Preparation of biodiesel from vegetable oil.

3. Avoiding waste

Principle of atom economy.

Use of molecular model kit to stimulate the reaction to investigate how the atom economy can illustrate Green Chemistry.

Preparation of propene by two methods can be studied

(I) Triethylamine ion + OH⁻ → propene + trimethylpropene + water

(II) 1-propanol $\xrightarrow{\text{H}_2\text{SO}_4/\Delta}$ propene + water

The other types of reactions, like addition, elimination, substitution and rearrangement should also be studied for the calculation of atom economy.

4. Use of enzymes as catalysts

Benzoin condensation using Thiamine Hydrochloride as a catalyst instead of cyanide

Alternative Green solvents

5. Diels Alder reaction in water

Reaction between furan and maleic acid in water and at room temperature rather than in benzene and reflux.

6. Extraction of D-limonene from orange peel using liquid CO₂ prepared from dry ice.

7. Mechanochemical solvent free synthesis of azomethines

8. Co-crystal controlled solid state synthesis (C₂S₃) of N-organophthalimide using phthalic anhydride and 3-aminobenzoic acid.

Alternative sources of energy

9. Solvent free, microwave assisted one pot synthesis of phthalocyanine complex of copper (II).

10. Photoreduction of benzophenone to benzopinacol in the presence of sunlight.

Recommended Books:

1. Anastas, P.T & Warner, J.C. *Green Chemistry: Theory and Practice*, Oxford University Press (1998).
2. Kirchoff, M. & Ryan, M.A. *Greener approaches to undergraduate chemistry experiment*. American Chemical Society, Washington DC (2002).
3. Ryan, M.A. *Introduction to Green Chemistry*, Tinnesand; (Ed), American Chemical Society, Washington DC (2002).
4. Sharma, R.K.; Sidhwani, I.T. & Chaudhari, M.K. *Green Chemistry Experiment:*

A monograph, I.K International Publishing House Pvt Ltd. New Delhi. Bangalore
CISBN 978-93-81141-55-7 (2013).

5. Cann, M.C. & Connelly, M. E. *Real world cases in Green Chemistry*, American Chemical Society (2008).
6. Cann, M. C. & Thomas, P. *Real world cases in Green Chemistry*, American Chemical Society (2008).
7. Pavia, D. L. Lampman, G. H. & Kriz, G.S. *W B Introduction to Organic Laboratory Techniques: A Microscale Approach*, 4th Ed., Brooks/Cole; 2007.

CHE-HE-6026: INDUSTRIAL CHEMICALS AND ENVIRONMENT

(Credits: Theory-04, Lab-02)

Theory: 60 Lectures

***Course Objectives:** This course provides an introduction to the various industrial gases and inorganic chemicals, their manufacturing processes, applications, storage and the hazards of handling them. Contribution of these industrial chemicals towards air and water pollution and their effects on living organisms and the environment has also been covered. Students are also expected to learn about metallurgy, energy generation industry and the pollution threat they pose. This course also discusses about management of the different kinds of wastes, their safe disposal and the importance of practicing green chemistry in chemical industry.*

***Learning Outcomes:** After successful completion of the course, students would have learnt about the manufacture, applications and safe ways of storage and handling gaseous and inorganic industrial chemicals. Students will get to know about industrial metallurgy and the energy generation industry. Students will also learn about environmental pollution by various gaseous, liquid wastes and nuclear wastes and their effects on living beings. Finally, the students will learn about industrial waste management, their safe disposal and the importance of environment friendly “green chemistry” in chemical industry.*

Industrial Gases and Inorganic Chemicals

***Industrial Gases:** Large scale production, uses, storage and hazards in handling of the following gases: oxygen, nitrogen, argon, neon, helium, hydrogen, acetylene, carbon monoxide, chlorine, fluorine, sulphur dioxide and phosgene.*

***Inorganic Chemicals:** Manufacture, application, analysis and hazards in handling the following chemicals: hydrochloric acid, nitric acid, sulphuric acid, caustic soda, common salt, borax, bleaching powder, sodium thiosulphate, hydrogen peroxide, potash alum, chrome alum, potassium dichromate and potassium permanganate.*

(10 Lectures)

Industrial Metallurgy

Preparation of metals (ferrous and nonferrous) and ultrapure metals for semiconductor technology.

(4 Lectures)

Environment and its segments

Ecosystems. Biogeochemical cycles of carbon, nitrogen and sulphur.

Air Pollution: Major regions of atmosphere. Chemical and photochemical reactions in atmosphere. Air pollutants: types, sources, particle size and chemical nature; Photochemical smog: its constituents and photochemistry. Environmental effects of ozone, Major sources of air pollution.

Pollution by SO₂, CO₂, CO, NO_x, H₂S and other foul smelling gases. Methods of estimation of CO, NO_x, SO_x and control procedures.

Effects of air pollution on living organisms and vegetation. Greenhouse effect and Global warming, Ozone depletion by oxides of nitrogen, chlorofluorocarbons and Halogens, removal of sulphur from coal. Control of particulates.

Water Pollution: Hydrological cycle, water resources, aquatic ecosystems, Sources and nature of water pollutants, Techniques for measuring water pollution, Impacts of water pollution on hydrological and ecosystems.

Water purification methods. Effluent treatment plants (primary, secondary and tertiary treatment). Industrial effluents from the following industries and their treatment: electroplating, textile, tannery, dairy, petroleum and petrochemicals, agro, fertilizer, etc. Sludge disposal.

Industrial waste management, incineration of waste. Water treatment and purification (reverse osmosis, electro dialysis, ion exchange). Water quality parameters for waste water, industrial water and domestic water.

(30 Lectures)

Energy & Environment

Sources of energy: Coal, petrol and natural gas. Nuclear Fusion / Fission, Solar energy, Hydrogen, geothermal, Tidal and Hydel, etc.

Nuclear Pollution: Disposal of nuclear waste, nuclear disaster and its management.

(10 Lectures)

Biocatalysis

Introduction to biocatalysis: Importance in “Green Chemistry” and Chemical Industry.

(6 Lectures)

Recommended Books:

1. E. Stocchi: *Industrial Chemistry*, Vol-I, Ellis Horwood Ltd. UK.
2. R.M. Felder, R.W. Rousseau: *Elementary Principles of Chemical Processes*, Wiley Publishers, New Delhi.
3. J. A. Kent: Riegel's *Handbook of Industrial Chemistry*, CBS Publishers, New Delhi.
4. S. S. Dara: *A Textbook of Engineering Chemistry*, S. Chand & Company Ltd. New Delhi.
5. K. De, *Environmental Chemistry*: New Age International Pvt., Ltd, New Delhi.
6. S. M. Khopkar, *Environmental Pollution Analysis*: Wiley Eastern Ltd, New Delhi.
7. S.E. Manahan, *Environmental Chemistry*, CRC Press (2005).

8. G.T. Miller, Environmental Science 11th edition. Brooks/ Cole (2006).
 9. A. Mishra, Environmental Studies. Selective and Scientific Books, New Delhi (2005).
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LAB

60 Lectures

1. Determination of dissolved oxygen in water.
2. Determination of Chemical Oxygen Demand (COD)
3. Determination of Biological Oxygen Demand (BOD)
4. Percentage of available chlorine in bleaching powder.
5. Measurement of chloride, sulphate and salinity of water samples by simple titration method (AgNO_3 and potassium chromate).
6. Estimation of total alkalinity of water samples (CO_3^{2-} , HCO_3^-) using double titration method.
7. Measurement of dissolved CO_2 .
8. Study of some of the common bio-indicators of pollution.
9. Estimation of SPM in air samples.
10. Preparation of borax/ boric acid.

Recommended Books:

1. E. Stocchi: *Industrial Chemistry*, Vol-I, Ellis Horwood Ltd. UK.
 2. R.M. Felder, R.W. Rousseau: *Elementary Principles of Chemical Processes*, Wiley Publishers, New Delhi.
 3. J. A. Kent: Riegel's *Handbook of Industrial Chemistry*, CBS Publishers, New Delhi.
 4. S. S. Dara: *A Textbook of Engineering Chemistry*, S. Chand & Company Ltd. New Delhi.
 5. K. De, *Environmental Chemistry*: New Age International Pvt., Ltd, New Delhi.
 6. S. M. Khopkar, *Environmental Pollution Analysis*: Wiley Eastern Ltd, New Delhi.
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CHE-HE-6036: INORGANIC MATERIALS OF INDUSTRIAL IMPORTANCE

(Credits: Theory-04, Lab-02)

Theory: 60 Lectures

Course Objectives: To learn the synthetic process, properties and the utility of the industrially important inorganic materials (such as silicates, ceramics, cements, fertilizers, paints, batteries, alloys and explosives).

To provide opportunity to learn some of the industrial process such as surface coating and catalysis in relevant to industry where heterogeneous catalysis dominates.

Experiments are aimed at helping learners acquire hands on experience in qualitative and quantitative analysis of the inorganic materials which are basically manufactured in chemical industries.

To learn some industrial techniques such as surface coating etc..

Learning Outcome: This course will establish the basic foundation of industrial inorganic chemistry among the students. This will be helpful for pursuing further studies of industrial chemistry in future. Experiments will help the Students to gather the experience of qualitative and quantitative chemical analysis. Students will be capable of doing analysis of the inorganic materials which are used in our daily life. They will have insight of the industrial processes.

Silicate Industries

Glass: Glassy state and its properties, classification (silicate and non-silicate glasses). Manufacture and processing of glass. Composition and properties of the following types of glasses: Soda lime glass, lead glass, armoured glass, safety glass, borosilicate glass, fluorosilicate, coloured glass, photosensitive glass.

Ceramics: Important clays and feldspar, ceramic, their types and manufacture. High technology ceramics and their applications, superconducting and semiconducting oxides, fullerenes carbon nanotubes and carbon fibre.

Cements: Classification of cement, ingredients and their role, Manufacture of cement and the setting process, quick setting cements.

(16 Lectures)

Fertilizers:

Different types of fertilizers. Manufacture of the following fertilizers: Urea, ammonium nitrate, calcium ammonium nitrate, ammonium phosphates; polyphosphate, superphosphate, compound and mixed fertilizers, potassium chloride, potassium sulphate.

(8 Lectures)

Surface Coatings:

Objectives of coatings surfaces, preliminary treatment of surface, classification of surface coatings. Paints and pigments-formulation, composition and related properties. Oil paint, Vehicle, modified oils, Pigments, toners and lakes pigments, Fillers, Thinners, Enamels, emulsifying agents. Special paints (Heat retardant, Fire retardant, Eco-friendly paint, Plastic paint), Dyes, Wax polishing, Water and Oil paints, additives, Metallic coatings (electrolytic and electroless), metal spraying and anodizing.

(10 Lectures)

Batteries:

Primary and secondary batteries, battery components and their role, Characteristics of battery. Working of following batteries: Pb acid, Li-Battery, Solid state electrolyte battery. Fuel cells, Solar cell and polymer cell.

(6 Lectures)

Alloys:

Classification of alloys, ferrous and non-ferrous alloys, Specific properties of elements in alloys. Manufacture of Steel (removal of silicon decarbonization, demanganization, desulphurization dephosphorisation) and surface treatment (argon treatment, heat treatment, nitriding, carburizing). Composition and properties of different types of steels.

(10 Lectures)

Catalysis:

General principles and properties of catalysts, homogenous catalysis (catalytic steps and examples) and heterogenous catalysis (catalytic steps and examples) and their industrial applications, Deactivation or regeneration of catalysts.

Phase transfer catalysts, application of zeolites as catalysts.

(6 Lectures)

Chemical explosives:

Origin of explosive properties in organic compounds, preparation and explosive properties of lead azide, PETN, cyclonite (RDX). Introduction to rocket propellants.

(4 Lectures)

Recommended Books:

1. E. Stocchi: *Industrial Chemistry*, Vol-I, Ellis Horwood Ltd. UK.
 2. R. M. Felder, R. W. Rousseau: *Elementary Principles of Chemical Processes*, Wiley Publishers, New Delhi.
 3. W. D. Kingery, H. K. Bowen, D. R. Uhlmann: *Introduction to Ceramics*, Wiley Publishers, New Delhi.
 4. Karl Heinz Büchel, Hans-Heinrich Moretto Peter, Woditsch; *Industrial Inorganic Chemistry*, Wiley-VCH.
 5. J. A. Kent: Riegel's *Handbook of Industrial Chemistry*, CBS Publishers, New Delhi.
 6. P. C. Jain, M. Jain: *Engineering Chemistry*, Dhanpat Rai & Sons, Delhi.
 7. R. Gopalan, D. Venkappayya, S. Nagarajan: *Engineering Chemistry*, Vikas Publications, New Delhi.
 8. B. K. Sharma: *Engineering Chemistry*, Goel Publishing House, Meerut
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LAB

60 Lectures

1. Determination of free acidity in ammonium sulphate fertilizer.
2. Estimation of Calcium in Calcium ammonium nitrate fertilizer.
3. Estimation of phosphoric acid in superphosphate fertilizer.
4. Electroless metallic coatings on ceramic and plastic material.
5. Determination of composition of dolomite (by complexometric titration).
6. Analysis of (Cu, Ni); (Cu, Zn) in alloy or synthetic samples.
7. Analysis of Cement.
8. Preparation of pigment (zinc oxide).

Recommended Books:

1. E. Stocchi: *Industrial Chemistry*, Vol-I, Ellis Horwood Ltd. UK.
2. R. M. Felder, R. W. Rousseau: *Elementary Principles of Chemical Processes*, Wiley Publishers, New Delhi.
3. W. D. Kingery, H. K. Bowen, D. R. Uhlmann: *Introduction to Ceramics*, Wiley Publishers, New Delhi.
4. J. A. Kent: Riegel's *Handbook of Industrial Chemistry*, CBS Publishers, New Delhi.
5. P. C. Jain, M. Jain: *Engineering Chemistry*, Dhanpat Rai & Sons, Delhi.
6. R. Gopalan, D. Venkappayya, S. Nagarajan: *Engineering Chemistry*, Vikas Publications, New Delhi.

CHE-HE-6046: RESEARCH METHODOLOGY FOR CHEMISTRY

(Credits: Theory-05, Tutorials-01)

Theory: 75 Lectures

Course Objectives:

This course is introduced to impart knowledge about the basic concepts of research and to provide a road map for conducting research

Students are expected to identify, explain and apply basic concepts of research; acquire information, recognize various issues related to research and to learn instrumental methods required for research in chemistry.

Learning Outcome:

After completing this course, students should be able to construct a rational research proposal to generate fruitful output in terms of publications and patents in the field of chemical sciences.

Literature Survey:

Print: Sources of information: Primary, secondary, tertiary sources; Journals: Journal abbreviations, abstracts, current titles, reviews, monographs, dictionaries, text-books, current contents, Introduction to Chemical Abstracts and Beilstein, Subject Index, Substance Index, Author Index, Formula Index, and other Indices with examples.

Digital: Web resources, E-journals, Journal access, TOC alerts, Hot articles, Citation index, Impact factor, H-index, E-consortium, UGC infonet, E-books, Internet discussion groups and

communities, Blogs, Preprint servers, Search engines, Scirus, Google Scholar, ChemIndustry, Wiki- Databases, ChemSpider, Science Direct, SciFinder, Scopus.

Information Technology and Library Resources: The Internet and World Wide Web. Internet resources for chemistry. Finding and citing published information.

(20 Lectures)

Methods of Scientific Research and Writing Scientific Papers:

Reporting practical and project work. Writing literature surveys and reviews. Organizing a poster display. Giving an oral presentation.

Writing scientific papers – justification for scientific contributions, bibliography, description of methods, conclusions, the need for illustration, style, publications of scientific work. Writing ethics. Avoiding plagiarism.

(20 Lectures)

Chemical Safety and Ethical Handling of Chemicals:

Safe working procedure and protective environment, protective apparel, emergency procedure and first aid, laboratory ventilation. Safe storage and use of hazardous chemicals, procedure for working with substances that pose hazards, flammable or explosive hazards, procedures for working with gases at pressures above or below atmospheric – safe storage and disposal of waste chemicals, recovery, recycling and reuse of laboratory chemicals, procedure for laboratory disposal of explosives, identification, verification and segregation of

laboratory waste, disposal of chemicals in the sanitary sewer system, incineration and transportation of hazardous chemicals.

(12 Lectures)

Data Analysis

The Investigative Approach: Making and Recording Measurements. SI Units and their use. Scientific method and design of experiments.

Analysis and Presentation of Data: Descriptive statistics. Choosing and using statistical tests. Chemometrics. Analysis of variance (ANOVA), Correlation and regression, Curve fitting, fitting of linear equations, simple linear cases, weighted linear case, analysis of residuals, General polynomial fitting, linearizing transformations, exponential function fit, r and its abuse. Basic aspects of multiple linear regression analysis.

(13 Lectures)

Electronics

Basic fundamentals of electronic circuits and their components used in circuits of common instruments like spectrophotometers, typical circuits involving operational amplifiers for electrochemical instruments. Elementary aspects of digital electronics.

(10 Lectures)

Recommended Books

1. Dean, J. R., Jones, A. M., Holmes, D., Reed, R., Weyers, J. & Jones, A. (2011) *Practical skills in chemistry*. 2nd Ed. Prentice-Hall, Harlow.
2. Hibbert, D. B. & Gooding, J. J. (2006) *Data analysis for chemistry*. Oxford University Press.
3. Topping, J. (1984) *Errors of observation and their treatment*. Fourth Ed., Chapman Hall, London.
4. Harris, D. C. *Quantitative chemical analysis*. 6th Ed., Freeman (2007) Chapters 3-5.
5. Levie, R. de, *How to use Excel in analytical chemistry and in general scientific data analysis*. Cambridge Univ. Press (2001) 487 pages.
6. Chemical safety matters – IUPAC – IPCS, Cambridge University Press, 1992.
7. OSU safety manual 1.01.

CHE-HE-6056: DISSERTATION

Student will complete a project work and then prepare a report on that.

Skill Enhancement Courses

CHE-SE-3024: IT SKILLS FOR CHEMISTS

(Credits: 04)

60 Lectures

Course Objective: *The objectives of the proposed course are:*

- 1) *To provide the basic knowledge of mathematics which are needed to pursue chemistry as major subject.*
- 2) *To provide the necessary training for the basic programming knowledge.*
- 3) *The course provides information technology literacy and basic skills training for learners with limited experience.*
- 4) *To familiarize with the Introductory writing activities and Handling numeric data.*

Learning Outcome: *Course learning outcomes focus on skill development related to basic computer operations and information technology. After completing the course the incumbent is able to use the computer for basic purposes of preparing his personnel/business letters, viewing information on Internet (the web), sending mails, using internet banking services etc. After opting this course the students are expected to accumulate the skills in writing activities and Handling numeric data.*

Mathematics

Fundamentals, mathematical functions, polynomial expressions, logarithms, the exponential function, units of a measurement, interconversion of units, constants and variables, equation of a straight line, plotting graphs.

Uncertainty in experimental techniques: Displaying uncertainties, measurements in chemistry, decimal places, significant figures, combining quantities.

Uncertainty in measurement: types of uncertainties, combining uncertainties. Statistical treatment. Mean, standard deviation, relative error. Data reduction and the propagation of errors. Graphical and numerical data reduction. Numerical curve fitting: the method of least squares (regression).

Algebraic operations on real scalar variables (e.g. manipulation of van der Waals equation in different forms). Roots of quadratic equations analytically and iteratively (e.g. pH of a weak acid). Numerical methods of finding roots (Newton-Raphson, binary –bisection, e.g. pH of a weak acid not ignoring the ionization of water, volume of a van der Waals gas, equilibrium constant expressions).

Differential calculus: The tangent line and the derivative of a function, numerical differentiation (e.g., change in pressure for small change in volume of a van der Waals gas, potentiometric titrations).

Numerical integration (Trapezoidal and Simpson's rule, e.g. entropy/enthalpy change from heat capacity data).

Computer programming:

Constants, variables, bits, bytes, binary and ASCII formats, arithmetic expressions, hierarchy of operations, inbuilt functions. Elements of the BASIC language. BASIC keywords and commands. Logical and relative operators. Strings and graphics. Compiled versus interpreted languages. Errors (Syntax and Logical), Debugging. Simple programs using these concepts. Matrix addition and multiplication. Statistical analysis.

BASIC programs for curve fitting, numerical differentiation and integration (Trapezoidal rule, Simpson's rule), finding roots (quadratic formula, iterative, Newton-Raphson method).

HANDS ON

Introductory writing activities: Introduction to word processor and structure drawing (ChemSketch) software. Incorporating chemical structures, chemical equations, expressions from chemistry (e.g. Maxwell-Boltzmann distribution law, Bragg's law, van der Waals equation, etc.) into word processing documents/Latex.

Handling numeric data: Spreadsheet software (Excel), creating a spreadsheet, entering and formatting information, basic functions and formulae, creating charts, tables and graphs. Incorporating tables and graphs into word processing documents. Simple calculations, plotting graphs using a spreadsheet (Planck's distribution law, radial distribution curves for hydrogenic orbitals, gas kinetic theory- Maxwell-Boltzmann distribution curves as function of temperature and molecular weight), spectral data, pressure-volume curves of van der Waals gas (van der Waals isotherms), data from phase equilibria studies. Graphical solution of equations.

Numeric modelling: Simulation of pH metric titration curves. Excel functions LINEST and Least Squares. Numerical curve fitting, linear regression (rate constants from concentrationtime data, molar extinction coefficients from absorbance data), numerical differentiation (e.g. handling data from potentiometric and pH metric titrations, pK_a of weak acid), integration (e.g. entropy/enthalpy change from heat capacity data).

Statistical analysis: Gaussian distribution and Errors in measurements and their effect on data sets. Descriptive statistics using Excel. Statistical significance testing: The t test. The F test.

Presentation: Presentation graphics

Recommended Books:

1. McQuarrie, D. A. Mathematics for Physical Chemistry University Science Books (2008).
2. Mortimer, R. Mathematics for Physical Chemistry. 3rd Ed. Elsevier (2005).
3. Steiner, E. The Chemical Maths Book Oxford University Press (1996).
4. Yates, P. Chemical calculations. 2nd Ed. CRC Press (2007).
5. Harris, D. C. *Quantitative Chemical Analysis*. 6th Ed., Freeman (2007) Chapters 3-5.
6. Levie, R. de, *How to use Excel in analytical chemistry and in general scientific data analysis*, Cambridge Univ. Press (2001) 487 pages.
7. Noggle, J. H. *Physical chemistry on a Microcomputer*. Little Brown & Co. (1985).
8. Venit, S.M. *Programming in BASIC: Problem solving with structure and style*. Jaico Publishing House: Delhi (1996).

CHE-SE-3034: BASIC ANALYTICAL CHEMISTRY

(Credits: 04)

60 Lectures

Course Objective: To familiarize students with different micro and semimicro analytical techniques and help develop the ability to use modern instrumental methods for chemical analysis of food, soil, air and water.

Learning Outcome: Upon completion of this course, students shall be able to explain the basic principles of chemical analysis, design/implement microscale and semimicro experiments, record, interpret and analyze data following scientific methodology.

Introduction: Introduction to Analytical Chemistry and its interdisciplinary nature. Concept of sampling. Importance of accuracy, precision and sources of error in analytical measurements. Presentation of experimental data and results, from the point of view of significant figures.

Analysis of soil: Composition of soil, Concept of pH and pH measurement, Complexometric titrations, Chelation, Chelating agents, use of indicators

- Determination of pH of soil samples.
- Estimation of Calcium and Magnesium ions as Calcium carbonate by complexometric titration.

Analysis of water: Definition of pure water, sources responsible for contaminating water, water sampling methods, water purification methods.

- Determination of pH, acidity and alkalinity of a water sample.
- Determination of dissolved oxygen (DO) of a water sample.

Analysis of food products: Nutritional value of foods, idea about food processing and food preservations and adulteration.

- Identification of adulterants in some common food items like coffee powder, asafoetida, chilli powder, turmeric powder, coriander powder and pulses, etc.
- Analysis of preservatives and colouring matter.

Chromatography: Definition, general introduction on principles of chromatography, paper chromatography, TLC etc.

- Paper chromatographic separation of mixture of metal ion (Fe^{3+} and Al^{3+}).
- To compare paint samples by TLC method.

Ion-exchange: Column, ion-exchange chromatography etc.
Determination of ion exchange capacity of anion / cation exchange resin (using batch procedure if use of column is not feasible).

Analysis of cosmetics: Major and minor constituents and their function

- Analysis of deodorants and antiperspirants, Al, Zn, boric acid, chloride, sulphate.
- Determination of constituents of talcum powder: Magnesium oxide, Calcium oxide, Zinc oxide and Calcium carbonate by complexometric titration.

Suggested Applications (Any one):

- To study the use of phenolphthalein in trap cases.
- To analyze arson accelerants.
- To carry out analysis of gasoline.

Suggested Instrumental demonstrations:

- a. Estimation of macro nutrients: Potassium, Calcium, Magnesium in soil samples by flame photometry.
- b. Spectrophotometric determination of Iron in Vitamin / Dietary Tablets.
- c. Spectrophotometric Identification and Determination of Caffeine and Benzoic Acid in Soft Drink.

Recommended Books:

1. Willard, H. H. *Instrumental Methods of Analysis*, CBS Publishers.
2. Skoog & Lerry. *Instrumental Methods of Analysis*, Saunders College Publications, New York.
3. Skoog, D.A.; West, D.M. & Holler, F.J. *Fundamentals of Analytical Chemistry 6th Ed.*, Saunders College Publishing, Fort Worth (1992).
4. Harris, D. C. *Quantitative Chemical Analysis*, W. H. Freeman.
5. Dean, J. A. *Analytical Chemistry Notebook*, McGraw Hill.
6. Day, R. A. & Underwood, A. L. *Quantitative Analysis*, Prentice Hall of India.
7. Freifelder, D. *Physical Biochemistry 2nd Ed.*, W.H. Freeman and Co., N.Y. USA(1982).
8. Cooper, T.G. *The Tools of Biochemistry*, John Wiley and Sons, N.Y. USA. 16(1977).
9. Vogel, A. I. *Vogel's Qualitative Inorganic Analysis 7th Ed.*, Prentice Hall.
10. Vogel, A. I. *Vogel's Quantitative Chemical Analysis 6th Ed.*, Prentice Hall.
11. Robinson, J.W. *Undergraduate Instrumental Analysis 5th Ed.*, Marcel Dekker, Inc., New York (1995).

CHE-SE-3044: CHEMICAL TECHNOLOGY & SOCIETY

(Credits: 04)

Theory: 60 Lectures

***Course Objective:** The objective of the course is to enable students to have a firsthand understanding of different types of equipments needed in chemical technology and offer them concepts regarding some important parameters. The syllabus also emphasizes the dynamic nature of the relations between society on one hand and technological achievement from chemical industries on the other hand. In other words, it tries to explore societal and technological issues from a chemical perspective.*

***Learning Outcome:** Students shall be familiarized with processes and terminologies in chemical industry, like mass balance, energy balance etc... Learners will be able to use chemical and scientific literacy as a means to better understand the topics related to the society.*

Chemical Technology

Different types of equipments needed in chemical technology, including reactors, distillation columns, extruders, pumps, mills, emulgators. Scaling up operations in chemical industry. Introduction to clean technology.

Concept of relative humidity, molal humidity, dew point, partial saturation.

Material Balance: Recycle, bypass in batch, stage wise and continuous operations in systems with and without chemical reactions.

Energy balance: Energy balance of systems with and without chemical reactions.

Society

Social issues related to soil, air and water pollution.

Energy crisis of modern society and search for alternatives such as energy from natural sources (i.e. solar and renewable forms), and from nuclear fission, biofuel etc.

Pros and cons of use of materials like plastics and polymers and their natural analogues, Genetic engineering and the manufacture of drugs (proteins and nucleic acids, and molecular reactivity and interconversions)

Recommended Book:

1. John W. Hill, Terry W. McCreary & Doris K. Kolb, *Chemistry for changing times* 13th Ed.
2. E.J. Hackett, O. Amsterdamska, M. Lynch and J. Wajcman (eds.), *The Handbook of Science and Technology Studies*, The MIT Press, 2008.
3. D. MacKenzie and J. Wajcman (eds.), *The Social Shaping of Technology*, The Open University Press, 1999.

CHE-SE-3054: CHEMOINFORMATICS

(Credits: 04)

Theory: 60 Lectures

***Learning Objectives:** The primary objective of this course is to familiarize the students with the use of various computer software and information technology. The students are expected to learn different chemical search engines and utilize them for molecular modelling and structure elucidation with a final goal to compute NMR, IR, mass and other spectra that can be later compared with the experimental data. The course also provides sufficient information and hands on exercises on the use of cheminformatics, with a special emphasis on its application in modern drug discovery.*

***Learning Outcomes:** On the successful completion of the course, the students should be able to explain, interpret and critically examine the utility of computers and software tools to solving chemistry related problems. Recognize, apply, compare and predict chemical structures, properties, and reactivity and; solve chemistry related problems.*

Employ critical thinking and scientific reasoning to design and safely implement laboratory experiments and keep the records of the same.

Compile, interpret and analyze the qualitative/quantitative data and communicate the same in a scientific literature

Introduction to Chemoinformatics: History and evolution of chemoinformatics, Use of chemoinformatics, Prospects of chemoinformatics, Molecular Modelling and Structure elucidation.

Representation of molecules and chemical reactions: Nomenclature, Different types of notations, SMILES coding, Matrix representations, Structure of Molfiles and Sdfiles, Libraries and toolkits, Different electronic effects, Reaction classification.

Searching chemical structures: Full structure search, sub-structure search, basic ideas, similarity search, three dimensional search methods, basics of computation of physical and chemical data and structure descriptors, data visualization.

Applications: Prediction of Properties of Compounds; Linear Free Energy Relations; Quantitative Structure-Property Relations; Descriptor Analysis; Model Building; Modeling Toxicity; Structure-Spectra correlations; Prediction of NMR, IR and Mass spectra; Computer Assisted Structure elucidations; Computer Assisted Synthesis Design, Introduction to drug design; Target Identification and Validation; Lead Finding and Optimization; Analysis of HTS data; Virtual Screening; Design of Combinatorial Libraries; Ligand-Based and Structure Based Drug design; Application of Chemoinformatics in Drug Design.

Hands-on Exercises

Recommended Books:

1. Andrew R. Leach & Valerie, J. Gillet (2007) *An introduction to Chemoinformatics*. Springer: The Netherlands.
 2. Gasteiger, J. & Engel, T. (2003) *Chemoinformatics: A text-book*. Wiley-VCH.
 3. Gupta, S. P. (2011) *QSAR & Molecular Modeling*. Anamaya Pub.: New Delhi.
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CHE-SE-3064: BUSINESS SKILLS FOR CHEMISTS

(Credits: 04)

Theory: 60 Lectures

Course Objective: To familiarize students with important concepts of business operations and intellectual rights as applied to chemical industry.

Learning outcome: students shall be able to explain and/or analyze the important steps of business operations, finance and intellectual property as applied to chemical industry.

Chemistry in Industry

Current challenges and opportunities for the chemistry-using industries, role of chemistry in India and global economies.

Basics of Business and Management

Key business concepts: Business plans, market need, project management and routes to market.

Management Functions and skills, principles of motivation, forms of business organization including partnerships and companies.

Marketing Skills

Understanding basics of marketing and marketing mix strategies with cases.

Human Resource Management (HRM) Skills

Managerial HRM functions viz. recruitment, training and development and compensation.

Financial Management Skills

An overview of financial and cost accounting with cases, managerial finance functions.

Intellectual Property Rights

Concept of intellectual property rights, patents.

Recommended books

1. <http://www.rsc.org/learn-chemistry/resources/business-skills-for-chemists/OnlineCourse/>
2. Philip Kotler, Keven Lane Keller Marketing Management 15th Ed., Pearson Education; Fifteenth edition (10 August 2017)
- 3.

CHE-SE-3074: INTELLECTUAL PROPERTY RIGHTS (IPR)

(Credits: 04)

Theory: 60 Lectures

Course Objective: In this era of liberalization and globalization, the perception about science and its practices has undergone dramatic change. The importance of protecting the scientific discoveries, with commercial potential or the intellectual property rights is being discussed at all levels – statutory, administrative, and judicial. With India ratifying the WTO agreement, it has become obligatory on its part to follow a minimum acceptable standard for protection and enforcement of intellectual property rights. The purpose of this course is to apprise the students about the multifaceted dimensions of this issue.

Learning Outcome: After completing this course, students will have in-depth understanding about the importance and types of IPR. This course will also provide the clarity on the legal and economic aspects of the IP system.

Introduction to Intellectual Property:

Historical Perspective, Different Types of IP, Importance of protecting IP.

Copyrights

Introduction, How to obtain, Differences from Patents.

Trade Marks

Introduction, How to obtain, Different types of marks – Collective marks, certification marks, service marks, Trade names, etc.

Differences from Designs.

Patents

Historical Perspective, Basic and associated right, WIPO, PCT system, Traditional Knowledge, Patents and Healthcare – balancing promoting innovation with public health, Software patents and their importance for India.

Geographical Indications

Definition, rules for registration, prevention of illegal exploitation, importance to India.

Industrial Designs

Definition, How to obtain, features, International design registration.

Layout design of integrated circuits

Circuit Boards, Integrated Chips, Importance for electronic industry.

Trade Secrets

Introduction and Historical Perspectives, Scope of Protection, Risks involved and legal aspects of Trade Secret Protection.

Different International agreements

(a) World Trade Organization (WTO):

- (i) General Agreement on Tariffs & Trade (GATT), Trade Related Intellectual Property Rights (TRIPS) agreement
- (ii) General Agreement on Trade related Services (GATS)
- (iii) Madrid Protocol
- (iv) Berne Convention
- (v) Budapest Treaty

(b) Paris Convention

WIPO and TRIPS, IPR and Plant Breeders Rights, IPR and Biodiversity

IP Infringement issue and enforcement – Role of Judiciary, Role of law enforcement agencies – Police, Customs etc. Economic Value of Intellectual Property – Intangible assets and their valuation, Intellectual Property in the Indian Context – Various laws in India Licensing and technology transfer.

Recommended Books:

1. N.K. Acharya: *Textbook on intellectual property rights*, Asia Law House (2001).
2. Manjula Guru & M.B. Rao, *Understanding Trips: Managing Knowledge in Developing Countries*, Sage Publications (2003).
3. P. Ganguli, *Intellectual Property Rights: Unleashing the Knowledge Economy*, Tata McGraw-Hill (2001).
4. Arthur Raphael Miller, Micheal H.Davis; *Intellectual Property: Patents, Trademarks and Copyright in a Nutshell*, West Group Publishers (2000).
5. Jayashree Watal, *Intellectual property rights in the WTO and developing countries*, Oxford University Press, Oxford.

CHE-SE-4014: ANALYTICAL CLINICAL BIOCHEMISTRY

(Credits: 04)

THEORY: 60 Lectures

Course objective: This course is intended to apprise students with various clinically relevant biomolecules, their structures and physiological roles. Students are also expected to learn the basics of analysis of pathological samples (blood and urine).

Learning outcome: Students will be able to identify various molecules relevant to a particular pathological condition and their estimation protocols.

Basic understanding of the structures, properties and functions of carbohydrates, lipids and proteins:

Review of concepts studied in the core course.

Carbohydrates: Biological importance of carbohydrates, metabolism, cellular currency of energy (ATP), glycolysis, alcoholic and lactic acid fermentations, Krebs cycle, Isolation and characterization of polysachharides.

Proteins: Classification, biological importance, primary and secondary, tertiary and quaternary structures of proteins: α -helix and β -pleated sheets, isolation, characterization, denaturation of proteins.

Enzymes: Nomenclature, characteristics, classification, active site, mechanism of enzyme action, stereospecificity of enzymes, effect of pH, temperature on enzyme activity, , enzyme inhibitors, coenzymes and cofactors introduction to biocatalysis: importance in “Green Chemistry” and chemical industry.

Lipids: Classification, biological importance of triglycerides and phosphoglycerides and cholesterol, lipid membrane, liposomes and their biological functions and underlying applications.

Lipoproteins.

Properties, functions and biochemical functions of steroid hormones.

Biochemistry of peptide hormones.

Structure of DNA (Watson-Crick model) and RNA, genetic code, biological roles of DNA and RNA: replication, transcription and translation, introduction to gene therapy.

Biochemistry of disease: A diagnostic approach by blood/ urine analysis:

Blood: Composition and functions of blood, blood coagulation, blood collection and preservation of samples, anemia, regulation, estimation and interpretation of data for blood sugar, urea, creatinine, cholesterol and bilirubin.

Urine: Collection and preservation of samples, formation of urine, composition and estimation of constituents of normal and pathological urine.

Practicals:

Identification and estimation of the following:

1. Carbohydrates - qualitative and quantitative analysis.
2. Lipids - qualitative and quantitative analysis.
3. Determination of the iodine number of oil.
4. Determination of the saponification number of oil.
5. Detection of cholesterol using Liebermann- Burchard reaction.
6. Isolation of protein.
7. Determination of concentration of protein by the Biuret reaction.
8. Determination of nucleic acid concentration.
9. Separation of nucleic acids.

Recommended Books:

1. David L. Nelson and Michael M. Cox: Lehninger Principles of Biochemistry
 2. T.G. Cooper: Tool of Biochemistry.
 3. Keith Wilson and John Walker: Practical Biochemistry.
 4. Alan H Gowenlock: Varley's Practical Clinical Biochemistry.
 5. Thomas M. Devlin: Textbook of Biochemistry.
 6. Jeremy M. Berg, John L Tymoczko, Lubert Stryer: Biochemistry.
 7. G. P. Talwar and M Srivastava: Textbook of Biochemistry and Human Biology.
 8. O. Mikes, R.A. Chalmers: Laboratory Handbook of Chromatographic Methods.
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CHE-SE-4024: GREEN METHODS IN CHEMISTRY

(Credits: 04)

Theory: 60 Lectures

Course Objectives: This course introduces students to the utilization of green chemistry from industrial perspective and provides exposure to methods by which environmental problems are evaluated and designing of sustainable solutions.

Learning Outcome: Students shall be able to describe and evaluate chemical products and processes from environmental perspective, define and propose sustainable solutions and critically assess the methods for waste reduction and recycling.

Tools of Green chemistry, Twelve principles of Green Chemistry, with examples.

The following Real world Cases in Green Chemistry should be discussed:

- 1 A green synthesis of ibuprofen which creates less waste and fewer byproducts (Atom economy).
- 2 Surfactants for Carbon Dioxide – replacing smog producing and ozone depleting solvents with CO₂ for precision cleaning and dry cleaning of garments.
- 3 Environmentally safe antifoulant.
- 4 CO₂ as an environmentally friendly blowing agent for the polystyrene foam sheet packaging market.
- 5 Using a catalyst to improve the delignifying (bleaching) activity of hydrogen peroxide.

- 6 A new generation of environmentally advanced preservative: getting the chromium and arsenic out of pressure treated wood.
7. Rightfit pigment: synthetic azopigments to replace toxic organic and inorganic pigments.
- 8 Development of a fully recyclable carpet: cradle to cradle carpeting.

Recommended Books:

1. Manahan S.E. (2005) Environmental Chemistry, CRC Press
 2. Miller, G.T. (2006) Environmental Science 11th edition. Brooks/Cole
 3. Mishra, A. (2005) Environmental Studies. Selective and Scientific Books, New
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CHE-SE-4034: PHARMACEUTICAL CHEMISTRY

(Credits: 04)

Theory: 60 Lectures

Course Objective: This primary objective of this course is to introduce students to the fundamentals of drug design and development process, drugs for various diseases available in market, their mode of action and side effects. Students are expected to learn the biosynthetic procedures of various bio-relevant small molecules.

Learning Outcome: Students will be able to appreciate the drug development process, identify various small molecules used for treatments different ailments and other physiological processes.

Drugs & Pharmaceuticals:

Drug discovery, design and development; basic retrosynthetic approach, synthesis of the representative drugs of the following classes: analgesics, antipyretic, anti-inflammatory (aspirin, paracetamol, ibuprofen), antibiotics (chloramphenicol), antibacterial and antifungal (sulphonamides, sulphanethoxazol, sulphacetamide, trimethoprim), antiviral (acyclovir), drugs effecting central nervous system (phenobarbital, diazepam), cardiovascular (glyceryl trinitrate), antilaprosy (dapson), HIV-AIDS related drugs (AZT- Zidovudine).

Fermentation:

Aerobic and anaerobic fermentation, production of (i) ethanol and citric acid, (ii) antibiotics (penicillin, cephalosporin, chloromycetin and streptomycin), (iii) lysine, glutamic acid, vitamin B2, vitamin B12 and vitamin C.

Practicals:

1. Preparation of Aspirin and its analysis.
2. Preparation of magnesium bisilicate (antacid).

Recommended Books:

1. Graham L. Patrick: *An Introduction to Medicinal Chemistry*, Oxford University Press, UK.
2. Gareth Thomas: *Fundamentals of Medicinal Chemistry*, Wiley.

3. Hakishan, V.K. Kapoor: *Medicinal and Pharmaceutical Chemistry*, Vallabh Prakashan, Pitampura, New Delhi.

4. William O. Foye, Thomas L., Lemke, David A. William: *Principles of Medicinal Chemistry*, B.I. Waverly Pvt. Ltd. New Delhi.

CHE-SE-4044: CHEMISTRY OF COSMETICS & PERFUMES

(Credits: 04)

60 Lectures

Course Objective: This course intends to apprise students about the chemical knowledge related to some of the commonly used cosmetics. Laboratory experiments for preparation of talcum powder, shampoo etc. are included to give hands on experience.

Learning Outcome: Students will learn about the preparation and chemistry involved with the production different cosmetic. This may encourage students to take up entry level jobs at cosmetics industry or venture into commercial production of cosmetics as an entrepreneur.

A general study including preparation and uses of the following: Hair dye, hair spray, shampoo, suntan lotions, face powder, lipsticks, talcum powder, nail enamel, creams (cold, vanishing and shaving creams), antiperspirants and artificial flavours. Essential oils and their importance in cosmetic industries with reference to Eugenol, Geraniol, sandalwood oil, eucalyptus, rose oil, 2-phenyl ethyl alcohol, Jasmone, Civetone, Muscone.

Practicals

1. Preparation of talcum powder.
2. Preparation of shampoo.
3. Preparation of enamels.
4. Preparation of hair remover.
5. Preparation of face cream.
6. Preparation of nail polish and nail polish remover.

Recommended Books:

1. E. Stocchi: *Industrial Chemistry*, Vol -I, Ellis Horwood Ltd. UK.
 2. P.C. Jain, M. Jain: *Engineering Chemistry*, Dhanpat Rai & Sons, Delhi.
 3. B.K. Sharma: *Industrial Chemistry*, Goel Publishing House, Meerut.
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CHE-SE-4054: PESTICIDE CHEMISTRY

(Credits: 04)

60 Lectures

Course Objective: This is a brief and introductory course on pesticides, through which the students will be introduced to various classes of pesticides, their synthesis, applications and possible hazards of their uses.

Learning Outcome: *Students will be able to explain or describe and critically examine different types of pesticides, their activity/toxicity and their applications and the need for the search of an alternative based on natural products.*

Definition of pesticides, general introduction to pesticides (natural and synthetic), benefits and adverse effects of pesticides. Classification, mode of action, toxicity and methods of pesticides residue analysis. Synthesis and technical manufacture and uses of representative pesticides in the following classes: Organochlorines (DDT, Gammexene); organophosphate (Malathion, Parathion); Carbamates (Carbofuran and carbaryl); Quinones (Chloranil), Anilides (Alachlor and Butachlor)

Practicals:

1. To calculate acidity/alkalinity in given sample of pesticides formulations as per BIS specifications.
2. Preparation of simple organophosphates, phosphonates and thiophosphates.

Recommended Book:

1. R. Cremlyn: Pesticides, Preparation and Mode of Action, John Wiley & Sons, New York, 1978
 2. RPBateman, Pesticide Applications, AAB Press, 2004
 3. Principles of Pesticide chemistry: S K Handa, Ed. by Agrobios (India), 2008
 4. Pesticide Science & Biotechnology: R Greenhalgh and T R Robers, IUPAC, Blackwell Scientific Publications, 1987
 5. The Chemical Process Industries: D N Shreve
 6. Pesticide Chemistry : G Matolesy, M. Nadasy, V. Andriska, Elsevier Sc. Publisher, USA, 1988
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CHE-SE-4064: FUEL CHEMISTRY

(Credits: 04)

60 Lectures

Course Objectives: *This course discusses about the chemistry of various sources of energy. Students are expected to learn about the composition of coal and petroleum products, their extraction, purification methods and usage. A section also covers classification and applications of natural and synthetic lubricants. Students will also learn about the determination and significance of various industrially relevant physical parameters for different fuels and lubricants.*

Learning Outcomes: At the end of this course students will learn about the classes of renewable and non-renewable energy sources. Students will learn about the composition of coal and crude petroleum, their classification, isolation of coal and petroleum products and their usage in various industries. They will also learn to determine industrially significant physical parameters for fuels and lubricants.

Fuel Chemistry

Review of energy sources (renewable and non-renewable). Classification of fuels and their calorific value.

Coal: Uses of coal (fuel and nonfuel) in various industries, its composition, carbonization of coal. Coal gas, producer gas and water gas—composition and uses. Fractionation of coal tar, uses of coal tar bases chemicals, requisites of a good metallurgical coke, Coal gasification (Hydro gasification and Catalytic gasification), Coal liquefaction and Solvent Refining.

Petroleum and Petrochemical Industry: Composition of crude petroleum, Refining and different types of petroleum products and their applications.

Fractional Distillation (Principle and process), Cracking (Thermal and catalytic cracking), Reforming Petroleum and non-petroleum fuels (LPG, CNG, LNG, bio-gas, fuels derived from biomass), fuel from waste, synthetic fuels (gaseous and liquids), clean fuels. Petrochemicals: Vinyl acetate, Propylene oxide, Isoprene, Butadiene, Toluene and its derivatives Xylene.

Lubricants: Classification of lubricants, lubricating oils (conducting and non-conducting) Solid and semisolid lubricants, synthetic lubricants.

Properties of lubricants (viscosity index, cloud point, pour point) and their determination.

Recommended Books:

1. E. Stocchi: *Industrial Chemistry*, Vol -I, Ellis Horwood Ltd. UK.
 2. P.C. Jain, M. Jain: *Engineering Chemistry*, Dhanpat Rai & Sons, Delhi.
 3. B.K. Sharma: *Industrial Chemistry*, Goel Publishing House, Meerut.
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CHOICE BASED CREDIT SYSTEM

Syllabus

**For
B.Sc. BOTANY HONOURS**



**DEPARTMENT OF BOTANY
GAUHATI UNIVERSITY
GUWAHATI-781014**

Effective from Academic Session 2019-2020

Preamble

Today plant science is a fusion of the traditional components with the modern aspects of biochemistry, molecular biology and biotechnology. Over the years, plant science (Botany) has shown enormous gain in information and applications owing to tremendous inputs from research in all its aspects. With global recognition of the need for conservation, field plant biologists have contributed significantly in assessing plant diversity. Taxonomists have explored newer dimensions for the classification of plants. New insights have been gained in functional and structural aspects of plant development by utilizing novel tools and techniques for botanical research. Challenging areas of teaching and research have emerged in ecology and reproductive biology. Concern for ever increasing pollution and climate change is at its highest than ever before. Keeping these advancements in view, a revision of the curriculum at the undergraduate level is perfectly timed as sought by UGC from the beginning of 2019 session, the Botany students of Gauhati Universities shall have the benefit of a balanced, carefully-crafted course structure taking care of different aspects of plant science, namely plant diversity, physiology, genetics, biochemistry, molecular biology, reproduction, anatomy, taxonomy, ecology, economic botany and the impact of environment on the growth and development of plants. All these aspects have been given due weightage over the six semesters. Keeping the employment entrepreneurship in mind, applied courses have also been introduced. These courses shall provide the botany students hands on experience and professional inputs. On the whole, the curriculum is a source of lot of information and is supported by rich resource materials. It is hoped that a student graduating in Botany with the new curriculum will be a complete botanist at Honours level.

Students should opt for atleast 1 or 2 Generic Electives from other life sciences like Zoology/Microbiology/Biotechnology / Biochemistry and Chemistry. They should, however, opt atleast one generic elective from Chemistry Course besides life Sciences.

Scheme for Choice Based Credit System in B. Sc. Botany Honours

Semester		CORE COURSE(14)	Ability Enhancement Compulsory Course(AEC)(2)	Skill Enhancement Course (SEC) (2)	Discipline Specific Elective (DSE) (4)	Generic Elective: (GE) (4)
I	Core Course I	Phycology and Microbiology	English Communication			GE-1
	Core Course II	Biomolecules and Cell Biology				
II	Core Course III	Mycology and Phytopathology	Environmental Studies			GE-2
	Core Course IV	Archegoniate				
III	Core Course V	Morphology and Anatomy of Angiosperm		SEC -1		GE-3
	Core Course VI	Economic Botany				
	Core Course VII	Genetics				
IV	Core Course VIII	Molecular Biology		SEC -2		GE-4
	Core Course IX	Plant Ecology and Phytogeography				
	Core Course X	Plant Systematics				
V	Core Course XI	Reproductive Biology of Angiosperms			DSE-1	
	Core Course XII	Plant Physiology			DSE-2	
VI	Core Course XIII	Plant Metabolism			DSE -3	
	Core Course XIV	Plant Biotechnology			DSE-4	

Course Structure for CBCS in B. Sc. Botany Hounours as per requirement of UGC

SEMESTER	COURSE OPTED	COURSE NAME	Credits
I	ENG-AE-1014	English communications	4
	BOT-HC-1016	Phycology and Microbiology	4
	BOT-HC-1016 (Practical)	Phycology and Microbiology	2
	BOT-HC-1026	Biomolecules and Cell Biology	4
	BOT-HC-1026 (Practical)	Biomolecules and Cell Biology- Practical	2
II	ENV-AE-2014	Environmental Studies	4
	BOT-HC-2016	Mycology and Phytopathology	4
	BOT-HC-2016 (Practical)	Mycology and Phytopathology- Practical	2
	BOT-HC-2026	Archegoniate	4
	BOT-HC-2026 (Practical)	Archegoniate- Practical	2
III	BOT-HC-3016	Morphology Anatomy and of Angiosperm	4
	BOT-HC-3016 (Practical)	Morphology Anatomy and of Angiosperm –Practical	2
	BOT-HC-3026	Economic Botany	4
	BOT-HC-3026 (Practical)	Economic Botany-Practical	2
	BOT-HC-3036	Genetics	4
	BOT-HC-3036 (Practical)	Genetics- Practical	2
	1. BOT-SE-3014 2. BOT-SE-3024	SEC-1 (any one) 1. Biofertilizers 2. Herbal Technology	4

IV	BOT-HC-4016	Molecular Biology	4
	BOT-HC-4016 (Practical)	Molecular Biology- Practical	2
	BOT-HC-4026	Plant Ecology and Phytogeography	4
	BOT-HC-4026 (Practical)	Plant Ecology and Phytogeography – Practical	2
	BOT-HC-4036	Plant Systematics	4
	BOT-HC-4036 (Practical)	Plant Systematics Practical	2
	1. BOT-SE-4014 2. BOT-SE-4024 3. BOT-SE-4034	SEC-II (any one) 1. Nursery and Gardening 2. Floriculture 3. Intellectual Property Rights	4
V	BOT-HC-5016	Reproductive Biology of Angiosperms	4
	BOT-HC-5016 (Practical)	Reproductive Biology of Angiosperm – Practical	2
	BOT-HC-5026	Plant Physiology	4
	BOT-HC-5026 (Practical)	Plant Physiology- Practical	2
	BOT-HE-5016	DSE-1 Natural Resource Management	4
	BOT-HE-5016 (Practical)	DSE-1 Practical Natural Resource Management – Practical	2
	BOT-HE-5026	DSE-2 Horticultural Practices and Post-Harvest Technology	4
	BOT-HE-5026 (Practical)	DSE-2 Practical Horticultural Practices and Post-Harvest Technology-Practical	2

VI	BOT-HC-6016	Plant Metabolism	4	
	BOT-HC-6016 (Practical)	Plant Metabolism- Practical	2	
	BOT-HC-6026	Plant Biotechnology	4	
	BOT-HC-6026 (Practical)	Plant Biotechnology- Practical	2	
	BOT-HE-6016	DSE-3 Industrial and Environmental Microbiology	4	
	BOT-HE-6016 (Practical)	DSE-3 Industrial and Environmental Microbiology-Practical	2	
	Discipline Centric Elective-4 (Theory & practical / Project Work)	Either 1 or 2 below		
	1.BOT-HE-6026	DSE-4 1.Analytical Techniques in Plant Sciences	4	6
	1.BOT-HE-6026 (Practical)	DSE-4 1.Analytical Techniques in Plant Sciences-Practical	2	
	2.BOT-HE-6036	DSE-4 2. Project Work/ Dissertation	6	
Total Credits in B. Sc. Botany Honours: 116				

List of Papers

B. Sc Honours Botany Under CBCS

Core Papers

1	BOT-HC-1016	: Phycology and Microbiology
2	BOT-HC-1026	: Biomolecules and Cell Biology
3	BOT-HC-2016	: Mycology and Phytopathology
4	BOT-HC-2026	: Archegoniate
5	BOT-HC-3016	: Morphology and Anatomy of Angiosperm
6	BOT-HC-3026	: Economic Botany
7	BOT-HC-3036	: Genetics
8	BOT-HC-4016	: Molecular Biology
9	BOT-HC-4026	: Plant Ecology and Phytogeography
10	BOT-HC-4036	: Plant Systematics
11	BOT-HC-5016	: Reproductive Biology of Angiosperms
12	BOT-HC-5026	: Plant Physiology
13	BOT-HC-6016	: Plant Metabolism
14	BOT-HC-6026	: Plant Biotechnology

Discipline Specific Elective (DSE) Papers

1	BOT-HE-5016	: Natural Resource Management
2	BOT-HE-5026	: Horticultural Practices and Post-Harvest Technology
3	BOT-HE-6016	: Industrial and Environmental Microbiology
4	BOT-HE-6026	: Analytical Techniques in Plant Sciences
5	BOT-HE-6036	: Project work/Dissertation

Generic Elective (GE)

1	BOT-HG-1016	: Biodiversity (Microbes, Algae, Fungi and Archegoniate)
2	BOT-HG-2016	: Plant Ecology and Taxonomy
3	BOT-HG-3016	: Plant Physiology and Metabolism
4	BOT-HG-3026	: Environmental Biotechnology
5	BOT-HG-4016	: Plant Anatomy and Embryology
6	BOT-HG-4026	: Economic Botany and Plant Biotechnology

Ability Enhancement Course Compulsory

- 1 ENG-AE-1014 : English/MIL communication
- 2 ENV-AE-2014: Environmental Studies

Skill Enhancement Paper

- 1 BOT-SE-3014 : Biofertilizers (SEC-I)
- 2 BOT-SE-3024 : Herbal Technology (SEC-I)
- 3 BOT-SE-4014 : Nursery and Gardening (SEC-II)
- 4 BOT-SE-4024 : Floriculture (SEC-II)
- 5 BOT-SE-4034 : Intellectual Property Rights (SEC-II)

Core Courses

1

BOT-HC-1016

Phycology and Microbiology

Total Lectures : 60 Credits : 6 (Theory - 4, Practical - 2)

1.1 THEORY

Unit 1 : *Introduction to microbial world*

(10 lectures)

Scope of microbes in industry and environment; Microbial nutrition, growth and metabolism [Only an overview of microbial metabolism- the concept of anabolism (Biosynthesis) and catabolism (ATP-generating Pathways-Respiration and Fermentation)].

Unit 2 : *Viruses*

(7 lectures)

Discovery, physiochemical and biological characteristics; classification (Baltimore), general structure with special reference to viroids and prions; replication (general account), DNA virus (T-phage), lytic and lysogenic cycle; RNA virus (TMV). Economic importance of viruses with reference to vaccine production, role in research, medicine and diagnostics, as causal organisms of plant diseases.

Unit 3 : *Bacteria*

(7 lectures)

Discovery, general characteristics; Types-archaeobacteria, eubacteria, actinomycetes, mycoplasma, rickettsia, chlamydiae and sphaeroplasts); Cell structure; Nutritional types; Reproduction-vegetative, asexual and recombination (conjugation, transformation and transduction). Economic importance of bacteria with reference to their role in agriculture and industry (Alcohol and Antibiotic production).

Unit 4 : Algae**(10 lectures)**

General characteristics; Ecology and distribution; range of thallus organization; Cell structure and components; cell wall, pigment system, reserve food (of only groups represented in the syllabus), flagella; methods of reproduction; Classification; Evolutionary significance of *Prochloron*; criteria, system of Fritsch, and evolutionary classification of Lee (only upto groups); Role of algae in the environment, agriculture, biotechnology and industry, Economic importance of Diatoms.

Unit 5 : Cyanophyta and Xanthophyta**(8 lectures)**

Ecology and occurrence; Range of thallus organization; Cell structure; Reproduction, Morphology and life-cycle of *Nostoc* and *Vaucheria*.

Unit 6 : Chlorophyta, Charophyta and Bacillariophyta**(10 lectures)**

General characteristics; Occurrence; Range of thallus organization; Cell structure; Reproduction. Morphology and life-cycles of *Volvox*, *Oedogonium*, *Coleochaete*, *Chara*. General Account of Bacillariophyta.

Unit 7 : Phaeophyta and Rhodophyta**(8 lectures)**

Characteristics; Occurrence; Range of thallus organization; Cell structure; Reproduction. Morphology and life-cycles of *Ectocarpus*, *Fucus* and *Polysiphonia*.

1.2 PRACTICAL

Microbiology

1. Electron micrographs/Models of viruses – T-Phage and TMV/ Line drawings/ Photographs of Lytic and Lysogenic Cycle.
2. Types of Bacteria to be observed from temporary/permanent slides/photographs. Electron micrographs of bacteria, binary fission, endospore, conjugation, root Nodule.
3. Gram staining.

4. Isolation of soil microflora.
5. Endospore staining with malachite green using the (endospores taken from soil bacteria).

Phycology

1. Study of vegetative and reproductive structures of *Nostoc*, *Volvox*, *Oedogonium*, *Chara*, *Vaucheria*, *Ectocarpus*, *Fucus* and *Polysiphonia*, *Prochloron* through electron micrographs, permanent slides.

Suggested Readings

1. Lee, R.E. (2008). Phycology, Cambridge University Press, Cambridge. 4th edition.
2. Wiley JM, Sherwood LM and Woolverton CJ. (2013) Prescott's Microbiology. 9th Edition. McGraw Hill International.
3. Kumar, H.D. (1999). Introductory Phycology. Affiliated East-West Press, Delhi.
4. Sahoo, D. (2000). Farming the ocean: seaweeds cultivation and utilization. Aravali International, New Delhi.
5. Campbell, N.A., Reece J.B., Urry L.A., Cain M.L., Wasserman S.A. Minorsky P.V., Jackson R.B. (2008). Biology, Pearson Benjamin Cummings, USA. 8th edition.
6. Pelczar, M.J. (2001). Microbiology, 5th edition, Tata McGraw-Hill Co, New Delhi.
7. Sharma, P.D. (2009). Microbiology, latest edition, Rastogi Publication, Meerut.

2

BOT-HC-1026 Biomolecules and Cell Biology

Total Lectures : 60 Credits : 6 (Theory - 4, Practical - 2)

2.1 THEORY

Unit 1 : Biomolecules (20 lectures)

Types and significance of chemical bonds; Structure and properties of water; pH and buffers.

Carbohydrates : Nomenclature and classification; Monosaccharides; Disaccharides; Oligosaccharides and polysaccharides.

Lipids : Definition and major classes of storage and structural lipids; Fatty acids structure and functions; Essential fatty acids; Triacyl glycerols structure, functions and properties; Phosphoglycerides.

Proteins : Structure of amino acids; Levels of protein structure-primary, secondary, tertiary and quaternary; Protein denaturation and biological roles of proteins.

Nucleic acids : Structure of nitrogenous bases; Structure and function of nucleotides; Types of nucleic acids; Structure of A, B, C, D, Z types of DNA; Types of RNA.

Unit 2 : Bioenergetics (4 lectures)

Laws of thermodynamics, concept of free energy, endergonic and exergonic reactions, coupled reactions, redox reactions. ATP: structure, its role as an energy currency molecule.

Unit 3 : Enzymes (6 lectures)

Structure of enzyme: holoenzyme, apoenzyme, cofactors, coenzymes and prosthetic group; Classification of enzymes; Features of active site, substrate specificity, mechanism of action (activation energy, lock and key hypothesis, induced-fit theory), Michaelis – Menten equation, enzyme inhibition and factors affecting enzyme activity.

Unit 4 : *The cell*

(4 lectures)

Cell as a unit of structure and function; Characteristics of prokaryotic and eukaryotic cells; Origin of eukaryotic cell (Endosymbiotic theory).

Unit 5 : *Cell wall and plasma membrane*

(4 lectures)

Chemistry, structure and function of Plant cell wall. Overview of membrane function; fluid mosaic model; Chemical composition of membranes; Membrane transport – Passive, active and facilitated transport, endocytosis and exocytosis.

Unit 6 : *Cell organelles*

(16 lectures)

Nucleus: Structure-nuclear envelope, nuclear pore complex, nuclear lamina, molecular organization of chromatin; nucleolus.

Cytoskeleton: Role and structure of microtubules, microfilaments and intermediary filament.

Chloroplast, mitochondria and peroxisomes: Structural organization; Function; Semiautonomous nature of mitochondria and chloroplast.

Endomembrane system: Endoplasmic Reticulum – Structure, targeting and insertion of proteins in the ER, protein folding, processing; Smooth ER and lipid synthesis, export of proteins and lipids; Golgi Apparatus – organization, protein glycosylation, protein sorting and export from Golgi Apparatus; Lysosomes

Unit 7 : *Cell division*

(6 lectures)

Phases of eukaryotic cell cycle, mitosis and meiosis; Regulation of cell cycle-checkpoints, role of protein kinases.

2.2 PRACTICAL

1. Qualitative tests for carbohydrates, reducing sugars, non-reducing sugars, lipids and proteins.
2. Study of plant cell structure with the help of epidermal peel mount of *Onion/Rhoeo/Crinum*.
3. Demonstration of the phenomenon of protoplasmic streaming in *Hydrilla* and *Vallisneria* leaf.
4. Counting the cells per unit volume with the help of haemocytometer. (Yeast/pollen grains).
5. Cytochemical staining of : DNA- Feulgen and cell wall in the epidermal peel of onion using Periodic Schiff's (PAS) staining technique.
6. Study the phenomenon of plasmolysis and deplasmolysis.
7. Study different stages of mitosis and meiosis (Demonstration).

Suggested Readings

1. Campbell, MK (2012) Biochemistry, 7th ed., Published by Cengage Learning
2. Campbell, PN and Smith AD (2011) Biochemistry Illustrated, 4th ed., Published by Churchill Livingstone
3. Tymoczko JL, Berg JM and Stryer L (2012) Biochemistry: A short course, 2nd ed., W.H.Freeman
4. Berg JM, Tymoczko JL and Stryer L (2011) Biochemistry, W.H.Freeman and Company
5. Nelson DL and Cox MM (2008) Lehninger Principles of Biochemistry, 5th Edition., W.H. Freeman and Company.
6. Karp, G. (2010). Cell Biology, John Wiley & Sons, U.S.A. 6th edition.
7. Hardin, J., Becker, G., Skliensmith, L.J. (2012). Becker's World of the Cell, Pearson Education Inc. U.S.A. 8th edition.
8. Cooper, G.M. and Hausman, R.E. (2009) The Cell: A Molecular Approach. 5th edition. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.
9. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. (2009) The World of the Cell. 7th edition. Pearson Benjamin Cummings Publishing, San Francisco

3

BOT-HC-2016 Mycology and Phytopathology

Total Lectures : 60 Credits : 6 (Theory - 4, Practical - 2)

3.1 THEORY

Unit 1 : *Introduction to Fungi* (10 lectures)

General characteristics; Status of Fungi in living system; Thallus organization, modification of hyphae; Cell and Cell wall composition; Nutrition, flagella, septum, homothallism and heterothallism, cell division.

History of Classification (Hidetta *et al.* 2007); Classification of Fungi (Ainsworth, 1973, Webster 1977) up to sub-division with diagnostic characters and examples.

General characteristics of Myxomycota, Oomycota, Zygomycota, Ascomycota, Basidiomycota and Deuteromycota.

Unit 2 : *Mastigomycotina (Chytridiomycetes and Oomycetes)* (6 lecture)

Characteristic features; Reproduction; Life cycle with reference to *Synchytrium*, *Phytophthora* and *Albugo*.

Unit 3 : *Zygomycotina* (2 lecture)

Characteristic features; Reproduction; Life cycle with reference to *Rhizopus*.

Unit 4 : *Ascomycotina* (10 lectures)

General characteristics (asexual and sexual fruiting bodies); Life cycle, Heterokaryosis and parasexuality; Life cycle and classification with reference to *Saccharomyces*, *Aspergillus*, *Penicillium*, *Neurospora* and *Peziza*.

Unit 5 : Basidiomycotina (8 lectures)

General characteristics; Life cycle and Classification with reference to black stem rust on wheat *Puccinia* (Physiological Specialization), loose and covered smut (symptoms only), *Agaricus*; Bioluminescence, Fairy Rings and Mushroom Cultivation.

Unit 6 : Deuteromycotina (Fungi Imperfecti) (3 lectures)

General characteristics; Thallus organization; Reproduction; Classification with special reference to *Alternaria* and *Colletotrichum*.

Unit 7 : Allied Fungi- Myxomycota (3 lectures)

General characteristics; Status of Slime molds, Classification; Occurrence; Types of plasmodia; Types of fruiting bodies.

Unit 8 : Symbiotic associations (3 lectures)

Lichen – Occurrence; General characteristics; Range of thallus organization; Internal structure and nature of associations of algal and fungal partners; Reproduction.

Mycorrhiza- Ectomycorrhiza, Endomycorrhiza and their significance.

Unit 9 : Applied Mycology (5 Lectures)

Role of fungi in biotechnology; food industry (Flavour & texture, Fermentation, Baking, Organic acids, Enzymes, Mycoproteins); Pharmaceutical (Secondary metabolites); Agriculture (Biofertilizers); Mycotoxins; Biological control (Mycofungicides, Mycoherbicides, Mycoinsecticides, Myconematicides); Medical mycology.

Unit 10 : Phytopathology (10 lectures)

Terms and concepts; General symptoms; Geographical distribution of diseases; Etiology; Symptomology; Host-Pathogen relationships; Disease cycle and environmental relation; prevention and control of plant diseases, and role of quarantine.

Bacterial diseases – Citrus canker and angular leaf spot of cotton. Viral diseases – Tobacco Mosaic viruses, vein clearing. Fungal diseases – Early blight of potato, Black stem rust of wheat, White rust of crucifers.

3.2 PRACTICAL

1. *Rhizopus*: study of asexual stage from temporary mounts and sexual structures through permanent slides.
2. *Aspergillus* and *Penicillium*: study of asexual stage from temporary mounts. Study of

- Sexual stage from permanent slides/photographs.
3. *Peziza*: sectioning through ascocarp.
 4. *Alternaria*: Specimens/photographs and temporary mounts.
 5. *Puccinia*: Herbarium specimens of Black Stem Rust of Wheat and infected Barberry leaves; sections/ mounts of spores on wheat and permanent slides of both the hosts.
 6. *Agaricus*: Specimens of button stage and full grown mushroom; sectioning of gills of *Agaricus*, fairy rings and bioluminescent mushrooms to be shown.
 7. Study of phaneroplasmodium from actual specimens and /or photograph. Study of *Stemonitis* sporangia.
 8. *Albugo*: Study of symptoms of plants infected with *Albugo*; asexual phase study through section/ temporary mounts and sexual structures through permanent slides.
 9. Lichens: Study of growth forms of lichens (crustose, foliose and fruticose) on different substrates. Study of thallus and reproductive structures (soredia and apothecium) through permanent slides. Mycorrhizae: ectomycorrhiza and endomycorrhiza (Photographs)
 10. Phytopathology: Bottle specimens, Herbarium specimens should be made of bacterial diseases, Viral diseases, Fungal diseases (Locally available).
 11. Applied mycology: Photographs of Mycorrhizae, Fungi used in medicine (Cylindriocarpon, Tolyposporium, Ganoderma, Cephalosporium – any one), fungi used as biological control agents (fungi used in control of seedling, soil borne, post-harvest diseases and in control of nematodes, insects and weeds – any one), photographs/mounts of spores of fungi causing human infections (*Aspergillus*, *Candida*, *Cryptococcus*, *Histoplasma*, *Microsporium*, *Trichophyton* – any one).

Suggested Readings

1. Agrios, G.N. (1997) Plant Pathology, 4th edition, Academic Press, U.K.
2. Alexopoulos, C.J., Mims, C.W., Blackwell, M. (1996). Introductory Mycology, John Wiley & Sons (Asia) Singapore. 4th edition.
3. Webster, J. and Weber, R. (2007). Introduction to Fungi, Cambridge University Press, Cambridge. 3rd edition.
4. Sethi, I.K. and Walia, S.K. (2011). Text book of Fungi and Their Allies, Macmillan Publishers India Ltd.
5. Sharma, P.D. (2011). Plant Pathology, Rastogi Publication, Meerut, India.
6. College Botany, Vol. II. – Gangulee and Kar, New Central Book Agency, Kolkata.
7. Studies in Botany, Vol. I. – Mitra, Mitra, Choudhury. Moulik Library, Kolkata.
8. Text Book of Botany, Vol. I & II. – Hait, Ghosh and Bhattacharya, New Central Book Agency, Kolkata.

4

BOT-HC-2026

Archegoniate

Total Lectures : 60 Credits : 6 (Theory - 4, Practical - 2)

4.1 THEORY

Unit 1: *Introduction* (4 lectures)

Unifying features of archegoniates; Transition to land habit; Alternation of generations.

Unit 2: *Bryophytes* (6 lectures)

General characteristics; Adaptations to land habit; Classification; Range of thallus organization.

Unit 3: *Type Studies- Bryophytes* (12 lectures)

Classification, morphology, anatomy and reproduction of *Riccia*, *Marchantia*, *Anthoceros*, *Sphagnum* and *Polytrichum*; Reproduction and evolutionary trends in *Riccia*, *Marchantia*, *Anthoceros*, *Sphagnum* and *Polytrichum*. Ecological and economic importance of bryophytes.

Unit 4: *Pteridophytes* (6 lectures)

General characteristics; Classification; Early land plants (*Cooksonia* and *Rhynia*).

Unit 5: *Type Studies- Pteridophytes* (14 lectures)

Classification, morphology, anatomy and reproduction of *Psilotum*, *Lycopodium*, *Selaginella*, *Equisetum*, *Pteris* and *Marsilea*. Apogamy and apospory, heterospory and seed habit, telome theory, stelar evolution; Ecological and economic importance.

Unit 6: *Gymnosperms*

(18 lectures)

General characteristics, classification (up to family), morphology, anatomy and reproduction of *Cycas*, *Pinus*, *Ginkgo* and *Gnetum*; Ecological and economic importance.

4.2 PRACTICAL

1. **Riccia** – Morphology of thallus.
2. **Marchantia**- Morphology of thallus and reproductive parts; vertical and transverse section of thallus; vertical section of Gemma cup, Antheridiophore and Archegoniophore. **Sphagnum**- Morphology of plant, whole mount of leaf.
3. **Sphagnum**- Morphology of plant; whole mount of leaf.
4. **Polytrichum**- Morphology of vegetative and reproductive parts; Transverse Section of rhizome, whole mount of leaf; Longitudinal Section through antheridial and archegonial heads; L.S. of capsule.
5. **Lycopodium**- Morphology of plant, whole mount of leaf; transverse section of stem; Longitudinal Section of strobilus; morphology of sporophyll.
6. **Selaginella**- Morphology of plant, whole mount of leaf with ligule, transverse section of stem and rhizophore; longitudinal section of strobilus; morphology of sporophyll.
7. **Equisetum**- Morphology of plant, transverse section of internode, longitudinal and transverse section of strobilus, whole mount of sporangiophore and spore.
8. **Pteris**- Morphology of plant, transverse section of rachis, vertical section of leaflets through sorus; whole mount of prothallus with sex (permanent slide).
9. **Marsilea**- Morphology of plant, transverse section of rhizome and petiole; vertical transverse and vertical longitudinal section of sporocarp.
10. **Cycas**- Morphology of plant; morphology and transverse section of coralloid roots; transverse section of leaflets; Longitudinal Section of male and female cone; morphology of microsporophyll and megasporophyll; Longitudinal section of ovule (permanent slide).
11. **Pinus**- Morphology of plant; transverse section of Needle; longitudinal section of male cone and female cone; whole mount of Microspores.
12. **Ginkgo**- Morphology of plants and reproductive structures (only photographs).
13. **Gnetum**- Morphology of plant; Morphology of male and female strobilus; vertical section of ovule (permanent slide).

Suggested Readings

1. Vashistha, P.C., Sinha, A.K., Kumar, A. (2010). Pteridophyta. S. Chand. Delhi, India.
2. Bhatnagar, S.P. & Moitra, A. (1996). Gymnosperms. New Age International (P) Ltd Publishers, New Delhi, India.
3. Parihar, N.S. (1991). An introduction to Embryophyta: Vol. I. Bryophyta. Central Book Depot. Allahabad.
4. Raven, P.H., Johnson, G.B., Losos, J.B., Singer, S.R. (2005). Biology. Tata McGraw Hill, Delhi.
5. Vanderpoorten, A. & Goffinet, B. (2009) Introduction to Bryophytes. Cambridge University Press.
6. Vashistha, B. R., Sinha, A.K. and Kumar, A. (Latest edition). Botany for Degree Students: Bryophyta. S. Chand Publishing 7361, Ram Nagar, Qutab Road, New Delhi-110055.
7. Vashistha, B. R., Sinha, A.K. and Kumar, A. (Latest edition). Botany for Degree Students: Gymnosperm. S. Chand Publishing 7361, Ram Nagar, Qutab Road, New Delhi-110055.
8. Vashistha, B. R., Sinha, A.K. and Kumar, A. (Latest edition). Botany for Degree Students: Pteridophytes. S. Chand Publishing 7361, Ram Nagar, Qutab Road, New Delhi-110055.

5

BOT-HC-3016

Morphology and Anatomy of Angiosperms

Total Lectures : 60 Credits : 6 (Theory - 4, Practical - 2)

5.1 THEORY

Unit 1: *Morphology* (4 Lectures)

Morphology of inflorescence, stamens and carpel, fruit; Telome theory, phyllode theory; Role of morphology in plant classification.

Unit 2: *Introduction and scope of plant Anatomy* (4 Lectures)

Application in systematics, forensics and pharmacognosy.

Unit 3: *Structure and Development of Plant Body* (6 Lectures)

Internal organization of plant body: The three tissue systems, types of cells and tissues. Development of plant body: Polarity, Cytodifferentiation and organogenesis during embryogenic development.

Unit 4: *Tissues* (11 Lectures)

Classification of tissues; Simple and complex tissues (no phylogeny); cytodifferentiation of tracheary elements and sieve elements; Pits and plasmodesmata; Wall ingrowths and transfer cells, adcrustation and incrustation, Ergastic substances. Hydathodes, cavities, lithocysts and laticifers.

Unit 5: Apical meristems**(14 Lectures)**

Evolution of concept of organization of shoot apex (Apical cell theory, Histogen theory, Tunica Corpus theory, continuing meristematic residue, cytohistological zonation); Types of vascular bundles; Structure of dicot and monocot stem. Origin, development, arrangement and diversity in size and shape of leaves; Structure of dicot and monocot leaf, Kranz anatomy. Organization of root apex (Apical cell theory, Histogen theory, Korper-Kappe theory); Quiescent centre; Root cap; Structure of dicot and monocot root; Endodermis, exodermis and origin of lateral root.

Unit 6: Vascular Cambium and Wood**(14 Lectures)**

Structure, function and seasonal activity of cambium; Secondary growth in root and stem. Axially and radially oriented elements; Types of rays and axial parenchyma; Cyclic aspects and reaction wood; Sapwood and heartwood; Ring and diffuse porous wood; Early and late wood, tyloses; Dendrochronology. Development and composition of periderm, rhytidome and lenticels.

Unit 7: Adaptive and Protective Systems**(7 Lectures)**

Epidermal tissue system, cuticle, epicuticular waxes, trichomes(uni- and multicellular, glandular and nonglandular, two examples of each), stomata (classification); Adcrustation and incrustation; Anatomical adaptations of xerophytes and hydrophytes.

5.2 PRACTICAL

1. Study of special types of inflorescence – Cyathium, Hypanthodium, Verticillaster, Hypanthium.
2. Study of special types of fruits- Superior fruits (*Dillenia*); Aggregate fruits (Custard apple, *Michelia*, Periwinkles, *Polyalthia*); Multiple fruits (Pine apple, Jack fruits).
3. Study of anatomical details through permanent slides/temporary stain mounts / macerations / museum specimens with the help of suitable examples.
4. Apical meristem of root, shoot and vascular cambium.
5. Epidermal system: cell types, stomata types; trichomes: non-glandular and glandular.
6. Root: monocot, dicot, secondary growth.
7. Stem: monocot, dicot - primary and secondary growth; periderm; lenticels.
8. Leaf: isobilateral, dorsiventral, C4 leaves (Kranz anatomy).
9. Adaptive Anatomy: xerophytes, hydrophytes.
10. Secretory tissues: cavities, lithocysts and laticifers.

Suggested Readings

1. Dickison, W.C. (2000). Integrative Plant Anatomy. Harcourt Academic Press, USA.
2. Fahn, A. (1974). Plant Anatomy. Pergmon Press, USA.
3. Mauseth, J.D. (1988). Plant Anatomy. The Benjammin/Cummings Publisher, USA.
4. Evert, R.F. (2006) Esau's Plant Anatomy: Meristems, Cells, and Tissues of the Plant Body: Their Structure, Function and Development. John Wiley and Sons, Inc.

6

BOT-HC-3026 Economic Botany

Total Lectures : 60 Credits : 6 (Theory - 4, Practical - 2)

6.1 THEORY

Unit 1: *Origin of Cultivated Plants* (6 lectures)

Centres of Origin, their importance with reference to Vavilov's work. Introductions, domestication and loss of crop genetic diversity; evolution of new crops/varieties, importance of germplasm diversity.

Unit 2: *Cereals* (6 lectures)

Wheat and Rice (origin, morphology, processing & uses); Brief account of millets.

Unit 3: *Legumes* (6 lectures)

Origin, morphology and uses of Chick pea, Pigeon pea and fodder legumes. Importance to man and ecosystem.

Unit 4: *Sources of sugars and starches* (4 lectures)

Morphology and processing of sugarcane, products and by-products of sugarcane industry. Potato – morphology, propagation & uses.

Unit 5: *Spices* (6 lectures)

Listing of important spices, their family and part used. Economic importance with special reference to fennel, saffron, clove and black pepper.

Unit 6: Beverages (4 lectures)

Tea, Coffee (morphology, processing & uses).

Unit 7: Sources of oils and fats (10 lectures)

General description, classification, extraction, their uses and health implications groundnut, coconut, linseed, soybean, mustard and coconut (Botanical name, family & uses). Essential Oils: General account, extraction methods, comparison with fatty oils & their uses.

Unit 8: Natural Rubber (3 lectures)

Para-rubber: tapping, processing and uses.

Unit 9: Drug-yielding plants (8 lectures)

Therapeutic and habit-forming drugs with special reference to *Cinchona*, *Digitalis*, *Papaver* and *Cannabis*; Tobacco (Morphology, processing, uses and health hazards).

Unit 10: Timber plants (3 Lectures)

General account with special reference to teak and pine.

Unit 11: Fibers (4 lectures)

Classification based on the origin of fibers; Cotton, Coir and Jute (morphology, extraction and uses).

6.2 PRACTICAL

1. **Cereals:** Study of useful parts: Rice/Bean (habit sketch, study of paddy and grain, starch grain, micro-chemical test).
2. **Legumes:** Bean, Groundnut, (habit, fruit, seed structure, micro-chemical tests).
3. **Beverages:** Tea (plant specimen, tea leaves), Coffee (plant specimen, beans).
4. **Sources of oils and fats:** Coconut and Mustard.
5. **Rubber:** Specimen, photograph/model of tapping, samples of rubber products.
6. **Test for alkaloids:** Neem, *Vinca rosea*.
7. **Fiber-yielding plants:** Cotton (specimen, whole mount of seed to show lint and fuzz; whole mount of fiber and test for cellulose), Jute (specimen, transverse section of stem, test for lignin).

Suggested Readings

1. Kochhar, S.L. (2012). *Economic Botany in Tropics*, MacMillan & Co. New Delhi, India.
2. Wickens, G.E. (2001). *Economic Botany: Principles & Practices*. Kluwer Academic Publishers, The Netherlands.
3. Chrispeels, M.J. and Sadava, D.E. 1994 *Plants, Genes and Agriculture*. Jones & Bartlett Publishers.

7

BOT-HC-3036

Genetics

Total Lectures : 60 Credits : 6 (Theory - 4, Practical - 2)

7.1 THEORY

Unit 1: *Mendelian genetics and its extension* (16 lectures)

Mendelism: History; Principles of inheritance; Chromosome theory of inheritance; Autosomes and sex chromosomes; Probability and pedigree analysis; Incomplete dominance and codominance; Multiple alleles, Lethal alleles, Epistasis, Pleiotropy, Recessive and Dominant traits, Penetrance and Expressivity, Numericals; Polygenic inheritance.

Unit 2: *Extrachromosomal Inheritance* (7 lectures)

Chloroplast inheritance: Variegation in Four o'clock plant; Mitochondrial inheritance in yeast; Maternal effects-shell coiling in snail; Kappa particles in *Paramecium*.

Unit 3: *Linkage, crossing over and chromosome mapping* (12 lectures)

Linkage and crossing over-Cytological basis of crossing over; Recombination frequency, two factor and three factor crosses; Interference and coincidence; Numericals based on gene mapping; Sex Linkage.

Unit 4: *Variation in chromosome number and structure* (8 lectures)

Deletion, Duplication, Inversion, Translocation, Position effect, Euploidy and Aneuploidy

Unit 5: *Gene mutations* (7 lectures)

Types of mutations; Molecular basis of Mutations; Mutagens – physical and chemical (Base analogs, deaminating, alkylating and intercalating agents); Detection of mutations: CIB method. Role of Transposons in mutation. DNA repair mechanisms.

Unit 6: *Fine structure of gene*

(4 lectures)

Classical vs molecular concepts of gene; Ciston, Racon, Muton, rII locus

Unit 7. *Population and Evolutionary Genetics*

(6 lectures)

Allele frequencies, Genotype frequencies, Hardy-Weinberg Law, role of natural selection, mutation, genetic drift. Genetic variation and Speciation.

7.2 PRACTICAL

1. Meiosis through temporary squash preparation.
2. Mendel's laws through seed ratios.
3. Chromosome mapping using point test cross data.
4. Incomplete dominance and gene interaction through seed ratios (9:7, 9:6:1, 13:3, 15:1, 12:3:1, 9:3:4).
5. Permanent Slides showing Translocation Ring, Photograph showing Laggards and Inversion Bridge.

Suggested Readings

1. Gardner, E.J., Simmons, M.J., Snustad, D.P. (1991). Principles of Genetics, John Wiley & sons, India. 8th edition.
2. Snustad, D.P. and Simmons, M.J. (2010). Principles of Genetics, John Wiley & Sons Inc., India. 5th edition.
3. Klug, W.S., Cummings, M.R., Spencer, C.A. (2009). Concepts of Genetics. Benjamin Cummings, U.S.A. 9th edition.
4. Griffiths, A.J.F., Wessler, S.R., Carroll, S.B., Doebley, J. (2010). Introduction to Genetic Analysis. W. H. Freeman and Co., U.S.A. 10th edition.

8

BOT-HC-4016 Molecular Biology

Total Lectures : 60 Credits : 6 (Theory - 4, Practical - 2)

8.1 THEORY

Unit 1: *Nucleic acids : Carriers of genetic information* (4 lectures)

Historical perspective; DNA as the carrier of genetic information (Griffith's, Hershey & Chase, Avery, McLeod & McCarty, Fraenkel-Conrat's experiment.

Unit 2: *The Structures of DNA and RNA / Genetic Material* (10 lectures)

DNA Structure: Miescher to Watson and Crick- historic perspective, DNA structure, Salient features of double helix, denaturation and renaturation, cot curves; Organization of DNA- Prokaryotes, Viruses, Eukaryotes. Organelle DNA -- mitochondria and chloroplast DNA. The Nucleosome Chromatin structure- Euchromatin, Heterochromatin- Constitutive and Facultative heterochromatin.

Unit 3: *The replication of DNA* (10 lectures)

Chemistry of DNA synthesis (Kornberg's discovery); General principles – bidirectional, semi-conservative and semi discontinuous replication, RNA priming; Various models of DNA replication, including rolling circle, θ (theta) mode of replication, replication of linear ds-DNA; Enzymes involved in DNA replication.

Unit 4: *Central dogma and genetic code* (2 lectures)

Key experiments establishing-The Central Dogma (Adaptor hypothesis and discovery of mRNA template), Genetic code (deciphering & salient features)

Unit 5: Transcription**(18 lectures)**

Transcription in prokaryotes and eukaryotes. Principles of transcriptional regulation; Prokaryotes: Regulation of lactose metabolism and tryptophan synthesis in *E.coli*. Eukaryotes: transcription factors, heat shock proteins, steroids and peptide hormones; Gene silencing.

Unit 6: Processing and modification of RNA**(8 lectures)**

Split genes-concept of introns and exons, removal of introns, spliceosome machinery, splicing pathways, group I and group II intron splicing, alternative splicing eukaryotic mRNA processing(5' cap, 3' poly A tail); Ribozymes; RNA editing and mRNA transport.

Unit 7: Translation**(8 lectures)**

Ribosome structure and assembly, mRNA; Charging of tRNA, aminoacyl tRNA synthetases; Various steps in protein synthesis, proteins involved in initiation, elongation and termination of polypeptides; Fidelity of translation; Inhibitors of protein synthesis; Post-translational modifications of proteins.

8.2 PRACTICAL

1. DNA isolation from any plant material.
2. DNA estimation by diphenylamine reagent/UV Spectrophotometry (Demonstration).
3. Study of DNA replication mechanisms through photographs (Rolling circle, Theta replication and semi-discontinuous replication).
4. Study of structures of prokaryotic RNA polymerase and eukaryotic RNA polymerase II through photographs.
5. Study of the following through photographs: Assembly of Spliceosome machinery; Splicing mechanism in group I & group II introns; Ribozyme and Alternative splicing.

Suggested Readings

1. Watson J.D., Baker, T.A., Bell, S.P., Gann, A., Levine, M., Losick, R. (2007). Molecular Biology of the Gene, Pearson Benjamin Cummings, CSHL Press, New York, U.S.A. 6th edition.
2. Snustad, D.P. and Simmons, M.J. (2010). Principles of Genetics. John Wiley and Sons Inc., U.S.A. 5th edition.
3. Klug, W.S., Cummings, M.R., Spencer, C.A. (2009). Concepts of Genetics. Benjamin Cummings. U.S.A. 9th edition.
4. Russell, P. J. (2010). i-Genetics- A Molecular Approach. Benjamin Cummings, U.S.A. 3rd edition.
5. Griffiths, A.J.F., Wessler, S.R., Carroll, S.B., Doebley, J. (2010). Introduction to Genetic Analysis. W. H. Freeman and Co., U.S.A. 10th edition.

9

BOT-HC-4026

Plant Ecology and Phytogeography

Total Lectures : 60 Credits : 6 (Theory - 4, Practical - 2)

9.1 THEORY

Unit 1 : *Introduction* (4 lectures)

Basic concepts; Levels of organization. Inter-relationships between the living world and the environment, the components and dynamism, homeostasis.

Unit 2 : *Soil* (8 lectures)

Importance; Origin; Formation; Composition; Physical; Chemical and Biological components; Soil profile; Role of climate in soil development.

Unit 3 : *Water* (4 lectures)

Importance: States of water in the environment; Atmospheric moisture; Precipitation types (rain, fog, snow, hail, dew); Hydrological Cycle; Water in soil; Water table.

Unit 4 : *Adaptation of plants to various environmental factors* (6 lectures)

Light, temperature, wind and fire

Unit 5 : *Biotic interactions* (2 lectures)

Trophic organization, basic source of energy, autotrophy, heterotrophy; symbiosis, commensalism, parasitism; food chains and webs; ecological pyramids; biomass, standing crop.

Unit 6 : *Population ecology* (4 lectures)

Population characteristics, Growth curve, population regulation, r and k selection.
Ecological speciation: Allopatric/ Sympatric and Parapatric speciation.

Unit 7 : *Plant communities* (8 lectures)

Concept of ecological amplitude; Habitat and niche; Characters: analytical and synthetic;
Ecotone and edge effect; Dynamics: succession – processes, types; climax concepts.

Unit 8 : *Ecosystems* (4 lectures)

Structure; Processes; Trophic organisation; Food chains and Food webs; Ecological pyramids.

Unit 9 : *Functional aspects of ecosystem* (8 lectures)

Principles and models of energy flow; Production and productivity; Ecological efficiencies;
Biogeochemical cycles; Cycling of Carbon, Nitrogen and Phosphorus.

Unit 10 : *Phytogeography* (12 lectures)

Principles; Continental drift; Theory of tolerance; Endemism; Brief description of major terrestrial biomes (one each from tropical, temperate & tundra); Phytogeographical division of India; Vegetation types of NE India with special reference to Assam.

9.2 PRACTICAL

1. Study of instruments used to measure microclimatic variables: Soil thermometer, maximum and minimum thermometer, anemometer, psychrometer/hygrometer, rain gauge and lux meter.
2. Determination of pH of various soil and water samples using pH meter.
3. Analysis for carbonates, chlorides, nitrates, sulphates, organic matter and base deficiency from two soil samples by rapid field tests.
4. Determination of organic matter of different soil samples by Walkley & Black rapid titration method.
5. Determination of dissolved oxygen of water samples from polluted and unpolluted sources.
6. (a). Study of morphological adaptations of hydrophytes and xerophytes (four each).

- (b). Study of biotic interactions of the following: Stem parasite (*Cuscuta*), Root parasite (*Orobancha*) Epiphytes, Predation (Insectivorous plants).
7. Determination of minimal quadrat size for the study of herbaceous vegetation in the college campus, by species area curve method (species to be listed).
 8. Quantitative analysis of herbaceous vegetation in the college campus for frequency and comparison with Raunkiaer's frequency distribution law.
 9. Quantitative analysis of herbaceous vegetation for density and abundance in the college campus.
 10. Field visit to familiarise students with ecology of different sites.

Suggested Readings

1. Odum, E.P. (2005). Fundamentals of ecology. Cengage Learning India Pvt. Ltd., New Delhi. 5th edition.
2. Singh, J.S., Singh, S.P., Gupta, S. (2006). Ecology Environment and Resource Conservation. Anamaya Publications, New Delhi, India.
3. Sharma, P.D. (2010). Ecology and Environment. Rastogi Publications, Meerut, India. 8th edition.
4. Wilkinson, D.M. (2007). Fundamental Processes in Ecology: An Earth Systems Approach. Oxford University Press. U.S.A.
5. Kormondy, E.J. (1996). Concepts of ecology. PHI Learning Pvt. Ltd., Delhi, India. 4th edition.
6. Smith and Smith(2012): Elements of Ecology. Pearson Publisher (Sixth edition).
7. Bhattacharya, K., Ghosh, A.K. and Hait, G. (2017). A text Book of Botany (Ecology, Environmental Biology, Economic Botany and Pharmacognosy). New Central Book Agency (P) Ltd.
8. Ambasht and Ambasht (2002): A text book of Plant Ecology. CBS publisher and Distributors.
9. Agarwal, A.K. and Deo, P.P. (2006). Plant Ecology. Agrobios (India)
10. William D Bowmen, Sally D Hacker and Michael L. Cain (2018) Ecology, Oxford University Press
11. Verma, P.S. and Agarwal V. K.(2003) Environmental Biology-Principles of Ecology. S Chand & Company Ltd, Ramnagar, New Delhi-110055.

10

BOT-HC-4036 Plant Systematics

Total Lectures : 60 Credits : 6 (Theory - 4, Practical - 2)

10.1 THEORY

Unit 1 : *Significance of Plant systematics* (8 lectures)

Introduction to systematics; Plant identification, Classification, Nomenclature. Evidences from palynology, cytology, phytochemistry and molecular data. Functions and importance of Herbarium; Important herbaria and botanical gardens of the world and India; Virtual herbarium; E-flora; Concept of taxa (family, genus, species); Categories and taxonomic hierarchy.

Unit 2 : *Botanical nomenclature* (10 lectures)

Principles and rules (ICN); Ranks and names; Typification, author citation, Effective and valid publication, rejection of names, principle of priority and its limitations; Names of hybrids.

Unit 3 : *Systems of classification* (12 lectures)

Major contributions of Theophrastus, Bauhin, Tournefort, Linnaeus, Adanson, de Candolle, Bessey, Hutchinson, Takhtajan and Cronquist; Classification systems of Bentham and Hooker (upto series) and Engler and Prantl (upto series); Brief reference of Angiosperm Phylogeny Group (APG) classification.

Unit 4 : *Numerical taxonomy and cladistics* (10 lectures)

Characters; Variations; OTUs, character weighting and coding; Cluster analysis; Phenograms, cladograms (definitions and differences).

Unit 5 : Phylogeny of Angiosperms**(12 lectures)**

Terms and concepts (primitive and advanced, homology and analogy, parallelism and convergence, monophyly, Paraphyly, polyphyly and clades). Origin and evolution of angiosperms; Co-evolution of angiosperms and animals; Methods of illustrating evolutionary relationship (phylogenetic tree, cladogram).

Unit 6 : Angiospermic Families**(8 lectures)**

Detail study of the following families:

Magnoliaceae, Fabaceae, Asteraceae, Solanaceae, Acanthaceae, Lamiaceae, Euphorbiaceae, Orchidaceae, Musaceae, Zingiberaceae, Poaceae.

10.2 PRACTICAL

1. Study of vegetative and floral characters of locally available angiospermic plants belonging to the following families (Description, V.S. flower, section of ovary, floral diagram/s, floral formula/e and systematic position according to Bentham & Hooker's system of classification): Fabaceae, Solanaceae, Acanthaceae, Lamiaceae, Euphorbiaceae, Musaceae, Orchidaceae.
2. Field visit to familiarise students with vegetation of an area and identification of plant species / Visit to Academic or Research Institutions.
3. Mounting of a properly dried and pressed specimen of any wild plant with herbarium label (to be submitted in the record book).

Suggested Readings

1. Singh, (2012). *Plant Systematics: Theory and Practice* Oxford & IBH Pvt. Ltd., New Delhi. 3rd edition.
2. Jeffrey, C. (1982). *An Introduction to Plant Taxonomy*. Cambridge University Press, Cambridge.
3. Judd, W.S., Campbell, C.S., Kellogg, E.A., Stevens, P.F. (2002). *Plant Systematics-A Phylogenetic Approach*. Sinauer Associates Inc., U.S.A. 2nd edition.
4. Maheshwari, J.K. (1963). *Flora of Delhi*. CSIR, New Delhi.
5. Radford, A.E. (1986). *Fundamentals of Plant Systematics*. Harper and Row, New York.
6. Pandey, B.P. (2018). *A Textbook of Botany: Angiosperm*. S. Chand Publishing, 7361, Ram Nagar, Qutab Road, New Delhi-110055.

11

BOT-HC-5016

Reproductive Biology of Angiosperms

Total Lectures : 60 Credits : 6 (Theory - 4, Practical - 2)

11.1 THEORY

Unit 1 : *Introduction* (4 lectures)

History (contributions of G.B. Amici, W. Hofmeister, E. Strasburger, S.G. Nawaschin, P. Maheshwari, B.M. Johri, W.A. Jensen, J. Heslop-Harrison) and scope.

Unit 2 : *Reproductive development* (6 lectures)

Induction of flowering; flower as a modified determinate shoot. Flower development: genetic and molecular aspects.

Unit 3 : *Anther and pollen biology* (10 lectures)

Anther wall: Structure and functions, microsporogenesis, callose deposition and its significance. Microgametogenesis; Pollen wall structure, MGU (male germ unit) structure, NPC system; Palynology and scope (a brief account); Pollen wall proteins; Pollen viability, storage and germination; Abnormal features: Pseudomonads, polyads, massulae, pollinia.

Unit 4 : *Ovule* (10 lectures)

Structure; Types; Special structures—endothelium, obturator, aril, caruncle and hypostase; Female gametophyte— megasporogenesis (monosporic, bisporic and tetrasporic) and megagametogenesis (details of *Polygonum* type); Organization and ultrastructure of mature embryo sac.

Unit 4 : Pollination and fertilization (6 lectures)

Pollination types and significance; adaptations; structure of stigma and style; path of pollen tube in pistil; double fertilization.

Unit 5 : Self incompatibility (10 lectures)

Basic concepts (interspecific, intraspecific, homomorphic, heteromorphic, GSI and SSD); Methods to overcome self- incompatibility: mixed pollination, bud pollination, stub pollination; Intra-ovarian and *in vitro* pollination; Modification of stigma surface, parasexual hybridization; Cybrids, *in vitro* fertilization.

Unit 6 : Embryo, Endosperm and Seed (8 lectures)

Structure and types; General pattern of development of dicot and monocot embryo and endosperm; Suspensor: structure and functions; Embryo-endosperm relationship; Nutrition of embryo; Unusual features; Embryo development in *Paeonia*. Seed structure, importance and dispersal mechanisms

Units 7 : Polyembryony and apomixis (6 lectures)

Introduction; Classification; Causes and applications.

11.2 PRACTICAL

1. **Anther:** Wall and its ontogeny; Tapetum (amoeboid and glandular); MMC, spore tetrads, uninucleate, bicelled and dehisced anther stages through slides/micrographs, male germ unit (MGU) through photographs and schematic representation.
3. **Pollen grains:** Fresh and acetolyzed showing ornamentation and aperture, pseudomonads, polyads, pollinia (slides/photographs, fresh material), ultrastructure of pollen wall (micrograph); Pollen viability: Tetrazolium test. germination: Calculation of percentage germination in different media using hanging drop method.
4. **Ovule:** Types-anatropous, orthotropous, amphitropous/campylotropous, circinotropous, unitegmic, bitegmic; Tenuinucellate and crassinucellate; Special structures: Endothelium, obturator, hypostase, caruncle and aril (permanent slides/specimens/photographs).
5. **Female gametophyte through permanent slides/ photographs:** Types, ultrastructure of mature egg apparatus.
6. Intra-ovarian pollination; Test tube pollination through photographs.
7. **Endosperm:** Dissections of developing seeds for endosperm with free-nuclear haustoria.
8. **Embryogenesis:** Study of development of dicot embryo through permanent slides; dissection of developing seeds for embryos at various developmental stages.

Suggested Readings

1. Bhojwani, S.S. and Bhatnagar, S.P. (2011). The Embryology of Angiosperms, Vikas Publishing House. Delhi. 5th edition.
2. Shivanna, K.R. (2003). Pollen Biology and Biotechnology. Oxford and IBH Publishing Co. Pvt. Ltd. Delhi.
3. Raghavan, V. (2000). Developmental Biology of Flowering plants, Springer, Netherlands.
4. Johri, B.M. 1 (1984). Embryology of Angiosperms, Springer-Verlag, Netherlands.
5. Bhattacharya, Majimdar and Bhattacharya. (2012). A Textbook of Palynology: Basic and Applied. New Central Book Agency (P) Ltd. Guwahati.

12

BOT-HC-5026 Plant Physiology

Total Lectures : 60 Credits : 6 (Theory - 4, Practical - 2)

12.1 THEORY

Unit 1 : *Plant-water relations* (10 lectures)

Water Potential and its components, water absorption by roots, aquaporins, pathway of water movement, symplast, apoplast, transmembrane pathways, root pressure, guttation. Ascent of sap– cohesion-tension theory. Transpiration and factors affecting transpiration, antitranspirants, mechanism of stomatal movement. Plant response to water stress.

Unit 2 : *Mineral nutrition* (8 lectures)

Essential and beneficial elements, macro and micronutrients, methods of study and use of nutrient solutions, criteria for essentiality, mineral deficiency symptoms, roles of essential elements, chelating agents, Ion antagonism and toxicity.

Unit 3 : *Nutrient Uptake* (8 lectures)

Soil as a nutrient reservoir, transport of ions across cell membrane, passive absorption, electrochemical gradient, facilitated diffusion, active absorption, role of ATP, carrier systems, proton ATPase pump and ion flux, uniport, co-transport, symport, antiport.

Unit 4 : *Translocation in the phloem* (8 lectures)

Experimental evidence in support of phloem as the site of sugar translocation. Pressure–Flow Model; Phloem loading and unloading; Source–sink relationship.

Unit 5 : *Plant growth regulators* (14 lectures)

Discovery, chemical nature (basic structure), bioassay and physiological roles of Auxin, Gibberellins, Cytokinin, Abscisic acid, Ethylene, Brassinosteroids and Jasmonic acid.

Unit 6 : *Physiology of flowering* (6 lectures)

Photoperiodism, flowering stimulus, florigen concept, vernalization, seed dormancy.

Unit 7 : *Phytochrome, cryptochromes and phototropins* (6 lectures)

Discovery, chemical nature, role in photomorphogenesis, low energy responses (LER) and high irradiance responses (HIR), mode of action.

12.2 PRACTICAL

1. Determination of osmotic potential of plant cell sap by plasmolytic method.
2. Determination of water potential of given tissue (potato tuber) by weight method.
3. Study of the effect of light on the rate of transpiration in excised twig/leaf.
4. Calculation of stomatal index and stomatal frequency from the two surfaces of leaves of a mesophyte and xerophyte.
5. To study the effect of different concentrations of IAA on Gram/Pea/Moong root (IAA Bioassay).
6. To study the induction of amylase activity in germinating Maize/Bean grains.
7. Effect of carbon dioxide concentration on the rate of photosynthesis.

Demonstration experiments

1. To demonstrate suction due to transpiration.
2. Fruit ripening/Rooting from cuttings (Demonstration).

Suggested Readings

1. Hopkins, W.G. and Huner, A. (2008). Introduction to Plant Physiology. John Wiley and Sons. U.S.A. 4th edition.
2. Taiz, L., Zeiger, E., Møller, I.M. and Murphy, A (2015). Plant Physiology and Development. Sinauer Associates Inc. USA. 6th edition.
3. Bajracharya D. (1999). Experiments in Plant Physiology-A Laboratory Manual. Narosa Publishing House, New Delhi.

Semester-VI

13

BOT-HC-6016 Plant Metabolism

Total Lectures : 60 Credits : 6 (Theory - 4, Practical - 2)

13.1 THEORY

Unit 1 : *Concept of metabolism* (8 lectures)

Introduction, anabolic and catabolic pathways, regulation of metabolism, role of regulatory enzymes; classification, nomenclature and importance of enzyme; concept of coenzyme, apoenzyme and prosthetic group; enzyme inhibition (allosteric, covalent modulation and Isozymes).

Unit 2 : *Carbon assimilation* (12 lectures)

Historical background, photosynthetic pigments, role of photosynthetic pigments (chlorophylls and accessory pigments), antenna molecules and reaction centres, photochemical reactions, photosynthetic electron transport, PSI, PSII, Q cycle, CO₂ reduction, photorespiration, C₄-pathways; Crassulacean acid metabolism; Factors affecting CO₂ reduction.

Unit 3 : *Carbohydrate metabolism* (2 lectures)

Synthesis and catabolism of sucrose and starch.

Unit 4 : *Carbon Oxidation* (10 lectures)

Glycolysis, fate of pyruvate, regulation of glycolysis, oxidative pentose phosphate pathway, oxidative decarboxylation of pyruvate, regulation of PDH, NADH shuttle; TCA cycle, amphibolic role, anaplerotic reactions, regulation of the cycle, mitochondrial electron transport, oxidative phosphorylation, cyanide-resistant respiration, factors affecting respiration.

Unit 5 : *ATP-Synthesis* (8 lectures)

Mechanism of ATP synthesis, substrate level phosphorylation, chemiosmotic mechanism

(oxidative and photophosphorylation), ATP synthase, Boyers conformational model, Racker's experiment, Jagendorf's experiment; role of uncouplers.

Unit 6 : *Lipid metabolism* (8 lectures)

Synthesis and breakdown of triglycerides, β -oxidation, glyoxylate cycle, gluconeogenesis and its role in mobilisation of lipids during seed germination, α oxidation.

Unit 7: *Nitrogen metabolism* (8 lectures)

Nitrate assimilation, biological nitrogen fixation (examples of legumes and non-legumes); Physiology and biochemistry of nitrogen fixation; Ammonia assimilation and transamination.

Unit 8 : *Mechanisms of signal transduction* (4 lectures)

Receptor-ligand interactions; Second messenger concept, Calcium calmodulin, MAP kinase cascade.

13.2 PRACTICAL

1. Chemical separation of photosynthetic pigments.
2. Estimation of sugar content by Somogyi method.
3. Determination of TAN in plant materials.
4. To compare the rate of respiration in different parts of a plant (Demonstration).
5. Estimation of protein in a sample by Biuret method.
6. Separation of amino acids by paper chromatography.
7. Demonstration of Thin layer chromatography (TLC).
8. Quantitative analysis of absorption spectrum of photosynthetic pigments.

Suggested Readings

1. Hopkins, W.G. and Huner, A. (2008). Introduction to Plant Physiology. John Wiley and Sons. U.S.A. 4th edition.
2. Taiz, L., Zeiger, E., Møller, I.M. and Murphy, A (2015). Plant Physiology and Development. Sinauer Associates Inc. USA. 6th edition.
3. Harborne, J.B. (1973). Phytochemical Methods. John Wiley & Sons. New York.

14

BOT-HC-6026 Plant Biotechnology

Total Lectures : 60 Credits : 6 (Theory - 4, Practical - 2)

14.1 THEORY

Unit 1 : *Plant Tissue Culture*

(16 lectures)

Historical perspective; Composition of media; Nutrient and hormone requirements (role of vitamins and hormones); Totipotency; Organogenesis; Embryogenesis (somatic and zygotic); Protoplast isolation, culture and fusion; Tissue culture applications (micropropagation, androgenesis, virus elimination, secondary metabolite production, haploids, triploids and hybrids; Cryopreservation; Germplasm Conservation).

Unit 2 : *Recombinant DNA technology*

(12 lectures)

Restriction Endonucleases (History, Types I-IV, biological role and application); Restriction Mapping (Linear and Circular); Cloning Vectors: Prokaryotic (pUC 18 and pUC19, pBR322, Ti plasmid, BAC); Lambda phage, M13 phagemid, Cosmid, Shuttle vector; Eukaryotic Vectors (YAC).

Unit 3 : *Gene Cloning*

(10 lectures)

Recombinant DNA, Bacterial Transformation and selection of recombinant clones, PCR-mediated gene cloning; Gene Construct; construction of genomic and cDNA libraries, screening DNA libraries to obtain gene of interest by genetic selection; complementation, colony hybridization; PCR

Unit 4 : Methods of gene transfer**(8 lectures)**

Agrobacterium-mediated, Direct gene transfer by Electroporation, Microinjection, Microprojectile bombardment; Selection of transgenics– selectable marker and reporter genes (Luciferase, GUS, GFP).

Unit 5 : Applications of Biotechnology**(14 lectures)**

Pest resistant (Bt-cotton); herbicide resistant plants (RoundUp Ready soybean); Transgenic crops with improved quality traits (Flavr Savr tomato, Golden rice); Improved horticultural varieties (Moondust carnations); Role of transgenics in bioremediation (Superbug); edible vaccines; Industrial enzymes (Aspergillase, Protease, Lipase); Genetically Engineered Products– Human Growth Hormone; Humulin; Biosafety concerns.

14.2 PRACTICAL

1. (a) Preparation of MS medium.
(b) Demonstration of *in vitro* sterilization and inoculation methods using leaf and nodal explants of tobacco, *Datura*, *Brassica* etc.
2. Study of anther, embryo and endosperm culture, micropropagation, somatic embryogenesis & artificial seeds through photographs.
3. Isolation of protoplasts.
4. Construction of restriction map of circular and linear DNA from the data provided.
5. Study of methods of gene transfer through photographs: *Agrobacterium*-mediated, direct gene transfer by electroporation, microinjection, microprojectile bombardment.
6. Study of steps of genetic engineering for production of Bt cotton, Golden rice, Flavr Savr tomato through photographs.
7. Isolation of plasmid DNA.
8. Restriction digestion and gel electrophoresis of plasmid DNA.

Suggested Readings

1. Bhojwani, S.S. and Razdan, M.K., (1996). Plant Tissue Culture: Theory and Practice. Elsevier Science Amsterdam. The Netherlands.
2. Glick, B.R., Pasternak, J.J. (2003). Molecular Biotechnology- Principles and Applications of recombinant DNA. ASM Press, Washington.
3. Bhojwani, S.S. and Bhatnagar, S.P. (2011). The Embryology of Angiosperms. Vikas Publication House Pvt. Ltd., New Delhi. 5th edition.
4. Snustad, D.P. and Simmons, M.J. (2010). Principles of Genetics. John Wiley and Sons, U.K. 5th edition.
5. Stewart, C.N. Jr. (2008). Plant Biotechnology & Genetics: Principles, Techniques and Applications. John Wiley & Sons Inc. U.S.A.

Discipline Specific Elective

1

BOT-HE-5016 Natural Resource Management

Total Lectures : 60 Credits : 6 (Theory - 4, Practical - 2)

1.1 THEORY

Unit 1 : *Natural resources*

Definition and types.

(2 lectures)

Unit 2 : *Sustainable utilization*

Concept, approaches (economic, ecological and socio-cultural).

(8 lectures)

Unit 3 : *Land*

Utilization (agricultural, pastoral, horticultural, silvicultural); Soil degradation and management.

(8 lectures)

Unit 4 : *Water*

Fresh water (rivers, lakes, groundwater, aquifers, watershed); Marine; Estuarine; Wetlands; Threats and management strategies.

(8 lectures)

Unit 5 : *Biological Resources*

Biodiversity-definition and types; Significance; Threats; Management strategies; Bio-prospecting; IPR; CBD; National Biodiversity Action Plan).

(10 lectures)

Unit 6 : *Forests*

Definition, Cover and its significance (with special reference to India); Major and minor forestproducts; Depletion; Management.

(6 lectures)

Unit 7 : *Energy*

Renewable and non-renewable sources of energy.

(6 lectures)

Unit 8 : *Contemporary practices in resource management*

(8 lectures)

EIA, GIS, Participatory Resource Appraisal, Ecological Footprint with emphasis on carbon footprint, Resource Accounting; Waste management.

Unit 9 : *National and international efforts in resource management and conservation*

(4 lectures)

1.2 PRACTICAL

1. Estimation of solid waste generated by a domestic system (biodegradable and non-biodegradable) and its impact on land degradation.
2. Collection of data on forest cover of specific area.
3. Measurement of dominance of woody species by DBH (diameter at breast height) method.
4. Calculation and analysis of ecological footprint.
5. Uses of GPS and GIS (Mapping of an area).

Suggested Readings

1. Vasudevan, N. (2006). Essentials of Environmental Science. Narosa Publishing House, New Delhi.
2. Singh, J. S., Singh, S.P. and Gupta, S. (2006). Ecology, Environment and Resource Conservation. Anamaya Publications, New Delhi.
3. Rogers, P.P., Jalal, K.F. and Boyd, J.A. (2008). An Introduction to Sustainable Development. Prentice Hall of India Private Limited, New Delhi.

2

BOT-HE-5026

Horticultural Practices and Post-Harvest Technology

Total Lectures : 60 Credits : 6 (Theory - 4, Practical - 2)

2.1 THEORY

Unit 1 : *Introduction*

(4 lectures)

Scope and importance, Branches of horticulture; Role in rural economy and employment generation; Importance in food and nutritional security; Urban horticulture and ecotourism.

Unit 2 : *Ornamental plants*

(4 lectures)

Types, classification (annuals, perennials, climbers and trees); Identification and salient features of some ornamental plants [rose, marigold, gladiolus, carnations, orchids, poppies, gerberas, tuberose, sages, cacti and succulents (opuntia, agave and spurges)] Ornamental flowering trees (Indian laburnum, gulmohar, Jacaranda, Lagerstroemia, fishtail and areca palms, semul, coraltree).

Unit 3 : *Fruit and vegetable crops*

(4 lectures)

Production, origin and distribution; Description of plants and their economic products; Management and marketing of vegetable and fruit crops; Identification of some fruits and vegetable varieties (citrus, banana, mango, chillies and cucurbits).

Unit 4 : *Horticultural techniques*

(8 lectures)

Application of manure, fertilizers, nutrients and PGRs; Weed control; Biofertilizers, biopesticides; Irrigation methods (drip irrigation, surface irrigation, furrow and border irrigation); Hydroponics; Propagation Methods: asexual (grafting, cutting, layering, budding), sexual (seed propagation), Scope and limitations.

Unit 5 : *Landscaping and garden design*

(6 lectures)

Planning and layout (parks and avenues); gardening traditions - Ancient Indian, European, Mughal and Japanese Gardens; Urban forestry; policies and practices.

Unit 6 : Floriculture**(6 lectures)**

Cut flowers, bonsai, commerce (market demand and supply); Importance of flower shows and exhibitions.

Unit 7 : Post-harvest technology**(10 lectures)**

Importance of post harvest technology in horticultural crops; Evaluation of quality traits; Harvesting and handling of fruits, vegetables and cut flowers; Principles, methods of preservation and processing; Methods of minimizing losses during storage and transportation; Food irradiation - advantages and disadvantages; food safety.

Unit 8 : Disease control and management**(8 lectures)**

Field and post-harvest diseases; Identification of deficiency symptoms; remedial measures and nutritional management practices; Crop sanitation; IPM strategies (genetic, biological and chemical methods for pest control); Quarantine practices; Identification of common diseases and pests of ornamentals, fruits and vegetable crops.

Unit 9 : Horticultural crops - conservation and management**(10 lectures)**

Documentation and conservation of germplasm; Role of micropropagation and tissue culture techniques; Varieties and cultivars of various horticultural crops; IPR issues; National, international and professional societies and sources of information on horticulture.

Unit 10 : Field trip

Field visits to gardens, standing crop sites, nurseries, vegetable gardens and horticultural fields at suitable locations.

Suggested Readings

1. Singh, D. & Manivannan, S. (2009). Genetic Resources of Horticultural Crops. Ridhi International, Delhi, India.
2. Swaminathan, M.S. and Kochhar, S.L. (2007). Groves of Beauty and Plenty: An Atlas of Major Flowering Trees in India. Macmillan Publishers, India.
3. NIIR Board (2005). Cultivation of Fruits, Vegetables and Floriculture. National Institute of Industrial Research Board, Delhi.
4. Kader, A.A. (2002). Post-Harvest Technology of Horticultural Crops. UCANR Publications, USA.
5. Capon, B. (2010). Botany for Gardeners. 3rd Edition. Timber Press, Portland, Oregon.

3

BOT-HE-6016

Industrial and Environmental Microbiology

Total Lectures : 60 Credits : 6 (Theory - 4, Practical - 2)

3.1 THEORY

Unit 1 : *Scope of microbes in industry and environment* (6 lectures)

Unit 2 : *Bioreactors/Fermenters and fermentation processes* (12 lectures)

Solid-state and liquid-state (stationary and submerged) fermentations; Batch and continuous fermentations. Components of a typical bioreactor, Types of bioreactors-laboratory, pilotscale and production fermenters; Constantly stirred tank fermenter, tower fermenter, fixed bed and fluidized bed bioreactors and air-lift fermenter.

A visit to any educational institute/ industry to see an industrial fermenter, and other downstream processing operations.

Unit 3: *Microbial production of industrial products* (12 lectures)

Microorganisms involved, media, fermentation conditions, downstream processing and uses; Filtration, centrifugation, cell disruption, solvent extraction, precipitation and ultrafiltration, lyophilization, spray drying; Hands on microbial fermentations for the production and estimation (qualitative and quantitative) of Enzyme: amylase or lipase activity, Organic acid (citric acid or glutamic acid), alcohol (Ethanol) and antibiotic (Penicillin)

Unit 4: *Microbial enzymes of industrial interest and enzyme immobilization* (8 lectures)

Microorganisms for industrial applications and hands on screening microorganisms for casein hydrolysis; starch hydrolysis; cellulose hydrolysis. Methods of immobilization, advantages and applications of immobilization, large scale applications of immobilized enzymes (glucose isomerase and penicillin acylase).

Unit 5: Microbes and quality of environment. (6 lectures)

Distribution of microbes in air; Isolation of microorganisms from soil, air and water.

Unit 6: Microbial flora of water. (8 lectures)

Water pollution, role of microbes in sewage and domestic waste water treatment systems. Determination of BOD, COD, TDS and TOC of water samples; Microorganisms as indicators of water quality, check coliform and fecal coliform in water samples.

Unit 7: Microbes in agriculture and remediation of contaminated soils. (8 lectures)

Biological fixation; Mycorrhizae; Bioremediation of contaminated soils. Isolation of root nodulating bacteria, arbuscular mycorrhizal colonization in plant roots.

3.2 PRACTICAL

1. Principles and functioning of instruments in microbiology laboratory
2. Hands on sterilization techniques and preparation of culture media.
3. Pure culture techniques.

Suggested Readings

1. Pelzar, M.J. Jr., Chen E.C. S., Krieg, N.R. (2010). Microbiology: An application based approach. Tata McGraw Hill Education Pvt. Ltd., Delhi.
2. Tortora, G.J., Funke, B.R., Case. C.L. (2007). Microbiology. Pearson Benjamin Cummings, San Francisco, U.S.A. 9th edition.

4

BOT-HE-6026

Analytical Techniques in Plant Sciences

Total Lectures : 60 Credits : 6 (Theory - 4, Practical - 2)

4.1 THEORY

Unit 1 : *Imaging and related techniques* (15 lectures)

Principles of microscopy; Light microscopy; Fluorescence microscopy; Confocal microscopy; Use of fluorochromes: (a) Flow cytometry (FACS); (b) Applications of fluorescence microscopy: Chromosome banding, FISH, chromosome painting; Transmission and Scanning electron microscopy – sample preparation for electron microscopy, cryofixation, negative staining, shadow casting, freeze fracture, freeze etching.

Unit 2 : *Cell fractionation* (8 lectures)

Centrifugation: Differential and density gradient centrifugation, sucrose density gradient, CsCl₂ gradient, analytical centrifugation, ultracentrifugation, marker enzymes.

Unit 3 : *Radioisotopes* (4 lectures)

Use in biological research, auto-radiography, pulse chase experiment.

Unit 4 : *Spectrophotometry* (4 lectures)

Principle and its application in biological research.

Unit 5 : *Chromatography* (8 lectures)

Principle; Paper chromatography; Column chromatography, TLC, GLC, HPLC, Ion-exchange chromatography; Molecular sieve chromatography; Affinity chromatography.

Unit 6 : *Characterization of proteins and nucleic acids* (6 lectures)

Mass spectrometry; X-ray diffraction; X-ray crystallography; Characterization of proteins and nucleic acids; Electrophoresis: AGE, PAGE, SDS-PAGE

Unit 7 : *Biostatistics* (15 lectures)

Statistics, data, population, samples, parameters; Representation of Data: Tabular, Graphical; Measures of central tendency: Arithmetic mean, mode, median; Measures of dispersion: Range, mean deviation, variation, standard deviation; Chi-square test for goodness of fit.

4.2 PRACTICAL

1. Study of Blotting techniques: Southern, Northern and Western, DNA fingerprinting, DNA sequencing, PCR through photographs.
2. Demonstration of ELISA.
3. To separate sugars by thin layer chromatography.
4. Isolation of chloroplasts by differential centrifugation.
5. To separate chloroplast pigments by column chromatography.
6. To estimate protein concentration through Lowry's methods.
7. To separate proteins using PAGE.
8. To separation DNA (marker) using AGE.
9. Study of different microscopic techniques using photographs/micrographs (freeze fracture, freeze etching, negative staining, positive staining, fluorescence and FISH).

Suggested Readings

1. Plummer, D.T. (1996). An Introduction to Practical Biochemistry. Tata McGraw-Hill Publishing Co. Ltd. New Delhi. 3rd edition.
2. Ruzin, S.E. (1999). Plant Microtechnique and Microscopy, Oxford University Press, New York. U.S.A.
3. Ausubel, F., Brent, R., Kingston, R. E., Moore, D.D., Seidman, J.G., Smith, J.A., Struhl, K. (1995). Short Protocols in Molecular Biology. John Wiley & Sons. 3rd edition.
4. Zar, J.H. (2012). Biostatistical Analysis. Pearson Publication. U.S.A. 4th edition.

5

BOT-HE-6036
Project Work/Dissertation

Credits : 6

Generic Elective Courses

1

BOT-HG-1016

Biodiversity (Microbes, Algae, Fungi and Archegoniate)

Total Lectures : 60 Credits : 6 (Theory - 4, Practical - 2)

1.1 THEORY

Unit 1 : *Microbes* (10 lectures)

Viruses – Discovery, general structure, replication (general account), DNA virus (T-phage); Lytic and lysogenic cycle, RNA virus (TMV); Economic importance; Bacteria – Discovery, General characteristics and cell structure; Reproduction – vegetative, asexual and recombination (conjugation, transformation and transduction); Economic importance.

Unit 2 : *Algae* (12 lectures)

General characteristics; Ecology and distribution; Range of thallus organization and reproduction; Classification of algae; Morphology and life-cycles of the following: *Nostoc*, *Chlamydomonas*, *Oedogonium*, *Vaucheria*, *Fucus*, *Polysiphonia*. Economic importance of algae.

Unit 3 : *Fungi* (12 lectures)

Introduction- General characteristics, ecology and significance, range of thallus organization, cell wall composition, nutrition, reproduction and classification; True Fungi- General characteristics, ecology and significance, life cycle of *Rhizopus* (Zygomycota) *Penicillium*, *Alternaria* (Ascomycota), *Puccinia*, *Agaricus* (Basidiomycota); Symbiotic Associations-Lichens:

General account, reproduction and significance; Mycorrhiza: ectomycorrhiza and endomycorrhiza and their significance.

Unit 4 : Introduction to Archegoniate (2 lectures)

Unifying features of archegoniate, Transition to land habit, Alternation of generations.

Unit 5 : *Bryophytes*

(10 lectures)

General characteristics, adaptations to land habit, Classification, Range of thallus organization. Classification (up to family), morphology, anatomy and reproduction of *Marchantia* and *Funaria*. (Developmental details not to be included). Ecology and economic importance of bryophytes with special mention of *Sphagnum*.

Unit 6 : *Pteridophytes*

(8 lectures)

General characteristics, classification, Early land plants (*Cooksonia* and *Rhynia*). Classification (up to family), morphology, anatomy and reproduction of *Selaginella*, *Equisetum* and *Pteris*. (Developmental details not to be included). Heterospory and seed habit, stellar evolution. Ecological and economical importance of Pteridophytes.

Unit 7: *Gymnosperms*

(6 lectures)

General characteristics; Classification (up to family), morphology, anatomy and reproduction of *Cycas* and *Pinus* (Developmental details not to be included). Ecological and economical importance.

1.2 PRACTICAL

1. EMs/Models of viruses – T-Phage and TMV, Line drawing/Photograph of Lytic and Lysogenic Cycle.
2. Types of Bacteria from temporary/permanent slides/photographs; Binary Fission; Conjugation; Structure of root nodule.
3. Gram staining
4. Study of vegetative and reproductive structures of *Nostoc*, *Chlamydomonas* (electron micrographs), *Oedogonium*, *Vaucheria*, *Fucus** and *Polysiphonia* through temporary preparations and permanent slides.
5. ***Rhizopus and Penicillium***: Asexual stage from temporary mounts and sexual structures through permanent slides.
6. ***Puccinia***: Herbarium specimens of Black Stem Rust of Wheat and infected Barberry leaves; section/tease mounts of spores on Wheat and permanent slides of both the hosts.
7. ***Agaricus***: Specimens of button stage and full grown mushroom; Sectioning of gills of *Agaricus*.
8. **Lichens**: Study of growth forms of lichens (crustose, foliose and fruticose)
9. **Mycorrhiza**: ecto mycorrhiza and endo mycorrhiza (Photographs)
10. ***Marchantia***- morphology of thallus, w.m. rhizoids and scales, v.s. thallus through gemma cup,

w.m.
gemmae
(all
temporar

y slides),

ophore,
sporophyte (all permanent slides).

v.s.
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archegoni

l.s.60

11. *Funaria*- morphology, w.m. leaf, rhizoids, operculum, peristome, annulus, spores (temporary slides); permanent slides showing antheridial and archegonial heads, l.s. capsule and protonema.
12. *Selaginella*- morphology, w.m. leaf with ligule, t.s. stem, w.m. strobilus, w.m. microsporophyll and megasporophyll (temporary slides), l.s. strobilus (permanent slide).
13. *Equisetum*- morphology, t.s. internode, l.s. strobilus, t.s. strobilus, w.m. sporangiophore, w.m. spores (wet and dry)(temporary slides); t.s rhizome (permanent slide).
14. *Pteris*- morphology, t.s. rachis, v.s. sporophyll, w.m. sporangium, w.m. spores (temporary slides), t.s. rhizome, w.m. prothallus with sex organs and young sporophyte (permanent slide).
15. *Cycas*- morphology (coralloid roots, bulbil, leaf), t.s. coralloid root, t.s. rachis, v.s. leaflet, v.s. microsporophyll, w.m. spores (temporary slides), l.s. ovule, t.s. root (permanent slide).
16. *Pinus*- morphology (long and dwarf shoots, w.m. dwarf shoot, male and female), w.m. dwarf shoot, t.s. needle, t.s. stem, , l.s./t.s. male cone, w.m. microsporophyll, w.m. microspores (temporary slides), l.s. female cone, t.l.s. & r.l.s. stem (permanent slide).

Suggested Readings

1. Kumar, H.D. (1999). Introductory Phycology. Affiliated East-West. Press Pvt. Ltd. Delhi. 2nd edition.
Tortora, G.J., Funke, B.R., Case, C.L. (2010). Microbiology: An Introduction, Pearson th Benjamin Cummings, U.S.A. 10th edition.
3. Sethi, I.K. and Walia, S.K. (2011). Text book of Fungi & Their Allies, MacMillan Publishers Pvt. Ltd., Delhi.
4. Alexopoulos, C.J., Mims, C.W., Blackwell, M. (1996). Introductory Mycology, John Wiley and Sons (Asia), Singapore. 4th edition.
5. Raven, P.H., Johnson, G.B., Losos, J.B., Singer, S.R., (2005). Biology. Tata McGraw Hill, Delhi, India.
6. Vashishta, P.C., Sinha, A.K., Kumar, A., (2010). Pteridophyta, S. Chand. Delhi, India.
7. Bhatnagar, S.P. and Moitra, A. (1996). Gymnosperms. New Age International (P) Ltd Publishers, New Delhi, India.
8. Parihar, N.S. (1991). An introduction to Embryophyta. Vol. I. Bryophyta. Central Book Depot, Allahabad.

2

BOT-HG-2016 Plant Ecology and Taxonomy

Total Lectures : 60 Credits : 6 (Theory - 4, Practical - 2)

2.1 THEORY

Unit 1 : *Introduction* (2 lectures)

Unit 2 : *Ecological factors* (10 lectures)

Soil: Origin, formation, composition, soil profile. Water: States of water in the environment, precipitation types. Light and temperature: Variation Optimal and limiting factors; Shelford law of tolerance. Adaptation of hydrophytes and xerophytes

Unit 3 : *Plant communities* (6 lectures)

Characters; Ecotone and edge effect; Succession; Processes and types

Unit 4 : *Ecosystem* (8 lectures)

Structure; energy flow trophic organisation; Food chains and food webs, Ecological pyramids production and productivity; Biogeochemical cycling; Cycling of carbon, nitrogen and Phosphorous

Unit 5 : *Phytogeography* (4 Lectures)

Principle biogeographical zones; Endemism.

Unit 6 : *Introduction to plant taxonomy* (2 Lectures)

Identification, Classification, Nomenclature.

Unit : 7 *Identification* (4 Lectures)

Functions of Herbarium, important herbaria and botanical gardens of the world and India; Documentation: Flora, Keys: single access and multi-access

Unit : 8 *Taxonomic evidences from palynology, cytology, phytochemistry and molecular data.*
(6 lectures)

Unit 9 : Taxonomic hierarchy (2 lectures)

Ranks, categories and taxonomic groups

Unit 10 : Botanical nomenclature (6 lectures)

Principles and rules (ICN); ranks and names; binominal system, typification, author citation, valid publication, rejection of names, principle of priority and its limitations.

Unit 11 : Classification (6 lectures)

Types of classification-artificial, natural and phylogenetic. Bentham and Hooker (upto series), Engler and Prantl (upto series).

Unit 12 : Biometrics, numerical taxonomy and cladistics (4 lectures)

Characters; variations; OTUs, character weighting and coding; cluster analysis; phenograms, cladograms (definitions and differences).

2.1 PRACTICAL

1. Study of instruments used to measure microclimatic variables: Soil thermometer, maximum and minimum thermometer, anemometer, psychrometer/hygrometer, rain gauge and lux meter.
2. Study of morphological adaptations of hydrophytes and xerophytes (four each).
3. Determination of minimal quadrat size for the study of herbaceous vegetation in the college campus by species area curve method. (species to be listed)
4. Quantitative analysis of herbaceous vegetation in the college campus for frequency and comparison with Raunkiaer's frequency distribution law.
5. Study of vegetative and floral characters of the following families (Description, V.S. flower, section of ovary, floral diagram/s, floral formula/e and systematic position according to Bentham & Hooker's system of classification): Brassicaceae, Solanaceae, Lamiaceae.
6. Mounting of a properly dried and pressed specimen of any wild plant with herbarium label (to be submitted in the record book).

Suggested Readings

1. Kormondy, E.J. (1996). Concepts of Ecology. Prentice Hall, U.S.A. 4th edition.
2. Sharma, P.D. (2010) Ecology and Environment. Rastogi Publications, Meerut, India. 8th edition.
3. Simpson, M.G. (2006). *Plant Systematics*. Elsevier Academic Press, San Diego, CA, U.S.A.
4. Singh, G. (2012). *Plant Systematics: Theory and Practice*. Oxford & IBH Pvt. Ltd., New Delhi. 3rd edition.

3

BOT-HG--3016

Plant Physiology and Metabolism

Total Lectures : 60 Credits : 6 (Theory - 4, Practical - 2)

3.1 THEORY

Unit 1 : *Plant-water relations*

(8 lectures)

Importance of water, water potential and its components; Transpiration and its significance; Factors affecting transpiration; Root pressure and guttation.

Unit 2 : *Mineral nutrition*

(8 lectures)

Essential elements, macro and micronutrients; Criteria of essentiality of elements; Role of essential elements; Transport of ions across cell membrane, active and passive transport, carriers, channels and pumps.

Unit 3 : *Translocation in phloem*

(6 lectures)

Composition of phloem sap, girdling experiment; Pressure flow model; Phloem loading and unloading

Unit 4 : *Photosynthesis*

(12 lectures)

Photosynthetic Pigments (Chl a, b, xanthophylls, carotene); Photosystem I and II, reaction center, antenna molecules; Electron transport and mechanism of ATP synthesis; C₃, C₄ and CAM pathways of carbon fixation; Photorespiration.

Unit 5 : *Respiration*

(6 lectures)

Glycolysis, anaerobic respiration, TCA cycle; Oxidative phosphorylation, Glyoxylate, Oxidative Pentose Phosphate Pathway.

Unit 6 : *Enzymes*

(4 lectures)

Structure and properties; Mechanism of enzyme catalysis and enzyme inhibition.

Unit 7 : Nitrogen metabolism**(4 lectures)**

Biological nitrogen fixation; Nitrate and ammonia assimilation.

Unit 8 : Plant growth regulators**(6 lectures)**

Discovery and physiological roles of auxins, gibberellins, cytokinins, ABA, ethylene.

Unit 9 : Plant response to light and temperature**(6 lectures)**

Photoperiodism (SDP, LDP, Day neutral plants); Phytochrome (discovery and structure), red and far red light responses on photomorphogenesis; Vernalization.

3.2 PRACTICAL

1. Determination of osmotic potential of plant cell sap by plasmolytic method.
2. To study the effect of light on transpiration by excised twig.
3. Calculation of stomatal index and stomatal frequency.
4. Demonstrate the activity of catalase and study the effect of pH and enzyme concentration.
5. To study the effect of bicarbonate concentration on O₂ evolution in photosynthesis.

Demonstration experiments

1. Bolting.
2. Effect of auxins on rooting.
3. Suction due to transpiration.
4. R.Q.
5. Respiration in roots.

Suggested Readings

1. Taiz, L., Zeiger, E., Møller, I.M. and Murphy, A (2015). Plant Physiology and Development. Sinauer Associates Inc. USA. 6th edition.
2. Hopkins, W.G., Huner, N.P., (2009). Introduction to Plant Physiology. John Wiley & Sons, U.S.A. 4th Edition.
3. Bajracharya, D., (1999). Experiments in Plant Physiology- A Laboratory Manual. Narosa Publishing House, New Delhi.

4

BOT-HG-3026 Environmental Biotechnology

Total Lectures : 60 Credits : 6 (Theory - 4, Practical - 2)

4.1 THEORY

Unit 1 : *Environment* (4 lectures)

Basic concepts and issues, global environmental problems - ozone depletion, UV-B, greenhouse effect and acid rain due to anthropogenic activities, their impact and biotechnological approaches for management.

Unit 2 : *Environmental problems* (6 lectures)

Environmental pollution - types of pollution, sources of pollution, measurement of pollution, methods of measurement of pollution, fate of pollutants in the environment, Bioconcentration, bio/geomagnification.

Unit 3 : *Microbiology of waste water treatment* (8 lectures)

Aerobic process - activated sludge, oxidation ponds, trickling filter, towers, rotating discs, rotating drums, oxidation ditch. Anaerobic process - anaerobic digestion, anaerobic filters, up-flow anaerobic sludge blanket reactors. Treatment schemes for waste waters of dairy, distillery, tannery, sugar and antibiotic industries.

Unit 4 : *Xenobiotic compounds* (10 lectures)

Organic (chlorinated hydrocarbons, substituted simple aromatic compounds, polyaromatic hydrocarbons, pesticides, surfactants) and inorganic (metals, radionuclides, phosphates, nitrates). Bioremediation of xenobiotics in environment - ecological consideration, decay behavior and degradative plasmids, molecular techniques in bioremediation.

Unit 5 : *Role of immobilized cells/enzymes in treatment of toxic compounds* (6 lectures)

Biopesticides, bioreactors, bioleaching, biomining, biosensors, biotechniques for air pollution abatement and odour control.

Unit 6 : *Sustainable Development* (8 lectures)

Economics and Environment: Economic growth, Gross National Productivity and the quality of life, Tragedy of Commons, Economics of Pollution control, Cost-benefit and cost effectiveness analysis, WTO and Environment, Corporate Social Responsibility, Environmental awareness and Education; Environmental Ethics.

Unit 7 : *International Legislations, Policies for Environmental Protection* (6 lectures)

Stockholm Conference (1972) and its declaration, WCED (1983) and Brundtland Report (1987), Rio Earth Summit-UNCED (1992) and its declaration, Montreal Protocol - 1987, Basel Convention (1989), Kyoto Protocol- 1997, Ramsar Convention 1971.

Unit 8 : *National Legislations, Policies for Pollution Management* (6 lectures)

Salient features of Wild life protection act 1972, Water Pollution (Prevention and Control) Act-1974, Forest conservation act 1980, Air Pollution (Prevention and Control) Act-1981, National Environmental Policy -2006, Central and State Pollution Control Boards: Constitution and power.

Unit 9 : *Public Participation for Environmental Protection* (6 lectures)

Environmental movement and people's participation with special references to Gandhamardan, Chilika and Narmada Bachao Andolan, Chipko and Silent valley Movement; Women and Environmental Protection, Role of NGO in bringing environmental awareness and education in the society.

4.2 PRACTICAL

1. Water/Soil analysis - DO, salinity, pH, chloride, total hardness, alkalinity, acidity, nitrate, calcium, Magnesium and phosphorus.
2. Gravimetric analysis-Total solid, dissolved solid, suspended solid in an effluent
3. Microbial assessment of air (open plate and air sample) and water

Suggested Readings

1. Waste water engineering - treatment, disposal and reuse, Metcalf and Eddy Inc., Tata McGraw Hill, New Delhi.
2. Environmental Chemistry, AK. De, Wiley Eastern Ltd, New Delhi.
3. Introduction to Biodeterioration, D.Allsopp and K.J. Seal, ELBS / Edward Arnold.
4. Bioremediation, Baaker, KH and Herson D.S., 1994. Mc.GrawHill Inc, NewYork.
5. Industrial and Environmental Biotechnology - Nuzhat Ahmed, Fouad M. Qureshi and Obaid Y. Khan, 2006. Horizon Press.
6. Environmental Molecular Biology, Paul. A, Rochelle, 2001.Horizon Press.
7. Environmental Protection and Laws by Jadhav and Bhosale, V.M.Himalaya publ. House
13. Biodiversity Assessment and Conservation by PC Trivedi, Agrobios publ.

5

BOT-HG-4016

Plant Anatomy and Embryology

Total Lectures : 60 Credits : 6 (Theory - 4, Practical - 2)

5.1 THEORY

Unit 1: *Meristematic and permanent tissues*

(8 lectures)

Root and shoot apical meristems; Simple and complex tissues

Unit 2: *Organs*

(4 lectures)

Structure of dicot and monocot root stem and leaf.

Unit 3: *Secondary Growth*

(8 lectures)

Vascular cambium – structure and function, seasonal activity. Secondary growth in root and stem, Wood (heartwood and sapwood)

Unit 4: *Adaptive and protective systems*

(8 lectures)

Epidermis, cuticle, stomata; General account of adaptations in xerophytes and hydrophytes.

Unit 5: *Structural organization of flower*

(8 lectures)

Structure of anther and pollen; Structure and types of ovules; Types of embryo sacs, organization and ultrastructure of mature embryo sac.

Unit 6: *Pollination and fertilization*

(8 lectures)

Pollination mechanisms and adaptations; Double fertilization; Seed-structure appendages and dispersal mechanisms.

Unit 7: *Embryo and endosperm*

(8 lectures)

Endosperm types, structure and functions; Dicot and monocot embryo; Embryo-endosperm relationship

5.2 PRACTICAL

1. Study of meristems through permanent slides and photographs.
2. Tissues (parenchyma, collenchyma and sclerenchyma); Macerated xylary elements, Phloem (Permanent slides, photographs)
3. Stem: Monocot: *Zea mays*; Dicot: *Helianthus*; Secondary: *Helianthus* (only Permanent slides).
4. Root: Monocot: *Zea mays*; Dicot: *Helianthus*; Secondary: *Helianthus* (only Permanent slides).
5. Leaf: Dicot and Monocot leaf (only Permanent slides).
6. Adaptive anatomy: Xerophyte (*Nerium* leaf); Hydrophyte (*Hydrillastem*).
7. Structure of anther (young and mature), tapetum (amoeboid and secretory) (Permanent slides).
8. Types of ovules: anatropous, orthotropous, circinotropous, amphitropous / campylotropous (permanent slides)
9. Female gametophyte: *Polygonum* (monosporic) type of Embryo sac Development (Permanent slides/photographs).
10. Ultrastructure of mature egg apparatus cells through electron micrographs.
11. Pollination types and seed dispersal mechanisms (including appendages, aril, caruncle) (Photographs and specimens).
12. Dissection of embryo/endosperm from developing seeds.

Suggested Readings

1. Bhojwani, S.S. & Bhatnagar, S.P. (2011). Embryology of Angiosperms. Vikas Publication House Pvt. Ltd. New Delhi. 5th edition.
2. Mauseth, J.D. (1988). Plant Anatomy. The Benjamin/Cummings Publisher, USA.

6

BOT-HG- 4026

Economic Botany and Plant Biotechnology

Total Lectures : 60 Credits : 6 (Theory - 4, Practical - 2)

6.1 THEORY

Unit 1 : *Origin of Cultivated Plants*

(4 lectures)

Concept of centres of origin, their importance with reference to Vavilov's work.

Unit 2 : *Cereals*

(4 lectures)

Wheat -Origin, morphology, uses

Unit 3 : *Legumes*

(4 lectures)

General account with special reference to Gram and soybean

Unit 4 : *Spices*

(4 lectures)

General account with special reference to clove and black pepper (Botanical name, family, part used, morphology and uses)

Unit 5 : *Beverages*

(2 lectures)

Tea (morphology, processing, uses)

Unit 6 : *Oils and Fats*

(2 lectures)

General description with special reference to groundnut

Unit 7 : *Fiber Yielding Plants*

(2 lectures)

General description with special reference to Cotton (Botanical name, family, part used, morphology and uses)

Unit 8 : *Introduction to biotechnology* (2 lecture)

Unit 9 : *Plant tissue culture* (8 lectures)

Micropropagation ; haploid production through androgenesis and gynogenesis; brief account of embryo and endosperm culture with their applications

Unit 10 : *Recombinant DNA Techniques* (18 lectures)

Blotting techniques: Northern, Southern and Western Blotting, DNA Fingerprinting; Molecular DNA markers i.e. RAPD, RFLP, SNPs; DNA sequencing, PCR and Reverse Transcriptase-PCR. Hybridoma and monoclonal antibodies, ELISA and Immunodetection. Molecular diagnosis of human disease, Human gene Therapy.

Unit 11 : *Bioinformatics* (5 Lectures)

Introduction, branches, Aim, Scope and research areas, Biological data base and the retrieval system.

Unit 12 : *Applications of Bioinformatics* (5 Lectures)

Molecular Phylogeny; Basics in Proteomics and Genomics and their applications in crop improvement, Drug Discovery.

6.2 PRACTICAL

1. Study of economically important plants : Wheat, Gram, Rice, Soybean, Black pepper, Curcuma, Clove, Tea, Cotton, Groundnut through specimens, sections and microchemical tests
2. Familiarization with basic equipment in tissue culture.
3. Study through photographs: Anther culture, somatic embryogenesis, endosperm and embryo culture; micropropagation.
4. Study of molecular techniques: PCR, Blotting techniques, AGE and PAGE.
5. Data base searching, and retrieval of Sequence from databases.
6. Sequence alignment, Homology and construction of Phylogenetic tree.

Suggested Readings

1. Kochhar, S.L. (2011). Economic Botany in the Tropics, MacMillan Publishers India Ltd., New Delhi. 4th edition.
2. Bhojwani, S.S. and Razdan, M.K., (1996). Plant Tissue Culture: Theory and Practice. Elsevier Science Amsterdam. The Netherlands.
3. Glick, B.R., Pasternak, J.J. (2003). Molecular Biotechnology- Principles and Applications of recombinant DNA. ASM Press, Washington.

4. Ghosh Z. and Bibekanand M. (2008) Bioinformatics: Principles and Applications. Oxford University Press.
5. Pevsner J. (2009) Bioinformatics and Functional Genomics. II Edition. Wiley Blackwell.
6. Campbell A. M., Heyer L. J. (2006) Discovering Genomics, Proteomics and Bioinformatics. II Edition. Benjamin Cummings.

Skill Enhancement Courses

1

BOT-SE-3014 Biofertilizers

Total Lectures : 60 Credits : 4

Unit 1 : General account about the microbes used as biofertilizer – Rhizobium – isolation, identification, mass multiplication, carrier based inoculants, Actinorrhizal symbiosis.

(8 lectures)

Unit 2 : *Azospirillum*: isolation and mass multiplication – carrier based inoculant, associative effect of different microorganisms. *Azotobacter*: classification, characteristics – crop response to *Azotobacter* inoculum, maintenance and mass multiplication.

(16 lectures)

Unit 3 : Cyanobacteria (blue green algae), *Azolla* and *Anabaena azollae* association, nitrogen fixation, factors affecting growth, blue green algae and *Azolla* in rice cultivation.

(8 lectures)

Unit 4 : Mycorrhizal association, types of mycorrhizal association, taxonomy, occurrence and distribution, phosphorus nutrition, growth and yield – colonization of VAM – isolation and inoculum production of VAM, and its influence on growth and yield of crop plants.

(16 lectures)

Unit 5 : Organic farming – Green manuring and organic fertilizers, Recycling of bio-degradable municipal, agricultural and Industrial wastes – biocompost making methods, types and method of vermicomposting – field Application.

(12 lectures)

Suggested Readings

1. Dubey, R.C., 2005 A Text book of Biotechnology S.Chand & Co, New Delhi.
2. Kumaresan, V. 2005, Biotechnology, Saras Publications, New Delhi.
3. John Jothi Prakash, E. 2004. Outlines of Plant Biotechnology. Emkay Publication, New Delhi.
4. Sathe, T.V. 2004 Vermiculture and Organic Farming. Daya publishers.
5. Subha Rao, N.S. 2000, Soil Microbiology, Oxford & IBH Publishers, New Delhi.
6. Vayas, S.C, Vayas, S. and Modi, H.A. 1998 Bio-fertilizers and organic Farming Akta Prakashan, Nadiad

2

BOT-SE-3024 Herbal Technology

Total Lectures : 60 Credits : 4

Unit 1: Herbal medicines: history and scope - definition of medical terms - role of medicinal plants in Siddha systems of medicine; cultivation - harvesting - processing - storage - marketing and utilization of medicinal plants. **(12 Lectures)**

Unit 2: Pharmacognosy - systematic position m edicinal uses of the following herbs in curing various ailments; Tulsi, Ginger, Fenugreek, Indian Goose berry and Ashoka. **(12 Lectures)**

Unit 3: Phytochemistry - active principles and methods of their testing - identification and utilization of the medicinal herbs; *Catharanthus roseus* (cardiotonic), *Withania somnifera* (drugs acting on nervous system), *Clerodendron phlomoides* (anti-rheumatic) and *Centella asiatica* (memory booster). **(12 Lectures)**

Unit 4: Analytical pharmacognosy: Drug adulteration - types, methods of drug evaluation - Biological testing of herbal drugs - Phytochemical screening tests for secondary metabolites (alkaloids, flavonoids, steroids, triterpenoids, phenolic compounds) **(16 Lectures)**

Unit 5: Medicinal plant banks micro propagation of important species (*Withania somnifera*, neem and tulsi- Herbal foods-future of pharmacognosy) **(8 Lectures)**

Suggested Readings

1. Glossary of Indian medicinal plants, R.N.Chopra, S.L.Nayar and I.C.Chopra, 1956. C.S.I.R, New Delhi.
2. The indigenous drugs of India, Kanny, Lall, Dey and Raj Bahadur, 1984. International Book Distributors.
3. Herbal plants and Drugs Agnes Arber, 1999. Mangal Deep Publications.
4. Ayurvedic drugs and their plant source. V.V. Sivarajan and Balachandran Indra 1994. Oxford IBH publishing Co.
5. Ayurveda and Aromatherapy. Miller, Light and Miller, Bryan, 1998. Banarsidass, Delhi.
6. Principles of Ayurveda, Anne Green, 2000. Thomsons, London.
7. Pharmacognosy, Dr.C.K.Kokate et al. 1999. Nirali Prakashan.

3

BOT-SE-4014 Nursery and Gardening

Total Lectures : 60 Credits : 4

Unit 1: Nursery: definition, objectives and scope and building up of infrastructure for nursery, planning and seasonal activities - Planting - direct seeding and transplants. **(8 Lectures)**

Unit 2: Seed: Structure and types - Seed dormancy; causes and methods of breaking dormancy - Seed storage: Seed banks, factors affecting seed viability, genetic erosion – Seed production technology - seed testing and certification. **(12 Lectures)**

Unit 3: Vegetative propagation: air-layering, cutting, selection of cutting, collecting season, treatment of cutting, rooting medium and planting of cuttings - Hardening of plants – green house - mist chamber, shed root, shade house and glass house. **(12 Lectures)**

Unit 4: Gardening: definition, objectives and scope - different types of gardening - landscape and home gardening - parks and its components - plant materials and design - computer applications in landscaping - Gardening operations: soil laying, manuring, watering, management of pests and diseases and harvesting. **(16 Lectures)**

Unit 5: Sowing/raising of seeds and seedlings - Transplanting of seedlings - Study of cultivation of different vegetables: cabbage, brinjal, lady's finger, onion, garlic, tomatoes, and carrots - Storage and marketing procedures. **(12 Lectures)**

Suggested Readings

1. Bose T.K. & Mukherjee, D., 1972, Gardening in India, Oxford & IBH Publishing Co., New Delhi.
2. Sandhu, M.K., 1989, Plant Propagation, Wile Eastern Ltd., Bangalore, Madras.
3. Kumar, N., 1997, Introduction to Horticulture, Rajalakshmi Publications, Nagercoil.
4. Edmond Musser & Andres, Fundamentals of Horticulture, McGraw Hill Book Co., New Delhi.
5. Agrawal, P.K. 1993, Hand Book of Seed Technology, Dept. of Agriculture and Cooperation, National Seed Corporation Ltd., New Delhi.
6. Janick Jules. 1979. Horticultural Science. (3rd Ed.), W.H. Freeman and Co., San Francisco, USA.

4

BOT-SE-4024

Floriculture

Total Lectures : 60 Credits : 4

Unit 1: Introduction: History of gardening; Importance and scope of floriculture and landscape gardening. **(4 Lectures)**

Unit 2: Nursery Management and Routine Garden Operations: Sexual and vegetative methods of propagation; Soil sterilization; Seed sowing; Pricking; Planting and transplanting; Shading; Stopping or pinching; Defoliation; Wintering; Mulching; Topiary; Role of plant growth regulators. **(16 lectures)**

Unit 3: Ornamental Plants: Flowering annuals; Herbaceous perennials; Divine vines; Shade and ornamental trees; Ornamental bulbous and foliage plants; Cacti and succulents; Palms and Cycads; Ferns and Selaginellas; Cultivation of plants in pots; Indoor gardening; Bonsai. **(8 lectures)**

Unit 4: Principles of Garden Designs: English, Italian, French, Persian, Mughal and Japanese gardens; Features of a garden (Garden wall, Fencing, Steps, Hedge, Edging, Lawn, Flower beds, Shrubbery, Borders, Water garden. Some Famous gardens of India. **(8 lectures)**

Unit 5: Landscaping Places of Public Importance: Landscaping highways and Educational institutions. **(8 lectures)**

Unit 6: Commercial Floriculture: Factors affecting flower production; Production and packaging of cut flowers; Flower arrangements; Methods to prolong vase life; Cultivation of Important cut flowers (Carnation, Aster, Chrysanthemum, Dahlia, Gerbera, Gladiolous, Marigold, Rose, Liliun, Orchids). **(12 lectures)**

Unit 7: Diseases and Pests of Ornamental Plants. **(4 lectures)**

Suggested Readings

1. Randhawa, G.S. and Mukhopadhyay, A. 1986. Floriculture in India. Allied Publishers.

5

BOT-SE-4034

Intellectual Property Rights

Total Lectures : 60 Credits : 4

Unit 1: Introduction to intellectual property right (IPR) (4 lectures)

Concept and kinds. Economic importance. IPR in India and world: Genesis and scope, some important examples. IPR and WTO (TRIPS, WIPO).

Unit 2 : Patents (6 Lectures)

Objectives, Rights, Patent Act 1970 and its amendments. Procedure of obtaining patents, Working of patents. Infringement.

Unit 3: Copyrights (6 Lectures)

Introduction, Works protected under copyright law, Rights, Transfer of Copyright, Infringement.

Unit 4: Trademarks (6 Lectures)

Objectives, Types, Rights, Protection of goodwill, Infringement, Passing off, Defences, Domain name.

Unit 5: Geographical Indications (6 Lectures)

Objectives, Justification, International Position, Multilateral Treaties, National Level, Indian Position.

Unit 6: Protection of Traditional Knowledge (8 Lectures)

Objective, Concept of Traditional Knowledge, Holders, Issues concerning, Bio-Prospecting and Bio-Piracy, Alternative ways, Protectability, need for a Sui-Generis regime, Traditional Knowledge on the International Arena, at WTO, at National level, Traditional Knowledge Digital Library.

Unit 7: Industrial Designs (4 Lectures)

Objectives, Rights, Assignments, Infringements, Defences of Design Infringement

Unit 8 : Protection of Plant Varieties**(4 Lectures)**

Plant Varieties Protection-Objectives, Justification, International Position, Plant varieties protection in India. Rights of farmers, Breeders and Researchers. National gene bank, Benefit sharing. Protection of Plant Varieties and Farmers' Rights Act, 2001.

Unit 9 : Information Technology Related Intellectual Property Rights**(8 Lectures)**

Computer Software and Intellectual Property, Database and Data Protection, Protection of Semi-conductor chips, Domain Name Protection

Unit 10 : Biotechnology and Intellectual Property Rights.**(8 Lectures)**

Patenting Biotech Inventions: Objective, Applications, Concept of Novelty, Concept of inventive step, Microorganisms, Moral Issues in Patenting Biotechnological inventions.

Suggested Readings

1. N.S. Gopalakrishnan & T.G. Agitha, (2009) Principles of Intellectual Property Eastern Book Company, Lucknow.
2. Kerly's Law of Trade Marks and Trade Names (14th Edition) Thomson, Sweet & Maxweel.
3. Ajit Parulekar and Sarita D' Souza, (2006) Indian Patents Law – Legal & Business Implications; Macmillan India Ltd.
4. B.L.Wadehra (2000) Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications; Universal law Publishing Pvt. Ltd., India.
5. P. Narayanan (2010) Law of Copyright and Industrial Designs; Eastern law House, Delhi.

APPENDIX I

SEMESTER	COURSE OPTED	COURSE NAME	Credits
I	Ability Enhancement Compulsory Course-I	English communications	2
	Core course-I	Phycology and Microbiology	4
	Core Course-I Practical	Phycology and Microbiology	2
	Core course-II	Biomolecules and Cell Biology	4
	Core Course-II Practical	Biomolecules and Cell Biology- Practical	2
	Generic Elective -1	GE-1	4
	Generic Elective -1 Practical/ Tutorial	GE-1 Practical	2
II	Ability Enhancement Compulsory Course-II	Environmental Studies	2
	Core course-III	Mycology and Phytopathology	4
	Core Course-III Practical	Mycology and Phytopathology- Practical	2
	Core course-IV	Archegoniate	4
	Core Course-IV Practical	Archegoniate- Practical	2

	Generic Elective -2	GE-2	4
	Generic Elective -2 -- Practical	GE-2 Practical	2
III	Core course-V	Morphology and Anatomy of Angiosperm	4
	Core Course-V Practical	Morphology and Anatomy of Angiosperm- Practical	2
	Core course-VI	Economic Botany	4
	Core Course-VI Practical	Economic Botany-Practical	2
	Core course-VII	Genetics	4
	Core Course-VII Practical	Genetics- Practical	2
	Skill Enhancement Course-1	SEC-1	4
	Generic Elective -3	GE-3	4
	Generic Elective -3 Practical	GE-3 Practical	2
IV	Core course-VIII	Molecular Biology	4
	Course-VIII Practical	Molecular Biology- Practical	2
	Core course-IX	Plant Ecology and Phytogeography	4
	Course-IX Practical	Plant Ecology and Phytogeography - practical	2
	Core course-X	Plant Systematics	4
	Core Course- X Practical	Plant Systematics	2

		Practical	
	Skill Enhancement Course-2	SEC-2	4
	Generic Elective -4	GE-4	4
	Generic Elective – 4 Practical	GE-4 Practical	2
V	Core course-XI	Reproductive Biology of Angiosperms	4
	Core Course-XI Practical	Reproductive Biology of Angiosperms - Practical	2
	Core course-XII	Plant Physiology	4
	Core Course-XII Practical	Plant Physiology-Practical	2
	Discipline Specific Elective -1	DSE-1	4
	Discipline Specific Elective -1 Practical	DSE-1 Practical	2
	Discipline Specific Elective -2	DSE-2	4
	Discipline Specific Elective-2 -Practical /Tutorial	DSE-2 Practical	2
VI	Core course-XIII	Plant Metabolism	4
	Core Course-XIII -Practical /Tutorial	Plant Metabolism-Practical	2
	Core course-XIV	Plant	4

		Biotechnology	
	Core Course-XIV - Practical /Tutorial	Plant Biotechnology-Practical	2
	Discipline Centric Elective -3	DSE-3	4
	Discipline Centric Elective -3 Practical /Tutorial	DSE-3 Practical	2
	Project Work	DSE-4 Practical	6
			Total: 144

Course outcomes

B.Sc. Botany Honours

Core Papers

BOT-HC-1016: Phycology and Microbiology

- CO1. Detailed knowledge on microbes, viruses and bacteria, and their importance in agriculture and medicine
- CO2. Knowledge on Algal classification, Economic and ecological importance of Algae
- CO3. Practical knowledge on structure of T-Phage and TMV, lytic and lysogenic life cycle
- CO4. Practical knowledge on microscopy of bacteria and algae

BOT-HC-1026: Biomolecules and Cell Biology

- CO1. Knowledge on structure, classification and physicochemical properties of biomolecules and enzymes
- CO2. Detailed knowledge on structure, properties and functions of cell and its components
- CO3. Practical knowledge on properties of cell and cell membrane, DNA staining techniques and microscopy of plant cell
- CO4. Knowledge on qualitative tests of biomolecules

BOT-HC-2016: Mycology and Phytopathology

- CO1. Detailed knowledge on different classes of fungi, their structure, classification, life cycle and reproduction
- CO2. Knowledge on diseases in plants caused by viruses, bacteria and fungi and biotechnological applications of fungi
- CO3. Structural analysis of different classes of fungi and their reproductive stages
- CO4. Knowledge on structures of symbiotic associations (Lichens, Mycorrhiza)

BOT-HC-2026: Archegoniate

CO1. Detailed knowledge on morphology, anatomy, classification and properties of bryophytes, pteridophytes and gymnosperms

CO2. Knowledge on reproduction and economic importance and ecological significance of bryophytes, pteridophytes and gymnosperms

CO3. Practical knowledge on morphology and reproductive structures of archegoniates

CO4. Spore morphology analysis and detailed knowledge on male and female reproductive structures in gymnosperms

BOT-HC-3016: Morphology and Anatomy of Angiosperms

CO1. Knowledge on morphology of angiosperms and developmental biology of plant body

CO2. Knowledge on structural and anatomical organization of tissue system in plants and their classification

CO3. Practical knowledge on inflorescences and fruits of angiosperms

CO4. Practical knowledge on anatomical features of plant body parts

BOT-HC-3026: Economic Botany

CO1. Knowledge on morphology, uses and economic importance of crop plants

CO2. Knowledge on uses of industrially important plants

CO3. Practical knowledge on economically important plant parts and their products

BOT-HC-3036: Genetics

CO1. Knowledge on Mendelian concepts in genetics; structure, functions and properties of chromosome; chromosomal aberration

CO2. Knowledge on gene structures and gene mutations, population genetics

CO3. Practical knowledge on chromosomal mapping and gene interaction studies

CO4. Practical visualization of chromosomal anomalies

BOT-HC-4016: Molecular Biology

CO1. Detailed knowledge on architecture of nucleic acids, organization of DNA in organisms, models of replication and the factors associated with it

CO2. Detailed knowledge on transcriptional and post transcriptional events in a cell, translation of proteins

CO3. Practical acquaintance of isolation and quantification of DNA from plants

CO4. Knowledge on photographic study of RNA polymerases and RNA modification machinery

BOT-HC-4026: Plant Ecology and Phytogeography

CO1. Knowledge on origin, formation and properties of abiotic components of the ecosystem, interactions and adaptation of plants with biotic and abiotic factors

CO2. Knowledge on properties of communities in a population and tropical and habitat organization in an ecosystem

CO3. Practical knowledge on property analysis of abiotic components of the ecosystem

CO4. Practical knowledge on vegetation study and different ecological sites

BOT-HC-4036: Plant Systematics

CO1. Knowledge on plant identification and classification systems, plant nomenclature

CO2. Knowledge on phylogenetic and evolutionary relationships of angiosperms

CO3. Practical knowledge on foliar morphology and taxonomical study of angiosperms

BOT-HC-5016: Reproductive Biology of Angiosperms

- CO1. Knowledge on detailed morphological and anatomical study of reproductive structures of angiospermic plants
- CO2. Knowledge on embryology and embryological abnormalities in angiosperms
- CO3. Structural documentation of reproductive structures of angiosperms
- CO4. Practical knowledge on developmental biology of embryo and endosperms

BOT-HC-5026: Plant Physiology

- CO1. Knowledge on mechanisms of water, minerals and nutrient absorption of plants
- CO2. Knowledge on roles of plant hormones and mechanism of flowering in plants
- CO3. Practical knowledge on effects of growth regulators on plant parts
- CO4. Practical knowledge on determination of osmotic and water potential

BOT-HC-6016: Plant Metabolism

- CO1. Detailed knowledge of metabolic events of photosynthesis and nutrient metabolism
- CO2. Knowledge of signalling molecules and pathways in the plant cell
- CO3. Practical knowledge on different types of chromatographic techniques
- CO4. Estimation of TAN, sugar and protein contents in plant sample

BOT-HC-6026: Plant Biotechnology

- CO1. Knowledge on applications of tissue culture techniques, construction of recombinant DNA and transformation into hosts, construction of DNA libraries
- CO2. Knowledge on development of transgenic plants for agricultural or industrial use
- CO3. Practical utility on isolation of plasmid DNA, its digestion and separation of fragments through gel electrophoresis
- CO4. Preparation of media for tissue culture techniques and photographic study of plant tissue culture
- CO5. Photographic study of generating transgenic plants for agriculture

Discipline Specific Elective (DSE) Papers

BOT-HE-5016: Natural Resource Management

- CO1. Comprehensive knowledge on different types of natural resources and their ecological, economical and socio-cultural values
- CO2. Basic understandings of land, water and forest resources
- CO3. Overall knowledge on resource degradation, their judicious use and management for sustainability
- CO4. Knowledge on biodiversity - its importance, management and Bioprospecting
- CO5. Knowledge on IPR, and global arena on resource management, conservation and benefit sharing
- CO6. Hands on experience on the domestic solid waste estimation and determining its impact on land degradation
- CO7. Hands on experience on forest study using tools like GPS/GIS, and understanding of ecological importance of forest resources

BOT-HE-5026: Horticultural Practices and Post-Harvest Technology

- CO1. Basic understandings on Horticultural science and its importance in employment generation and socio-economic development

- CO2. Classification of horticultural crops, identification of potential horticultural crops – their cultivation, production, management and commercialization
- CO3. Knowledge on horticultural techniques, landscaping and gardening
- CO4. Overall knowledge on post-harvest technology, disease management, and germplasm management for horticulture
- CO5. Field knowledge of gardening, nurseries, standing crops of horticultural importance

BOT-HE-6016: Industrial and Environmental Microbiology

- CO1. Understanding the roles of microbes in industries and environment
- CO2. Basic knowledge of different kinds of bioreactors and fermentation processes
- CO3. Knowledge on production processes of some microbial products in industries through site visits
- CO4. Knowledge on application of enzymes in industries
- CO5. Diversity and distribution of microbes in air, water and soil
- CO6. Basic understandings on water microbiology and water analysis methods
- CO7. Usefulness of microbes in agriculture and bioremediation of contaminated soils
- CO8. Practical experiences on basic microbiological techniques and handlings

BOT-HE-6026: Analytical Techniques in Plant Sciences

- CO1. Knowledge on microscopy and imaging in plant science
- CO2. Principles and application of centrifuge, spectroscopy and chromatography in biology
- CO3. Basic knowledge on biostatistics including measures of central tendency and dispersions, statistical data analysis and representations
- CO4. Practical knowledge on microscopy, chromatography, centrifugation and spectroscopy

BOT-HE-6036: Project Work/Dissertation

- CO1. Practical knowledge on addressing relevant scientific questions through experimentation

Generic Elective Courses

BOT-HG-1016: Biodiversity (Microbes, Algae, Fungi and Archegoniate)

- CO1. Knowledge on structure and reproduction of viruses and bacteria, and their economic importance
- CO2. Describe general characteristics, morphological diversity, thallus organization, life cycles, ecological and economic importance of algae
- CO3. Describe general characteristics, morphological diversity, thallus organization, life cycles, ecological and economic importance of fungi
- CO4. General characteristics, classification, morphological diversity and evolutionary significance of bryophytes
- CO5. General characteristics and classification of pteridophytes; evolution of stele, heterospory and seed habit in pteridophytes
- CO6. Classify gymnosperms, and describe their general characteristics and economic importance
- CO7. Practical knowledge on staining and slide preparation to study bacteria, algae and fungi under the microscope
- CO8. Practical knowledge on vegetative and reproductive structures of some representative bryophytes, pteridophytes and gymnosperms

BOT-HG-2016: Plant Ecology and Taxonomy

- CO1. Understanding soil, water, light and temperature as ecological factors

- CO2. Knowledge on adaptive characters of hydrophytes and xerophytes
- CO3. Knowledge on plant community types and their succession
- CO4. Knowledge on ecosystem, trophic levels and energy flow in ecosystems
- CO5. Knowledge on biogeochemical cycling with an emphasis on carbon, nitrogen and phosphorus cycles
- CO6. General idea on phytogeography and endemism
- CO7. Knowledge on plant taxonomy, principles, ICN rules, ranks and hierarchy
- CO8. Knowledge on different systems of plant classification and cluster analysis
- CO9. Practical knowledge on soil temperature measurement, humidity measurement, rainfall estimation and light intensity measurement
- CO10. Adaptive morphological characterization of hydrophytes and xerophytes
- CO11. Quadrature size determination for herbaceous plant studies in ecology
- CO12. Estimation of frequency distribution of herbaceous plants using quadrature method
- CO13. Practical knowledge on plant identification upto the family level that belongs to Brassicaceae, Solanaceae and Lamiaceae; Preparation of herbarium specimens

BOT-HG-3016: Plant Physiology and Metabolism

- CO1. Understanding the roles of water in plant physiology, transpiration, and guttation
- CO2. Knowing of macro- and micro-nutrients and mineral uptakes in plants
- CO3. Understanding the transportations of minerals and foods in plants
- CO4. Knowledge on photosynthetic pigments, photosynthetic reactions and photorespiration
- CO5. Understanding of respiration processes – glycolysis, TCA and PPP pathways
- CO6. Knowledge on enzyme properties, actions and inhibitions
- CO7. Knowledge on biological nitrogen fixation
- CO8. Knowledge on plant hormones, and plant responses to light and temperature
- CO9. Determine osmotic potentials of plant cells and effect of light on transpiration
- CO10. Calculate stomatal index and frequency
- CO11. Demonstrate the effect of pH and concentrations in catalase activity
- CO12. Demonstrate the effect of bicarbonate concentration on O₂ evolution in photosynthesis

BOT-HG-3026: Environmental Biotechnology

- CO1. Knowledge on environment and the cause of environmental pollutions
- CO2. Knowledge on the methods of pollution measurement and bioremediation
- CO3. Knowledge on waste water treatment processes
- CO4. Knowledge on xenobiotics – their types and bioremediation
- CO5. Knowledge on application of immobilized cells/enzymes in industries
- CO6. Knowledge on national legislations and international treaties for environmental protection and pollution management
- CO7. Practical knowledge on determining basic properties of soil and water like DO, salinity, pH, total hardness, etc
- CO8. Practical knowledge on gravimetric analysis of effluents
- CO9. Practical knowledge on the assessment of microorganisms in air and water samples

BOT-HG-4016: Plant Anatomy and Embryology

- CO1. Knowledge on different types of tissues and their organizations in plants
- CO2. Knowledge on secondary growth and anomalous structures in plants
- CO3. Knowledge on adaptive and protective characters of plants
- CO4. Understanding the reproductive units of a flower; ovule types, ovary types, pollination and fertilization mechanisms; embryo and endosperm developments and functions
- CO5. Hands on experiences on slide preparation for anatomical studies of leaf, stem and root
- CO6. Flower dissection and study of flower reproductive parts and events

BOT-HG-4026: Economic Botany and Plant Biotechnology

- CO1. Understanding the concept of 'centre of origin of crop plants' and their distribution with a special emphasis on wheat
- CO2. Overall knowledge on economically important crops with their botanical characters and parts used
- CO3. Knowledge on plant tissue culture and the basic molecular techniques used in biotechnology
- CO4. Basic concept of bioinformatics and its application

Skill Enhancement Paper

BOT-SE-3014: Biofertilizers

- CO1. Basic knowledge on the microbes used as biofertilizer and understand the process of their isolation, identification, mass multiplication, carrier based inoculants and knowledge on Actinorrhizal symbiosis
- CO2. Concept on the general characteristics, isolation, mass multiplication carrier based inoculants of *Azospirillum* and *Azotobacter* also the knowledge on the crop response to *Azotobacter*
- CO3. Basic knowledge on Cyanobacteria including factors affecting growth of Cyanobacteria, concept on the nitrogen fixation and use of blue green algae in rice cultivation
- CO4. Brief knowledge on the Mycorrhizal association and understand the details of various types, taxonomy, occurrence, distribution and growth parameters of Mycorrhiza
- CO5. Details about the organic farming, maintenance and recycling of biodegradable waste material and understand the methods of making biocompost and vermicompost with application

BOT-SE-3024: Herbal Technology

- CO1. Concept on the plants used as traditional medicine, and understanding the process of cultivation, harvesting, processing, storage, marketing and utilization of medicinal plants

CO2. Brief knowledge on medicinal drugs obtained from plants and comprehensive idea about systematic position, medicinal uses of Tulsi, Ginger, Fenu greek, Indian goose berry and Ashoka

CO3. Concept on the phytochemistry of medicinal herbs and identification, utilization of medicinal plants

CO4. Basic knowledge on quality control, owing the medicinal properties of herbal drugs including the secondary metabolites and concept of drug adulteration, types, methods of drug evaluation

CO5. Understand the process of micro propagation of important medicinal plant species

BOT-SE-4014: Nursery and Gardening

CO1. Brief idea about objectives, scope, infrastructure and maintenance of Nursery

CO2. Concept on structure, types and dormancy of seeds and brief idea about seed storage including types and process and knowledge on seed production technology

CO3. Knowledge on various modes of vegetative propagation and maintenance of plants in green house

CO4. Brief idea about development and maintenance of gardening including scope and types and understand the various gardening operations including management of pests and diseases

CO5. Detail knowledge on managements of seeds and seedlings and concept about cultivation, storage and marketing of important vegetables

BOT-SE-4024: Floriculture

CO1. Basic knowledge including history, importance and scope of floriculture

CO2. Brief idea about Nursery management and garden operations and knowledge on the terms related to gardening and concept about role of plant growth regulators

CO3. Covers the knowledge of various ornamental plants and concept of cultivations of plants in pots and knowledge about Bonsai

CO4. Idea about various garden designs and features of such gardens and knowledge about some famous gardens of India

CO5. Knowledge about the process of making garden more attractive by altering the existing design in places of public importance, highways and educational institute

BOT-SE-4034: Intellectual Property Rights

CO1. Knowledge on IPR, their types and infringement

CO2. Understanding about traditional knowledge and their protection, bio-prospecting and bio-piracy.

CO3. Knowledge on protection of plant varieties, farmer rights

CO4. Knowledge on Information technology related IPR; data, database, chips and domain name protection

CO5. Knowledge on novelty, bio-based patenting, and moral issues associated with biotechnological inventions

B.Sc. Biotechnology (Professional) Syllabus- CBCS

This is approved in the Academic Council held on 08.11.2019

Department of Biotechnology,

GAUHATI UNIVERSITY

Gopinath Bordoloi Nagar, Guwahati 781014, Assam, India.

CHOICE BASED CREDIT SYSTEM (CBCS)
B.Sc. (Honours/Professional) Biotechnology

COURSE STRUCTURE

	Type	CORE	AEC	SEC	DSE	GEN
	Credit	6 (60T+ 40P)	4 (100T)	4 (60T + 40P)	6(4T+2P) 60T + 40P	6 (5T + 1P) 80T + 20P
Semester I		C1(BIT-HC-1016)	AECC1 (ENG-AE-1014)			GE-1 (BIT-HG-1036)
		C2(BIT-HC-1026)				
Semester		C3(BIT-HC-2016)	AECC1 (ENG-AE-1014)			GE2 (BIT-HG-2046)
		C4(BIT-HC-2026)				
Semester III		C5 (BIT-HC-3016)		SEC-1 (BIT-SE-3014)		GE-3 (BIT-HG-3016)
		C6 (BIT-HC-3026)				
		C7 (BIT-HC-3036)				
Semester		C8 (BIT-HC-4016)		SEC-2 (BIT-SE-4014)		GE-4 (BIT-HG-4016)
		C9 (BIT-HC-4026)				
		C10 (BIT-HC-4036)				
Semester V		C11 (BIT-HC-5016)			DSE-I (BIT-HE-5016)	
		C12 (BIT-HC-5026)			DSE-2 (BIT-HE-5026)	
Semester VI		C-13 (BIT-HC-6016)			DSE-3 (BIT-HE-6016)	
		C-14 (BIT-HC-6026)			DSE-4 (BIT-HE-6026)	

LIST OF PAPERS:

Semester I	C1	BIT-HC-1016	Biochemistry & Metabolism	6 credits (60T + 40P marks)
	C2	BIT-HC-1026	Cell Biology	6 credits (60T + 40P marks)
	AECC1	ENG-AE-1014	English/ EVS/ MIL communication	4 credits
	GE1	BIT-HG-1036	Biotechnology & Human Welfare	(5 + 1P) credits (80T + 20P marks)
Semester II	C3	BIT-HC-2016	Mammalian Physiology	6 credits (60T + 40P marks)
	C4	BIT-HC-2026	Plant Physiology	6 credits (60T + 40P marks)
	AECC1	ENG-AE-1014	English/ EVS/ MIL communication	4 credits
	GE2	BIT-HG-2046	Developmental Biology	(5 + 1P) credits (80T + 20P marks)
Semester III	C5	BIT-HC-3016	Genetics	6 credits (60T + 40P marks)
	C6	BIT-HC-3026	General Microbiology	6 credits (60T + 40P marks)
	C7	BIT-HC-3036	Chemistry-I	6 credits (60T + 40P marks)
	SEC1	BIT-SE-3014	Enzymology	4 credits (60T + 40P marks)
	GE3	BIT-HG-3016	Bioethics and Biosafety	(5 + 1P) credits (80T + 20P marks)
Semester IV	C8	BIT-HC-4016	Molecular Biology	6 credits (60T + 40P marks)
	C9	BIT-HC-4026	Immunology	6 credits (60T + 40P marks)
	C10	BIT-HC-4036	Chemistry-II	6 credits (60T + 40P marks)
	SEC2	BIT-SE-4014	Industrial Fermentations	4 credits (60T + 40P marks)
	GE4	BIT-HG-4016	Entrepreneurship Development	(5 + 1P) credits (80T + 20P marks)
Semester V	C11	BIT-HC-5016	Bioprocess Technology	6 credits (60T + 40P marks)
	C12	BIT-HC-5026	Recombinant DNA Technology	6 credits (60T + 40P marks)
	DSE1	BIT-HE-5016	Bioinformatics	(4+2P) credits (60T + 40P marks)
	DSE2	BIT-HE-5026	Ecology & Environmental Management	(4+2P) credits (60T + 40P marks)
Semester VI	C13	BIT-HC-6016	Bio-Analytical Tools	6 credits (60T + 40P marks)
	C14	BIT-HC-6026	Genomics & Proteomics	6 credits (60T + 40P marks)
	DSE3	BIT-HE-6016	Biostatistics	(4+2P) credits (60T + 40P marks)
	DSE4	BIT-HE-6026	Dissertation/ Project	(4+2P) credits (60T + 40P marks)

CONTENT:

BIOCHEMISTRY AND METABOLISM

UNIT I: Introduction to Biochemistry: (20 Periods)

History of biochemistry- from the first enzyme purified to the first protein structure elucidated, and seeds of synthetic biology. Acids, bases, weak acids, pH, K_a , biological buffers, biological significance of normality, molarity, osmosis, diffusion and other phenomena involved in maintaining cellular morphology, cellular structure and dimension.

Amino acids & Proteins: Structure & Function. Structure and properties of Amino acids, Types of proteins and their classification, Forces stabilizing protein structure and shape. Different Levels of structural organization of proteins, Protein Purification. Denaturation and renaturation of proteins. Fibrous and globular proteins.

Carbohydrates: Structure, Function and properties of Monosaccharides, Disaccharides and Polysaccharides. Bacterial and fungal cell wall polysaccharides, Glycoprotein's and their biological functions.

UNIT II (10 Periods)

Lipids: Structure and functions –Classification, nomenclature and properties of fatty acids, essential fatty acids. Phospholipids, sphingolipids, glycolipids, cerebrosides, gangliosides, Prostaglandins, Cholesterol.

Nucleic acids: Structure and functions: Nitrogen, physical & chemical properties of Nucleic acids, Nucleosides & Nucleotides, purines & pyrimidines. Double helical model of DNA structure. Forces stabilizing DNA structure. Forms of DNA. DNA denaturation and renaturation. Introduction to nucleic acid metabolism.

UNIT III (15 Periods)

Carbohydrates Metabolism: Reactions, energetics and regulation. Glycolysis: Fate of pyruvate under aerobic and anaerobic conditions. Pentose phosphate pathway, Gluconeogenesis, Glycogenolysis and

glycogen synthesis. TCA cycle, Electron Transport Chain, Oxidative phosphorylation. β -oxidation of fatty acids.

UNIT IV

(15 periods)

Bioenergetics and thermodynamics, Laws of thermodynamics and biology, concepts of free energy, Gibb's free energy, entropy, phosphoryl group transfer and ATP synthesis, oxidation and reduction reactions in biology: Photosynthetic electron transfer, Calvin cycle, TCA cycle, electron transfer chain (oxidative phosphorylation). Reducing and oxidising agents (oxidants and antioxidants), and free radicals in biology.

PRACTICALS

1. Preparation of buffers.
2. Principles of Colorimetry:
 - a. Verification of Beer's law, estimation of protein.
 - b. To study relation between absorbance and % transmission.
3. Concept of standard curve, preparation of standard curve of Glucose.
4. Estimation of blood glucose by glucose oxidase method.
5. Quantification of proteins, carbohydrates and fats.
6. To study activity of any enzyme under optimum conditions.
7. To study the effect of pH, temperature on the activity of salivary amylase enzyme.
8. Separation of Amino acids by paper chromatography/TLC

SUGGESTED READING

1. Berg, J. M., Tymoczko, J. L. and Stryer, L. (2006). Biochemistry. VI Edition. W.H Freeman and Co.
2. Buchanan, B., Gruissem, W. and Jones, R. (2000) Biochemistry and Molecular Biology of Plants. American Society of Plant Biologists.
3. Nelson, D.L., Cox, M.M. (2004) Lehninger Principles of Biochemistry, 4th Edition, WH Freeman and Company, New York, USA.
4. Hopkins, W.G. and Huner, P.A. (2008) Introduction to Plant Physiology. John Wiley and Sons.
5. Salisbury, F.B. and Ross, C.W. (1991) Plant Physiology, Wadsworth Publishing Co. Ltd.

Contact person: Dr Mohammad Imtiyaj Khan, 9844162330, imtiyaj@gauhati.ac.in.

CELL BIOLOGY

UNIT I

(10 Periods)

Cell: Introduction and classification of organisms by cell structure, compartmentalization of eukaryotic cells, cell fractionation. Cell Membrane, its organization (Fluid Mosaic Model) and permeability, membrane as a dynamic entity, and transport across the membrane. An insight into the organization of the trans-membrane proteins.

UNIT II

(15 Periods)

Membrane Vacuolar system, cytoskeleton, cytoplasmic streaming and cell motility: Structure and function of microtubules, Microfilaments, Intermediate filaments.

Endoplasmic reticulum: Structure, function including role in protein segregation. Golgi complex: Structure, biogenesis and functions including role in protein secretion.

UNIT III

(15 Periods)

Lysosomes: Vacuoles and microbodies: Structure and functions Ribosomes: Structures and function. Mitochondria: Structure and function, Genomes, biogenesis. Chloroplasts: Structure and function, genomes, biogenesis

UNIT IV

(10 Periods)

Nucleus: Structure and function, chromosomes and their structure.

UNIT IV

(10 Periods)

Extracellular Matrix: Composition, molecules that mediate cell adhesion, membrane receptors, receptor ligand interactions and their function. Signal transduction- basic concept. Basics of apoptosis.

PRACTICALS

1. Demonstration of dialysis/plasmolysis/de-plasmolysis and the effect of temperature and organic solvents on semi permeable membrane.
2. Demonstration of different stages of mitosis in onion root tip.
3. Study of structure of any phytoplankton, zooplankton, diatom, blue green algae, algae and yeast.
4. Microtomy: Fixation, block making, section cutting, staining of animal tissues/plant tissue.
5. Preparation of Nuclear, Mitochondrial & cytoplasmic fractions.

SUGGESTED READING

1. Karp, G. 2010. Cell and Molecular Biology: Concepts and Experiments. 6th Edition. John Wiley & Sons. Inc.

2. De Robertis, E.D.P. and De Robertis, E.M.F. 2006. Cell and Molecular Biology. 8th edition. Lippincott Williams and Wilkins, Philadelphia.
3. Cooper, G.M. and Hausman, R.E. 2009. The Cell: A Molecular Approach. 5th edition. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.
4. Becker, W.M., Kleinsmith, L.J., Hardin, J. and Bertoni, G. P. 2009. The World of the Cell. 7th edition. Pearson Benjamin Cummings Publishing, San Francisco.
5. T. Devasena 2012. Cell Biology. Oxford University Press.

Contact person: Debasish Borbora, debasish.borbora@gauhati.ac.in (9577472620)

BIOTECHNOLOGY AND HUMAN WELFARE

UNIT I (10 Periods)

Protein engineering for industry: food, pharmaceutical, beverage, tanning and textile.

UNIT II (10 Periods)

N₂ fixing microbes for sustainable agriculture. Plant-microbe interaction, stress response in plants, qualitative improvement of livestock.

UNIT III (15 Periods)

Polyaromatic hydrocarbons, polycyclic biphenyls, non-chlorinated organic pollutants, biodegradation, bioremediation, degradation of hydrocarbons and agricultural wastes, bioplastics, biopolymers and biosurfactants.

UNIT IV (12 Periods)

Biotechnology in forensic science, criminology, paternity determination using various methods of DNA finger printing.

UNIT V (13 Periods)

Biotechnology in modern medicine- overview, therapeutic agents, vaccines, gene therapy, diagnostics, monoclonal antibodies, anti-venoms and chemotherapeutic agents.

PRACTICALS

(Wherever wet lab experiments are not possible the principles and concepts can be demonstrated through any other material or medium including videos/virtual labs etc.)

1. Ethanolic fermentation using yeast.
2. Isolation of *Rhizobium*/*Azotobacter*/*Azospirillum*, etc from soil/plant parts.
3. Microscopic observation of infected plant parts (sugarcane/rice/brinjal/legumes).
4. Estimation of residual halogens (chlorine/fluorine) in waste water/effluent.
5. Human DNA isolation from buccal swab/hair/urine using isolation kit.
6. visit to advanced laboratory/Universities.

SUGGESTED READING

1. Sateesh MK (2010) Bioethics and Biosafety, I. K. International Pvt Ltd.
2. Sree Krishna V (2007) Bioethics and Biosafety in Biotechnology, New age international

Publishers

Contact person: Dr. Sujoy Bose, Department of Biotechnology, GU

SEMESTER II
MAMMALIAN PHYSIOLOGY

UNIT I: Digestion and Respiration **(15 Periods)**

Digestion: Mechanism of digestion & absorption of carbohydrates, Proteins, Lipids and nucleic acids. Composition of bile, Saliva, Pancreatic, gastric and intestinal juice

Respiration: Exchange of gases, Transport of O₂ and CO₂, Oxygen dissociation curve, Chloride shift.

UNIT II: Circulation **(15 Periods)**

Composition of blood, Plasma proteins & their role, blood cells, Haemopoiesis, Mechanism of coagulation of blood. Mechanism of working of heart: Cardiac output, cardiac cycle, Origin & conduction of heart beat.

UNIT III: Muscle physiology and osmoregulation **(15 Periods)**

Structure of cardiac, smooth & skeletal muscle, threshold stimulus, All or None rule, single muscle twitch, muscle tone, isotonic and isometric contraction, Physical, chemical & electrical events of mechanism of muscle contraction.

Excretion: modes of excretion, Ornithine cycle, Mechanism of urine formation.

UNIT IV: Nervous and endocrine coordination **(15 Periods)**

Mechanism of generation & propagation of nerve impulse, structure of synapse, synaptic conduction, saltatory conduction, Neurotransmitters. Mechanism of action of hormones (insulin and steroids)

Different endocrine glands- Hypothalamus, pituitary, pineal, thymus, thyroid, parathyroid and adrenals, hypo & hyper-secretions.

PRACTICALS

1. Finding the coagulation time of blood
2. Determination of blood groups
3. Counting of mammalian RBCs
4. Determination of TLC and DLC
5. Demonstration of action of an enzyme
6. Determination of Haemoglobin

SUGGESTED READING

1. Guyton, A.C. & Hall, J.E. (2006). Textbook of Medical Physiology. XI Edition. Herculourt Asia

PTE Ltd. /W.B. Saunders Company.

2. Tortora, G.J. & Grabowski, S. (2006). Principles of Anatomy & Physiology. XI Edition. John Wiley & sons, Inc.

Contact person: Dr. Sujoy Bose, Department of Biotechnology, GU

PLANT ANATOMY AND PHYSIOLOGY

UNIT I: Anatomy

(10 Periods)

The shoot and root apical meristem and its histological organization, simple & complex permanent tissues, primary structure of shoot & root, secondary growth, growth rings, leaf anatomy (dorsi-ventral and isobilateral leaf)

UNIT II: Plant water relations and micro & macro nutrients

(12 Periods)

Plant water relations: Importance of water to plant life, diffusion, osmosis, plasmolysis, imbibition, guttation, transpiration, stomata & their mechanism of opening & closing.

Micro & macro nutrients: criteria for identification of essentiality of nutrients, roles and deficiency systems of nutrients, mechanism of uptake of nutrients, mechanism of food transport

UNIT III: Carbon and nitrogen metabolism

(20 Periods)

Photosynthesis- Photosynthesis pigments, concept of two photo systems, photophosphorylation, calvin cycle, CAM plants, photorespiration, compensation point

Nitrogen metabolism- inorganic & molecular nitrogen fixation, nitrate reduction and ammonium assimilation in plants.

UNIT IV: Growth and development

(18 Periods)

Growth and development: Definitions, phases of growth, growth curve, growth hormones (auxins, gibberellins, cytokinins, abscisic acid, ethylene)

Physiological role and mode of action, seed dormancy and seed germination, concept of photoperiodism and vernalization

PRACTICALS

1. Preparation of stained mounts of anatomy of monocot and dicot's root, stem & leaf.
2. Study of stomatal distribution/Index in different leaves.
3. Demonstration of opening & closing of stomata
4. Demonstration of guttation on leaf of any plant.
5. Separation of photosynthetic pigments by paper chromatography.
6. Demonstration of aerobic respiration.
7. Study of root nodules.

SUGGESTED READING

1. Dickinson, W.C. 2000 Integrative Plant Anatomy. Harcourt Academic Press, USA.
2. Esau, K. 1977 Anatomy of Seed Plants. Wiley Publishers.
3. Fahh, A. 1974 Plant Anatomy. Pergmon Press, USA and UK.
4. Hopkins, W.G. and Huner, P.A. 2008 Introduction to Plant Physiology. John Wiley and Sons.
5. Mauseth, J.D. 1988 Plant Anatomy. The Benjamin/Cummings Publisher, USA.
6. Nelson, D.L., Cox, M.M. 2004 Lehninger Principles of Biochemistry, 4th edition, W.H. Freeman and Company, New York, USA.
7. Salisbury, F.B. and Ross, C.W. 1991 Plant Physiology, Wadsworth Publishing Co. Ltd.

8. Taiz, L. and Zeiger, E. 2006 Plant Physiology, 4th edition, Sinauer Associates Inc .MA, USA

Contact person: Dr. Pranjan Barman, Department of Biotechnology, GU, pranjan.barman@gauhati.ac.in.

(Call +91 9859947743)

DEVELOPMENTAL BIOLOGY

5 credit (L) + 1 T

UNIT I: Gametogenesis and Fertilization

(10 Periods)

Definition, scope & historical perspective of development Biology, Gametogenesis, Spermatogenesis, Oogenesis, Differentiation of eggs, spermatogenesis, Definition, mechanism, types of fertilization. Different types of eggs on the basis of yolk.

UNIT II: Early embryonic development

(20 Periods)

Cleavage: Definition, types, patterns & mechanism Blastulation: Process, types & mechanism Gastrulation: Morphogenetic movements– epiboly, emboly, extension, invagination, convergence, de-lamination. Formation & differentiation of primary germ layers, Fate Maps in early embryos.

UNIT III: Embryonic Differentiation

(20 Periods)

Differentiation: Cell commitment and determination- the epigenetic landscape: a model of determination and differentiation, control of differentiation at the level of genome, transcription and post-translation level Concept of embryonic induction: Primary, secondary & tertiary embryonic induction, Neural induction and induction of vertebrate lens.

UNIT IV: Organogenesis

(10 Periods)

Neurulation, notogenesis, development of vertebrate eye. Fate of different primary germ layers Development of behaviour: constancy & plasticity, Extra embryonic membranes, placenta in Mammals.

TUTORIALS:

SUGGESTED READING

1. Gilbert, S. F. (2006). Developmental Biology, VIII Edition, Sinauer Associates, Inc., Publishers, Sunderland, Massachusetts, USA.
2. Balinsky, B.I. (2008). An introduction to Embryology, International Thomson Computer Press.
3. Kalthoff, (2000). Analysis of Biological Development, II Edition, McGraw-Hill Professional.

Contact person: Dr. Sujoy Bose, Department of Biotechnology, GU

SEMESTER III

GENETICS

UNIT I

(12 Periods)

Introduction: Historical developments in the field of genetics. Organisms suitable for genetic experimentation and their genetic significance. Cell Cycle: Mitosis and Meiosis: Control points in cell-cycle progression in yeast and *Drosophila*. Role of meiosis in life cycles of organisms.

Mendelian genetics : Experimental design, monohybrid, di-hybrid and tri hybrid crosses, Law of segregation, Principle of independent assortment. Verification of segregates by test and back crosses, Chromosomal theory of inheritance, Allelic interactions: Concept of dominance, recessiveness, incomplete dominance, co-dominance, pleiotropy, multiple allele, pseudo-allele, essential and lethal genes,

UNIT II

(18 Periods)

Non allelic interactions: Complementary genes, epistasis (dominant & recessive), duplicate and inhibitory genes. Chromosome and genomic organization: Eukaryotic nuclear genome nucleotide sequence composition –unique & repetitive DNA, satellite DNA. Centromere and telomere DNA sequences, middle repetitive sequences- VNTRs & dinucleotide repeats, repetitive transposed sequences- SINES & LINES, middle repetitive multiple copy genes, noncoding DNA. Genetic organization of prokaryotic and viral genome. Structure and characteristics of bacterial and eukaryotic chromosome, chromosome morphology, concept of euchromatin and heterochromatin. Packaging of DNA molecule into chromosomes, chromosome banding pattern, karyotype, giant chromosomes, one gene one polypeptide hypothesis, concept of cistron, exons, introns, genetic code, gene function.

UNIT III

(15 Periods)

Chromosome and gene mutations: Definition and types of mutations, causes of mutations, Ames test for mutagenic agents, screening procedures for isolation of mutants and uses of mutants, variations in chromosomes structure - deletion, duplication, inversion and translocation (reciprocal and Robertsonian), position effects of gene expression, chromosomal aberrations in human beings, abnormalities– Aneuploidy and Euploidy. Sex determination and sex linkage: Mechanisms of sex determination, Environmental factors and sex determination, sex differentiation, Barr bodies, dosage compensation, genetic balance theory, Fragile-X-syndrome and chromosome, sex influenced dominance, sex limited gene expression, sex linked inheritance.

UNIT IV

(15 Periods)

Genetic linkage, crossing over and chromosome mapping: Linkage and Recombination of genes in a chromosome crossing over, Cytological basis of crossing over, Molecular mechanism of crossing over, Crossing over at four strand stage, Multiple crossing overs Genetic mapping. Extra chromosomal inheritance: Extra nuclear inheritance, maternal effects, maternal inheritance, cytoplasmic inheritance, organelle heredity, genomic imprinting. Evolution and population genetics: In breeding and out breeding, Hardy Weinberg law (prediction, derivation), allelic and genotype frequencies, changes in allelic frequencies, systems of mating, evolutionary genetics, natural selection.

PRACTICALS

1. Permanent and temporary mount of mitosis.
2. Permanent and temporary mount of meiosis.
3. Mendelian deviations in dihybrid crosses
4. Demonstration of - Barr Body -*Rhoeo* translocation.
5. Karyotyping with the help of photographs
6. Pedigree charts of some common characters like blood group, color blindness and PTC tasting.
7. Study of polyploidy in onion root tip by colchicine treatment.

SUGGESTED READING

1. Gardner, E.J., Simmons, M.J., Snustad, D.P. (2006). Principles of Genetics. VIII Edition John Wiley & Sons.

2. Snustad, D.P., Simmons, M.J. (2009). Principles of Genetics. V Edition. John Wiley and Sons Inc.
3. Klug, W.S., Cummings, M.R., Spencer, C.A. (2009). Concepts of Genetics. IX Edition. Benjamin Cummings.
4. Russell, P. J. (2009). Genetics- A Molecular Approach. III Edition. Benjamin Cummings.
5. Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C. and Carroll, S.B. IX Edition. Introduction to Genetic Analysis, W. H. Freeman & Co.

Contact person: H.K. Sarma, Department of Biotechnology, GU

GENERAL MICROBIOLOGY

UNIT I

(15 Periods)

An introduction to microbiology and its underlying principles

Functional morphology of the microbial cell - Bacteria, Algae, Fungi, Protozoa, and viruses. Classification of microorganisms, Microbial taxonomy –principles and techniques including molecular approaches, Classification of bacteria - An introduction to Bergey's Manual of Systematic Bacteriology. Extremophiles.

UNIT II

(5 Periods)

Microbial nutrition, nutritional categories, methods of isolation and preservation

UNIT III

(20 Periods)

Microbial growth: Growth curve, Generation time, synchronous batch and continuous culture, measurement of growth and factors affecting the growth of bacteria.

Microbial Metabolism: Autotrophic, heterotrophic, mixotrophic, lithotrophic, organotrophic, chemotrophic and phototrophic. Bacterial Reproduction: Transformation, transduction, and conjugation. Endospores and sporulation in bacteria.

UNIT IV

(20 Periods)

Physical and chemical control of microorganisms.

Water Microbiology: Bacterial pollutants of water, coliforms, and non-coliforms.

Food Microbiology: Important microorganism in food Microbiology: Moulds, Yeasts, bacteria. Major foodborne infections and intoxications, an introduction to microbial food fermentation, food preservation.

PRACTICALS

1. Preparation of media & sterilization methods.
2. Isolation of bacteria & fungi and their biochemical characterization.
2. Staining methods: simple staining, Gram staining, fungal staining, spore staining, negative staining.

4. Determination of bacterial cell size by micrometry and bacterial cell count by haemocytometer.
5. Enumeration of microorganism - total & viable count.
6. Isolation of bacteriophages from sewage.

SUGGESTED READING

1. Alexopoulos CJ, Mims CW, and Blackwell M. (1996). *Introductory Mycology*. 4 th edition. John and Sons, Inc.
2. Jay JM, Loessner MJ and Golden DA. (2005). *Modern Food Microbiology*. 7th edition, CBS Publishers and Distributors, Delhi, India.
3. Kumar HD. (1990). *Introductory Phycology*. 2nd edition. Affiliated East Western Press.
4. Madigan MT, Martinko JM and Parker J. (2009). *Brock Biology of Microorganisms*. 12th edition. Pearson/Benjamin Cummings.
5. Pelczar MJ, Chan ECS and Krieg NR. (1993). *Microbiology*. 5th edition. McGraw Hill Book Company.
6. Stanier RY, Ingraham JL, Wheelis ML, and Painter PR. (2005). *General Microbiology*. 5th edition. McMillan.
7. Tortora GJ, Funke BR, and Case CL. (2008). *Microbiology: An Introduction*. 9 th edition. Pearson Education.
8. Willey JM, Sherwood LM, and Woolverton CJ. (2008). *Prescott, Harley and Klein's Microbiology*. 7th edition. McGraw Hill Higher Education.

Contact person: Dr. Debasish Borbora, Department of Biotechnology, GU

ENZYMOLOGY

UNIT – I

(15 Periods)

Enzymes: Nomenclature and classification of Enzymes, Holoenzyme, apoenzyme, Cofactors, coenzyme, prosthetic groups, metalloenzymes, monomeric & oligomeric enzymes, activation energy and transition state, complementarity, enzyme activity, Michaelis-Menten hypothesis, and Lineweaver Burke plot, specific activity, and common features of active sites.

Enzyme specificity: types & theories, Biocatalysts from extreme thermophilic and hyperthermophilic archaea and bacteria. Role of: NAD⁺, NADP⁺, FMN/FAD, coenzymes A, Thiamine pyrophosphate, Pyridoxal phosphate, lipoic-acid, Biotin vitamin B12, Tetrahydrofolate and metallic ions

UNIT - II

(15 Periods)

Isolation, crystallization and purification of enzymes, test of homogeneity of enzyme preparation, methods of enzyme analysis.

Enzyme classification (rationale, overview and specific examples) Zymogens and their activation (Proteases and Prothrombin).

Enzyme substrate complex: concept of E-S complex, binding sites, active site, specificity, Kinetics of enzyme activity, Michaelis-Menten equation and its derivation,

Different plots for the determination of K_m and V_{max} and their physiological significance, factors affecting initial rate, E, S, temp. & pH. Collision and transition state theories, Significance of activation energy and free energy.

UNIT - III

(15 Periods)

Two substrate reactions (Random, ordered and ping-pong mechanism). Enzyme inhibition and types of inhibition, determination of K_i , suicide inhibitor.

Mechanism of enzyme action: General mechanistic principle, factors associated with catalytic efficiency: proximity, orientation, distortion of strain, acid-base, nucleophilic and covalent catalysis. Techniques for studying mechanisms of action, chemical modification of active site groups, specific examples:- chymotrypsin, lysozyme, GPDH, aldolase, RNase, Carboxypeptidase and alcohol dehydrogenase.

Enzyme regulation: Product inhibition, feed backcontrol, covalent modification.

UNIT - IV

(12 Periods)

Allosteric enzymes with special reference to aspartate transcarbamylase and phosphofructokinase. Models of Allosteric enzymes. Negative cooperativity and half site reactivity. Macromolecular interaction: Enzyme interaction, Protein ligand binding, cooperativity, Hill and scatchard plots, kinetics of allosteric enzymes. Isoenzymes- types and significance with special reference to lactate dehydrogenase. Multienzyme complexes. Ribozymes. Abzymes. Multifunctional enzyme-eg Pyruvate dehydrogenase complex.

UNIT - IV

(8 Periods)

Enzyme Technology: Methods for large scale production of enzymes.

Immobilized enzyme and their comparison with soluble enzymes, Methods for immobilization of enzymes. Basic kinetics of immobilized enzymes.

PRACTICALS

1. Purification of an enzyme from any natural resource.
2. Quantitative estimation of proteins by Bradford/Lowry's method.
3. Perform assay for the purified enzyme.
4. Determination of - pH optima, temperature optima, K_m value, V_{max} value, Effect of inhibitor (Inorganic phosphate) on the enzyme activity.

SUGGESTED READING

1. Biochemistry, Lubert Stryer, 6th Edition, WH Freeman, 2006.
2. Harper's illustrated Biochemistry by Robert K. Murray, David A Bender, Kathleen M.Botham, Peter J. Kennelly, Victor W. Rodwell, P. Anthony Weil. 28th Edition, McGrawHill, 2009.
3. Biochemistry, Donald Voet and Judith Voet, 2nd Edition, Publisher: John Wiley andSons, 1995.
4. Biochemistry by Mary K.Campbell & Shawn O.Farrell, 5th Edition, Cenage Learning,2005.
5. Fundamentals of Enzymology Nicholas Price and Lewis Stevens Oxford University Press 1999

6. Fundamentals of Enzyme Kinetics Athel Cornish-Bowden Portland Press 2004
7. Practical Enzymology Hans Bisswanger Wiley–VCH 2004
8. The Organic Chemistry of Enzyme-catalyzed Reactions Richard B. Silverman Academic Press 2002

Contact person: Dr Mohammad Imtiyaj Khan, Department of Biotechnology, Gauhati University. 9844162330, imtiyaj@gauhati.ac.in.

BIOETHICS AND BIOSAFETYUNIT

UNIT- I: **(20 Periods)**
Introduction to Indian Patent Law. World Trade Organization and its related intellectual property provisions. Intellectual/Industrial property and its legal protection in research, design and development. Patenting in Biotechnology, economic, ethical and depository considerations.

UNIT II **(15 Periods)**
Bioethics – Necessity of Bioethics, different paradigms of Bioethics – National & International. Ethical issues against the molecular technologies.

UNIT IV **(15 Periods)**
Biosafety– Introduction to biosafety and health hazards concerning biotechnology. Introduction to the concept of containment level, Concept of BSL and Good Laboratory Practices (GLP) and Good Manufacturing Practices (GMP).to the concept of containment level and Good Laboratory Practices (GLP) and Good Manufacturing Practices (GMP).

PRACTICALS

1. Proxy filing of Indian Product patent
2. Proxy filing of Indian Process patent
3. Planning of establishing a hypothetical biotechnology industry in India
4. A case study on clinical trials of drugs in India with emphasis on ethical issues.
5. Case study on women health ethics.
6. Case study on medical errors and negligence.
7. Case study on handling and disposal of radioactive waste

SUGGESTED READING

1. Entrepreneurship: New Venture Creation : David H. Holt
2. Patterns of Entrepreneurship : Jack M. Kaplan
3. Entrepreneurship and Small Business Management: C.B. Gupta, S.S. Khanka, Sultan Chand & Sons.
4. Sateesh MK (2010) Bioethics and Biosafety, I. K. International Pvt Ltd.
5. Sree Krishna V (2007) Bioethics and Biosafety in Biotechnology, New age international publishers

Contact Person: Dr. H.K. Sarma, Department of Biotechnology. GU

SEMESTER IV MOLECULAR BIOLOGY

UNIT I: DNA structure and replication

(15 Periods)

DNA as genetic material, Structure of DNA, Types of DNA, Replication of DNA in prokaryotes and eukaryotes: Semiconservative nature of DNA replication, Bi-directional replication, DNA polymerases, The replication complex: Pre-priming proteins, primosome, replisome, Rolling circle replication, Unique aspects of eukaryotic chromosome replication, Fidelity of replication.

UNIT II: DNA damage, repair and homologous recombination

(10 Periods)

DNA damage and repair: causes and types of DNA damage, mechanism of DNA repair, base excision repair, nucleotide excision repair, mismatch repair, translation synthesis, Homologous recombination.

UNIT III: Transcription and RNA processing

(17 Periods)

RNA structure and types of RNA, Transcription in prokaryotes: Prokaryotic RNA polymerase, role of sigma factor, promoter, Initiation, elongation and termination of RNA chains
Transcription in eukaryotes: Eukaryotic RNA polymerases, transcription factors, promoters, enhancers, mechanism of transcription initiation, promoter clearance and elongation RNA splicing and processing: processing of pre-mRNA: 5' cap formation, polyadenylation, splicing, rRNA and tRNA splicing.

UNIT IV: Regulation of gene expression and translation

(18 Periods)

Regulation of gene expression in prokaryotes: Operon concept (inducible and repressible system), Genetic code and its characteristics, Prokaryotic and eukaryotic translation: ribosome structure and assembly, Charging of tRNA, aminoacyl tRNA synthetases, Mechanism of initiation, elongation and termination of polypeptides, Posttranslational modifications of proteins.

PRACTICALS

1. Preparation of solutions for Molecular Biology experiments.
2. Isolation of chromosomal DNA from bacterial cells.
3. Isolation of Plasmid DNA by alkaline lysis method
4. Agarose gel electrophoresis of genomic DNA & plasmid DNA
5. Preparation of restriction enzyme digests of DNA samples.

SUGGESTED READING

1. Karp, G. (2010). Cell and Molecular Biology: Concepts and Experiments. VI Edition. John Wiley & Sons. Inc.
2. De Robertis, E.D.P. and De Robertis, E.M.F. (2006). Cell and Molecular Biology. VIII Edition. Lippincott Williams and Wilkins, Philadelphia.
3. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. (2009). The World of the Cell. VII Edition. Pearson Benjamin Cummings Publishing, San Francisco.
4. Watson, J. D., Baker T.A., Bell, S. P., Gann, A., Levine, M., and Losick, R., (2008) Molecular Biology of the Gene (VI Edition.). Cold Spring Harbour Lab. Press, Pearson Pub.

Contact person: Dr. Pranjan Barman, Department of Biotechnology, GU pranjan.barman@gauhati.ac.in
(Call +91 9859947743).

IMMUNOLOGY

UNIT I **(20 Periods)**

Immune Response - An overview, components of mammalian immune system, molecular structure of Immuno-globulins or Antibodies, Humoral & Cellular immune responses, Tlymphocytes & immune response (cytotoxic T-cell, helper T-cell, suppressor T-cells), B-lymphocyte differentiation, Antigens.

UNIT II **(15 Periods)**

Regulation of immunoglobulin gene expression – clonal selection theory, allotypes & idiotypes, allelic exclusion, immunologic memory, heavy chain gene transcription, genetic basis of antibody diversity,

UNIT III **(13 Periods)**

Major Histocompatibility complexes – class I & class II MHC antigens, antigen processing. Immunity to infection, pathogen defense strategies, autoimmune diseases, Immunodeficiency-AIDS. Introduction to HLA system.

UNIT IV **(12 Periods)**

Types of Vaccines & adjuvants, cytokines, passive and active immunization. Introduction to immunodiagnosics –RIA, ELISA. Introduction to basics of plant immune system.

PRACTICALS

1. Differential leucocytes count
2. Total leucocytes count
3. Total RBC count
4. Haemagglutination assay
5. Haemagglutination inhibition assay
6. Separation of serum from blood.
7. ELISA
9. Preparation and quantification of microbial antigen.

SUGGESTED READING

1. Abbas AK, Lichtman AH, Pillai S. (2007). Cellular and Molecular Immunology. 6 th edition Saunders Publication, Philadelphia.
2. Delves P, Martin S, Burton D, Roitt IM. (2006). Roitt's Essential Immunology. 11th edition Wiley-Blackwell Scientific Publication, Oxford.
3. Goldsby RA, Kindt TJ, Osborne BA. (2007). Kuby's Immunology. 6th edition W.H. Freeman and Company, New York.
4. Murphy K, Travers P, Walport M. (2008). Janeway's Immunobiology. 7th edition Garland Science Publishers, New York.
5. Peakman M, and Vergani D. (2009). Basic and Clinical Immunology. 2nd edition Churchill Livingstone Publishers, Edinberg.
7. Richard C and Geiffrey S. (2009). Immunology. 6th edition. Wiley Blackwell Publication.

Contact person: Dr. Sujoy Bose, Department of Biotechnology, GU

INDUSTRIAL FERMENTATIONS

UNIT I

(12 Periods)

Biotechnology and bioprocess engineering – principles and steps involved. Media ingredients for industrial fermentation, media formulation, optimization, and sterilization. Inoculum production for bacterial and fungal processes. Strain development. Fermentation material and energy balance, microbial growth kinetics, growth cycle, batch, fed-batch and continuous fermentation. Aeration (O₂, N₂, CO₂) antifoam and buffers.

UNIT II

(15 Periods)

Microbial products of pharmacological interest, chemotherapeutic products, antibiotics, amino acids, vitamins, steroids and enzymes. Secondary metabolism – its significance and products. Cell immobilization techniques in industrial processing, enzymes in organic synthesis, enzymes in food sciences, textile industries and tanning and leather industries. Production of industrial chemicals viz., acetic acid, propionic acid, butyric acid. Ethanol fermentation and bio-hydrogen. Production of microbial polysaccharides, microbial insecticides, microbial biosurfactants.

UNIT III

(13 Periods)

Downstream processing - Separation characteristics of proteins and enzymes, purification methodologies. Cell disruption methods for intracellular products, homogenization, sonication, enzyme digestion. Distribution of microbial cells, centrifugation, filtration of fermentation broth, ultra-centrifugation, Supercritical fluid extraction, liquid extraction, ion-exchange recovery, precipitation, distillation, drying of biological products. Product recovery and yield.

UNIT IV

(20 Periods)

Rate equations for enzyme kinetics, simple and complex reactions. Mathematical derivation of growth kinetics, batch and continuous culture operations. Basic design of a fermenter, aseptic operation and containment, agitator and sparger design, and baffles. Process parameters, measurement of temperature, pressure, pH, dissolved oxygen, foaming, and flow rate of liquids and gases. Types of fermenters, Single stage Continuously Stirred Tank Reactor, bubble column, airlift, packed bed, fluidized bed, membrane type, solid state and photobioreactors.

PRACTICALS

1. Isolation of industrially important microorganisms
2. Production of Industrially important Enzyme by submerged fermentation (Lab scale)
3. Production of Industrially important Enzyme by solid state fermentation
4. Study of Microbial Growth Kinetics
5. Production of alcohol by viable yeast cells
6. Cell disruption by ultrasonication.
7. Soxhlet extraction of plant metabolites and usage of flash evaporator.

SUGGESTED READING

1. Casida LE. (1991). Industrial Microbiology. 1st edition. Wiley Eastern Limited.
2. Crueger W and Crueger A. (2000). Biotechnology: A textbook of Industrial Microbiology. 2nd edition. Panima Publishing Co. New Delhi.

3. Stanbury PF, Whitaker A and Hall SJ. (2006). Principles of Fermentation Technology. 2nd edition, Elsevier Science Ltd.
4. Salisbury, Whitaker and Hall. Principles of fermentation Technology,
5. Bioprocess Engineering, Basic Concepts, II Ed. Michael L Shuler, Fikret Kargi, Prentice Hall of India pvt. Ltd. 2002.

Contact person – Mr. Debasish Borbora (Debasish.borbora@gauhati.ac.in.) and Dr. Dr H.K. Sarma (hridip@gauhati.ac.in)

ENTREPRENEURSHIP DEVELOPMENT

UNIT I (10 Periods)

Introduction - Meaning, Needs and Importance of Entrepreneurship, Promotion of entrepreneurship, Factors influencing entrepreneurship, Features of a successful Entrepreneurship.

UNIT II (12 Periods)

Establishing an enterprise, Forms of Business Organization, Project Identification, Selection of the product, Project formulation, Assessment of project feasibility. Finance in projects.

UNIT III (15 Periods)

Financing the enterprise, Importance of finance / loans and repayments, Characteristics of finance, Fixed capital management: Sources of fixed capital, working capital its sources and how to move for loans, Inventory direct and indirect raw materials and its management.

UNIT IV (13 Periods)

Marketing management, Meaning and Importance, Marketing-mix, product management – Product line, Product mix, stages of product like cycle, marketing Research and Importance of survey, Physical Distribution and Stock Management.

UNIT V (10 Periods)

Entrepreneurship and international business, Meaning of International business, Selection of a product, Selection of a market for international business, Export financing, Institutional support for exports.

Project Report on a selected product should be prepared and submitted.

SUGGESTED READING

1. Holt DH. Entrepreneurship: New Venture Creation.
2. Kaplan JM Patterns of Entrepreneurship.
3. Gupta CB, Khanka SS. Entrepreneurship and Small Business Management, Sultan Chand & Sons.

Contact person – Mr. Debasish Borbora (Debasish.borbora@gauhati.ac.in.)

SEMESTER -V

BIOPROCESS TECHNOLOGY

UNIT I

(10 Periods)

Introduction to bioprocess technology. Techniques and basic principle components of fermentation technology. Types of microbial fermentation and their uses.

UNIT II

(20 Periods)

Design of bioprocess vessels- Significance of Impeller, Baffles, Sparger; Types of culture/production vessels- Airlift; Cyclone Column; Packed Tower and their application in production processes. Principles of upstream processing – Media preparation, Inocula development and sterilization.

UNIT III

(15 Periods)

Introduction to oxygen requirement in bioprocess; mass transfer coefficient; factors affecting KLa. Bioprocess measurement and control system with special reference to computer aided process control.

UNIT IV

(15 Periods)

Introduction to downstream processing, product recovery and purification. Effluent treatment. Microbial production of ethanol, amylase, lactic acid and Single Cell Proteins.

PRACTICALS

1. Bacterial growth curve.
2. Calculation of thermal death point (TDP) of a microbial sample.
3. Production and analysis of ethanol.
4. Production and analysis of amylase.
5. Production and analysis of lactic acid.
6. Isolation of industrially important microorganism from natural resource.

SUGGESTED READING

1. Casida LE. (1991). Industrial Microbiology. 1st edition. Wiley Eastern Limited.
2. Crueger W and Crueger A. (2000). Biotechnology: A textbook of Industrial Microbiology. 2nd edition. Panima Publishing Co. New Delhi.
3. Patel AH. (1996). Industrial Microbiology. 1st edition, Macmillan India Limited.
4. Stanbury PF, Whitaker A and Hall SJ. (2006). Principles of Fermentation Technology. 2nd edition, Elsevier Science Ltd.

Contact person: Dr H.K. Sarma

RECOMBINANT DNA TECHNOLOGY

UNIT I

(15 Periods)

Molecular tools and applications- restriction enzymes, ligases, polymerases, alkaline phosphatase. Gene Recombination and Gene transfer: Transformation, Episomes, Plasmids and other cloning vectors (Bacteriophage-derived vectors, artificial chromosomes), Microinjection, Electroporation, Ultrasonication, Principle and applications of Polymerase chain reaction (PCR), primer-design, and RT- (Reverse transcription) PCR.

UNIT II**(20 Periods)**

Restriction and modification system, restriction mapping. Southern and Northern hybridization. Preparation and comparison of Genomic and cDNA library, screening of recombinants, reverse transcription, DNA fingerprinting, Applications of Genetic Engineering in animals. Therapeutic products produced by genetic engineering-blood proteins, human hormones, immune modulators and vaccines (one example each).

UNIT III**(10 Periods)**

Random and site-directed mutagenesis: Primer extension and PCR based methods of site directed mutagenesis, Random mutagenesis, Protein engineering concepts and examples (any two).

UNIT IV**(15 Periods)**

Genetic engineering in plants: Strategies for gene transfer to plant cells, Direct DNA transfer to plants, Gene targeting in plants,

PRACTICALS

1. Isolation of chromosomal DNA from plant cells
2. Isolation of chromosomal DNA from *E.coli*
3. Qualitative and quantitative analysis of DNA using spectrophotometer
4. Plasmid DNA isolation
5. Restriction digestion of DNA
6. Making competent cells
7. Demonstration of PCR

SUGGESTED READING

1. Brown TA. (2006). Gene Cloning and DNA Analysis. 5th edition. Blackwell Publishing, Oxford, U.K.
2. Clark DP and Pazdernik NJ. (2009). Biotechnology-Appling the Genetic Revolution. Elsevier Academic Press, USA.
3. Glick, B.R., Pasternak, J.J. (2003). Molecular Biotechnology- Principles and Applications of recombinant DNA. ASM Press, Washington
4. Primrose SB and Twyman RM. (2006). Principles of Gene Manipulation and Genomics, 7th edition. Blackwell Publishing, Oxford, U.K.
5. Sambrook J, Fritsch EF and Maniatis T. (2001). Molecular Cloning-A Laboratory Manual. 3rd edition. Cold Spring Harbor Laboratory Press.

Contact person: Dr. Pranjan Barman, pranjan.barman@gauhati.ac.in (call: +91 9859947743)

BIOINFORMATICS**UNIT I****(10 Periods)**

Basic computer applications in biology, History of Bioinformatics. Sequence Information Sources, EMBL, GENBANK, Entrez, Unigene, Understanding the structure of each source and using it on the web.

UNIT II**(20 Periods)**

Protein Information Sources, PDB, SWISSPROT, TREMBL, Understanding the structure of each source and using it on the web. Introduction of Data Generating Techniques and Bioinformatics problem posed by them- Restriction Digestion, Chromatograms, Blots, PCR,

UNIT III

(20 Periods)

Sequence and Phylogeny analysis, Detecting Open Reading Frames, Outline of sequence Assembly, Mutation/Substitution Matrices, Concept of Homology search, Pairwise Alignments, Introduction to BLAST, using it on the web, Interpreting results, Multiple Sequence Alignment, Phylogenetic Analysis.

UNIT IV

(10 Periods)

Searching Databases: SRS, Entrez, Sequence Similarity Searches-BLAST, FASTA, Data Submission. Genome Annotation: Pattern and repeat finding, Gene identification tools.

PRACTICALS

1. Sequence information resource
2. Understanding and use of various web resources: EMBL, Genbank, Entrez, Unigene, Protein information resource (PIR)
3. Understanding and using: PDB, Swissprot, TREMBL
4. Using various BLAST and interpretation of results.
5. Retrieval of information from nucleotide databases.
6. Sequence alignment using BLAST.
7. Multiple sequence alignment using Clustal W.

SUGGESTED READING

1. Ghosh Z. and Bibekanand M. (2008) Bioinformatics: Principles and Applications. Oxford University Press.
2. Pevsner J. (2009) Bioinformatics and Functional Genomics. II Edition. Wiley-Blackwell.
3. Campbell A. M., Heyer L. J. (2006) Discovering Genomics, Proteomics and Bioinformatics. II Edition. Benjamin Cummings.

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Dr. Pranjan Barman, pranjan.barman@gauhati.ac.in (call +91 9859947743 M)

ECOLOGY AND ENVIRONMENT MANAGEMENT

UNIT-I

(12 Periods)

Scope of Ecology. Development & Evolution of Ecosystem. Principles & Concepts of Ecosystem. Structure and strata of ecosystem. Types of ecosystem including habitats, niche and biomes. Evolution of early life and changes in earth's atmosphere. Whittaker's classification of kingdoms, monera, protists, fungi, plant, and animal kingdoms. Darwin's and Wallace theories of evolution and inheritance.

UNIT II

(20 Periods)

Energy transfer in an Ecosystem. Food chain, food web, Energy budget, Production and decomposition in a system. Ecological efficiencies, trophic structure and energy pyramids, Ecological energetics, principles pertaining to limiting factors, Bio-geochemical cycles (N,C,P cycles). Population ecology – populations and communities, attributes of populations, introduction to Mendelian

and population genetics, Hardy Weinberg's law, genetic drift, gene flow.. Intraspecific interactions, commensalism, mutualism, competition and predation. Species diversity, richness, stability and disturbance.

UNIT-III

(18 Periods)

Aquatic and terrestrial communities; rare communities. Primary and secondary productivity - basic concepts. Primary and secondary ecological succession – water, forests, and lands. Invasive species and control. Adaptation and behaviour under various ecological conditions.

Pollution and environmental health related to soil, water, air, food, pesticides, metals, solvents, radiations, carcinogen, and poisons. Basics of detecting environmental pollutants, indicators of pollution.

UNIT-IV

(10 Periods)

Environmental biotechnology, approaches for the protection and preservation of environment. Bioremediation, waste water management. Analysis of air pollutants and mitigation of greenhouse gases. Estimation of physico-chemical parameters of water and soil quality, BOD, COD, DO, heavy metals and suspended solids. Principle, instrumentation and application of UV spectroscopy, flame spectrometry and atomic absorption spectroscopy.

PRACTICALS

1. Study of all the biotic and abiotic components of any simple ecosystem- natural pond or terrestrial ecosystem.
2. Determination of population density in a terrestrial or plant community and calculation of the Simpson's and Shannon- Weiner diversity index munity.
3. Study of fecundity table of three types of survivorship curves from zooplanktons collected from natural source.
4. Study of the types of soil, their texture by sieve method and rapid tests for –pH, phosphorous, chlorides, nitrates, carbonates and organic carbon
5. Study any five endangered/ threatened species- one from each class of Whittaker's classification.

SUGGESTED READING

1. Chapman, J.L., Reiss, M.J. 1999. Ecology: Principles and applications (2nd edition) Cambridge, University Press.
2. Divan Rosencraz, Environmental laws and policies in India, Oxford Publication.
3. Joseph, B., Environmental studies, Tata Mc Graw Hill.
4. Miller, G.T. 2002. Sustaining the earth, an integrated approach. (5th edition) Books/Cole, Thompson Learning, Inc.
5. Thakur, I S, Environmental Biotechnology, I K Publication.

Contact person –Dr. Dr H.K. Sarma (hridip@gauhati.ac.in)

SEMESTER VI BIO-ANALYTICAL TOOLS

UNIT I

(10 Periods)

Microscopy: Principles and applications of light, Camera lucida, Simple microscopy, phase contrast microscopy, florescence and electron microscopy (TEM and SEM), photomicrography, absorption and emission spectroscopy

UNIT II

(20 Periods)

Spectroscopy: General principles and law of absorption, Types of spectra and their biochemical usefulness, fluorimetry, colorimetry, spectrophotometry (visible, UV, infrared), IR spectroscopy, CD spectroscopy, Mass spectrometry, NMR, X-ray diffraction: Principles and Application.
Centrifugation: Basic principles of sedimentation – Types of centrifuges and their uses –Preparative and Analytical centrifuge, cell fractionation techniques, isolation of sub-cellular organelles and particles.

UNIT III

(10 Periods)

Chromatography: principle of chromatography – Adsorption and Partition Chromatography, Paper chromatography, thin layer chromatography, column chromatography: silica and gel filtration, affinity and ion exchange chromatography, gas chromatography, HPLC.

UNIT IV

(10 Periods)

Electrophoresis: General principles – apparatus, methods and applications. Starch-gel, polyacrylamide gel (native and SDS-PAGE), agarose-gel electrophoresis, pulse field gel electrophoresis, immuno-electrophoresis, isoelectric focusing, Western blotting.

UNIT V

(10 Periods)

Molecular Techniques: PCR, RT-PCR, Gradient PCR, Real Time PCR, DNA Sequencer, DNA Synthesizer. Introduction to Biosensors and Nanotechnology and their applications.

PRACTICAL

1. Native gel electrophoresis of proteins
2. SDS-polyacrylamide slab gel electrophoresis of proteins under reducing conditions.
3. Preparation of the sub-cellular fractions of rat liver cells.
4. Preparation of protoplasts from leaves.
5. Separation of amino acids by paper chromatography.
6. To identify lipids in a given sample by TLC.
7. To verify the validity of Beer's law and determine the molar extinction coefficient of NADH.
8. Gradient PCR

SUGGESTED READING

1. Karp, G. 2010. Cell and Molecular Biology: Concepts and Experiments. 6th Edition. John Wiley & Sons. Inc.
2. De Robertis, E.D.P. and De Robertis, E.M.F. 2006. Cell and Molecular Biology. 8th edition. Lippincott Williams and Wilkins, Philadelphia.
3. Cooper, G.M. and Hausman, R.E. 2009. The Cell: A Molecular Approach. 5th edition. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.
4. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. 2009 The World of the Cell. 7th edition. Pearson Benjamin Cummings Publishing, San Francisco

Contact person: Dr Mohammad Imtiyaj Khan, Department of Biotechnology, Gauhati University. 9844162330, imtiyaj@gauhati.ac.in.

GENOMICS & PROTEOMICS

UNIT I

(15 Periods)

Introduction to Genomics, DNA sequencing methods – manual & automated: Maxam & Gilbert and Sangers method. Pyrosequencing, Genome Sequencing: Shotgun & Hierarchical (clone contig) methods, Computer tools for sequencing projects: Genome sequence assembly software.

UNIT II

(10 Periods)

Managing and Distributing Genome Data: Web based servers and softwares for genome analysis: ENSEMBL, VISTA, UCSC Genome Browser, NCBI genome. Selected Model Organisms' Genomes and Databases.

UNIT III

(20 Periods)

Introduction to protein structure, Chemical properties of proteins. Physical interactions that determine the property of proteins. Short-range interactions, electrostatic forces, van der waal interactions, hydrogen bonds, Hydrophobic interactions. Determination of sizes (Sedimentation analysis, gel filtration, SDS-PAGE), Determination of covalent structures – Edman degradation.

UNIT IV

(15 Periods)

Introduction to Proteomics, Analysis of proteomes. 2D-PAGE. Sample preparation, Solubilisation, reduction, resolution. 2D-PAGE, Mass spectrometry based method.

PRACTICALS

1. Use of SNP databases at NCBI and other sites
2. Use of OMIM database
3. Detection of Open Reading Frames using ORF Finder
4. Proteomics 2D PAGE database
5. Softwares for Protein localization.
6. Hydropathy plots
7. SDS-PAGE

SUGGESTED READING

1. Genes IX by Benjamin Lewin, Johns and Bartlett Publisher, 2006.
2. Modern Biotechnology, 2nd Edition, S.B. Primrose, Blackwell Publishing, 1987.
3. Molecular Biotechnology: Principles and Applications of Recombinant DNA, 4th Edition, B.R. Glick, J.J. Pasternak and C.L. Patten, 2010.
5. Molecular Cloning: A Laboratory Manual (3rd Edition) Sambrook and Russell Vol. I to III, 1989.
6. Principles of Gene Manipulation 6th Edition, S.B.Primrose, R.M.Twyman and R.W. Old. Blackwell Science, 2001.
7. Snustad, D.P., Simmons, M.J. (2009). Principles of Genetics. V Edition. John Wiley and Sons Inc.
3. Klug, W.S., Cummings, M.R., Spencer, C.A. (2009). Concepts of Genetics. IX Edition. Benjamin Cummings.
4. Russell, P. J. (2009). *iGenetics- A Molecular Approach*. III Edition. Benjamin Cummings.
5. Glick, B.R., Pasternak, J.J. (2003). Molecular Biotechnology- Principles and Applications of recombinant DNA. ASM Press, Washington.
6. Pevsner, J. (2009). Bioinformatics and Functional Genomics. II Edition. John Wiley & Sons.

Contact person:

Dr. Pranjan Barman (pranjan.barman@gauhati.ac.in), Call +91 9859947743

BIOSTATISTICS

UNIT I

(12 Periods)

Types of Data, Collection of data; Primary & Secondary data, Classification and Graphical representation of Statistical data. Measures of central tendency and Dispersion. Measures of Skewness and Kurtosis.

UNIT II

(18 Periods)

Probability classical & axiomatic definition of probability, Theorems on total and compound probability), Elementary ideas of Binomial, Poisson and Normal distributions.

UNIT III

(18 Periods)

Methods of sampling, confidence level, critical region, testing of hypothesis and standard error, large sample test and small sample test. Problems on test of significance, t-test, chi-square test for goodness of fit and analysis of variance (ANOVA)

UNIT IV

(12 Periods)

Correlation and Regression. Emphasis on examples from Biological Sciences.

PRACTICALS

1. Based on graphical Representation
2. Based on measures of Central Tendency & Dispersion
3. Based on Distributions Binomial Poisson Normal
4. Based on t, f, z and Chi-square

SUGGESTED READING

1. Le CT (2003) Introductory biostatistics. 1st edition, John Wiley, USA
2. Glaser AN (2001) High Yield™ Biostatistics. Lippincott Williams and Wilkins, USA
3. Edmondson A and Druce D (1996) Advanced Biology Statistics, Oxford University Press.
4. Danial W (2004) Biostatistics : A foundation for Analysis in Health Sciences, John Wiley and Sons Inc.

Contact person –Dr. Dr H.K. Sarma (hridip@gauhati.ac.in), Dr S.S. Swargiary (swargiary.ss77@gauhati.ac.in)

DR S.S. SWARGIARY

Important Notes:

1. **Faculty Numbers and Specialization requirements:** For Teaching in B.Sc. (Major/ Regular) in Biotechnology (5 compulsory permanent posts + 1 additional Guest Faculty post as per requirement of the semester)

Post no.	Specialization	Post no.	Specialization
1	Biochemistry & Physiology	4	Bioinformatics & Bioinstrumentation or Biostatistics
2	Molecular Biology & Genetic Engineering	5	Industrial Biotechnology or Plant Biotechnology
3	Microbiology and Immunology		

2. For each core paper, the distribution of marks will be as follow-
- | | |
|-----------|--|
| Theory | : 60 marks (50 final exams + 10 internal assessment) |
| Practical | : 40 mark |

Internal assessment marks should be assessed as follows:

1 (one) Mid Term Examination, Theory papers	: 5 marks
1 (one) Seminar presentation per theory papers	: 3 marks
1 (one) Assignment (in group/ individually)	: 2 marks

3. Practicals will be assessed in the presence of external evaluator (Faculty) from the parent Department of the Affiliating University)
4. Dissertation projects can be done either individually or in groups but has to be done in house.

সন্মান পাঠ্যক্রম
(HONOURS COURSE)

This is approved in the Academic Council held on 08/11/2019

সন্মান পাঠ্যক্রম
(Honours Course)

- গুৱাহাটী বিশ্ববিদ্যালয়ৰ অসমীয়া বিষয়ৰ স্নাতক (সন্মান) পাঠ্যক্রম ৬ টা ষাণ্মাসিকত সম্পন্ন হ'ব।
- প্ৰত্যেক পাঠ্যৰ বাবে (Course) ৬ ক্রেডিট অথবা ৪ ক্রেডিট ধাৰ্য কৰা হৈছে। ৬ ক্রেডিটৰ পাঠ্যৰ বাবে সপ্তাহত ৬ বিদ্যায়তনিক ঘণ্টা আৰু ৪ ক্রেডিটৰ পাঠ্যৰ বাবে ৪ বিদ্যায়তনিক ঘণ্টা নিৰ্দিষ্ট কৰা হৈছে। সপ্তাহটোৰ ৬ ক্রেডিটৰ পাঠ্যত ৫ টা শৈক্ষিকশ্ৰেণী আৰু ১ টা শৈক্ষিক বৈঠক (Tutorial Class) অনুষ্ঠিত হ'ব।

অসমীয়া সন্মান পাঠ্যক্রমৰ পাঠ্য বিভাজন
(Course Structure for BA in Assamese (Honours) under CBCS)
২০১৯

Semester	ধৰণ (Type)	বুনিয়াদী পাঠ্য (Core Course)	সক্ষমতা বিকাশ পাঠ্য (AECC)	দক্ষতা বিকাশ পাঠ্য (SEC)	বিষয় সম্পৰ্কীয় ঐচ্ছিক পাঠ্য (DSE)	বৰ্গীয় ঐচ্ছিক পাঠ্য (GE)
	পুৰণ (Credit)	14 x 6 = 84	2 x 4 = 8	2 x 4 = 8	4 x 6 = 24	4 x 6 = 24
I		ASM-HC-1016 ASM-HC-1026	ASM-AE-1014 / ENG-AE-1014/ Other MIL Communication			ASM-HG- 1016
II		ASM-HC-2016 ASM-HC-2026	ENV-AE-2014			ASM-HG- 2016
III		ASM-HC-3016 ASM-HC-3026 ASM-HC-3036		ASM-SE- 3014		ASM-HG- 3016
IV		ASM-HC-4016 ASM-HC-4026 ASM-HC-4036		ASM-SE- 4014		ASM-HG- 4016
V		ASM-HC-5016 ASM-HC-5026			ASM-HE-5XX6 ASM-HE-5YY6	
VI		ASM-HC-6016 ASM-HC-6026			ASM-HE-6XX6 ASM-HE-6YY6	

নিৰ্দেশনা :

অসমীয়া (সন্মান)ৰ শিক্ষার্থীয়ে অসমীয়া বিষয়ৰ বাহিৰে মহাবিদ্যালয়ত উপলব্ধ অন্য যিকোনো বিষয়ৰ পৰা ঐচ্ছিক বৰ্গীয় পাঠ্য ল'ব পাৰিব।

স্নাতক সন্মান পাঠ্যক্রম (১৪৮ ক্রেডিট)
পাঠ্য তালিকা
(ক) বুনীয়াদী পাঠ্য (Core Course)

ক্রমিক নং	পাঠ্যসংখ্যা	পাঠ্যশীৰ্ষক
1	ASM-HC-1016	অসমীয়া সাহিত্যৰ বুৰঞ্জী (চৰ্যাপদ-শংকৰী যুগ)
2	ASM-HC-1026	অসমীয়া সাহিত্যৰ বুৰঞ্জী (উত্তৰ শংকৰী যুগ-অৰুণোদই যুগ)
3	ASM-HC-2016	ভাষা-বিজ্ঞান পৰিচয়
4	ASM-HC-2026	সাহিত্য-সমালোচনা
5	ASM-HC-3016	অসমীয়া সাহিত্য প্ৰৱেশ
6	ASM-HC-3026	অসমীয়া কবিতাৰ চানেকি
7	ASM-HC-3036	অসমৰ সংস্কৃতি
8	ASM-HC-4016	তুলনামূলক ভাৰতীয় সাহিত্য
9	ASM-HC-4026	অসমীয়া ভাষাৰ সমাহৰণ : আৰ্যভাষা আৰু আৰ্যভিন্নভাষা
10	ASM-HC-4036	অসমীয়া গদ্য সাহিত্য (আৰম্ভণিৰ পৰা অষ্টাদশ শতিকালৈ)
11	ASM-HC-5016	অসমীয়া নাটক আৰু পৰিৱেশন শৈলী
12	ASM-HC-5026	অসমীয়া ব্যাকৰণ
13	ASM-HC-6016	অসমীয়া চুটিগল্প আৰু উপন্যাস
14	ASM-HC-6026	অসমীয়া লিপিৰ ইতিহাস

(খ) বিষয়সম্পৰ্কীয় ঐচ্ছিক পাঠ্য (DSE)

ক্রমিক নং	পাঠ্যসংখ্যা	পাঠ্যশীৰ্ষক
1	ASM-HE-5016	অসমীয়া লোক-সাহিত্য অধ্যয়ন
2	ASM-HE-5026	অসমীয়া বমন্যাসবাদী কবিতা

3	ASM-HE-5036	শংকৰদেৱ
4	ASM-HE-5046	অসমীয়া কল্পবিজ্ঞান সাহিত্য
5	ASM-HE-6016	লক্ষ্মীনাথ বেজবৰুৱা
6	ASM-HE-6026	বাণীকান্ত কাকতি
7	ASM-HE-6036	অসমীয়া শিশু আৰু কিশোৰ সাহিত্য
8	ASM-HE-6046	অসমীয়া ভাষাৰ উপভাষা
9	ASM-HE-6056	প্রকল্প

(গ) দক্ষতা বিকাশ পাঠ্য (SEC)

<u>ক্রমিক নং</u>	<u>পাঠ্যসংখ্যা</u>	<u>পাঠ্যশীৰ্ষক</u>
1	ASM-SE-3014	ব্যৱহাৰিক অসমীয়া
2	ASM-SE-4014	সৃজনীমূলক সাহিত্য

(ঘ) বৰ্গীয় ঐচ্ছিক পাঠ্য (GE)

<u>ক্রমিক নং</u>	<u>পাঠ্যসংখ্যা</u>	<u>পাঠ্যশীৰ্ষক</u>
1	ASM-HG-1016	অসমীয়া ভাষাৰ ইতিহাস
2	ASM-HG-2016	অসমীয়া সাহিত্যৰ ইতিহাস (আৰম্ভণিৰ পৰা অষ্টাদশ শতিকা পৰ্যন্ত)
3	ASM-HG-3016	অসমীয়া নাটক আৰু মঞ্চকলা
4	ASM-HG-4016	আধুনিক অসমীয়া গীতিসাহিত্য

প্ৰথম ষাণ্মাসিক
বুনিয়াদী পাঠ্য
ASM-HC-1016
অসমীয়া সাহিত্যৰ বুৰঞ্জী
(চৰ্যাপদ - শংকৰী যুগ)
মূল্যাংক : ৮০

(উদ্দেশ্য : এই পাঠ্যৰ জৰিয়তে ছাত্ৰ-ছাত্ৰীসকলে অসমীয়া সাহিত্যৰ যুগ বিভাজন সম্পৰ্কত পণ্ডিতসকলৰ মতামত, উমৈহতীয়া সাহিত্যৰ ধাৰণা আৰু ইয়াৰ গুৰুত্বপূৰ্ণ নিদৰ্শন, প্ৰাক্-শংকৰী আৰু শংকৰী যুগৰ প্ৰধান সাহিত্যিকসকলৰ ৰচনাৰ বৈশিষ্ট্য সম্পৰ্কে জানিব পাৰিব।)

প্ৰথম গোট : অসমীয়া সাহিত্যৰ যুগ বিভাগ	২০
দেবেন্দ্ৰ নাথ বেজবৰুৱা, হেমচন্দ্ৰ গোস্বামী, বাণীকান্ত কাকতি, মহেশ্বৰ নেওগ, সত্যেন্দ্ৰনাথ শৰ্মা কৃত অসমীয়া সাহিত্যৰ যুগবিভাজন	
দ্বিতীয় গোট : উদ্ভৱ কালৰ অসমীয়া সাহিত্য	২০
উমৈহতীয়া সাহিত্য: চৰ্যাপদ, ডাকৰ বচন, শ্ৰীকৃষ্ণ কীৰ্তন আৰু শূন্য পুৰাণ	
তৃতীয় গোট : প্ৰাক্-শংকৰী যুগ	২০
পটভূমি, সাধাৰণ বৈশিষ্ট্য, কবিসকল আৰু তেওঁলোকৰ সাহিত্যৰাজি (হেম সৰস্বতী, মাধৱ কন্দলি, হৰিবৰ বিপ্ৰ)	
চতুৰ্থ গোট : শংকৰী যুগ	২০
পটভূমি, সাধাৰণ বৈশিষ্ট্য, বৈষ্ণৱ আৰু পাঁচালী (শংকৰদেৱ, মাধৱদেৱ, ভট্টদেৱ, দুৰ্গাবৰ, সুকবি নাৰায়ণ দেৱ) কবিসকল আৰু তেওঁলোকৰ সাহিত্যকৃতি	

সহায়ক গ্ৰন্থ (নিৰ্বাচিত) :

অসমৰ বৈষ্ণৱ ধৰ্ম আৰু সাহিত্য : কনক চন্দ্ৰ চহৰীয়া
অসমীয়া পাঞ্চালী গীত : নবীন চন্দ্ৰ শৰ্মা
অসমীয়া সাহিত্যৰ চানেকি (প্ৰথম, দ্বিতীয়, তৃতীয় খণ্ড) : হেমচন্দ্ৰ গোস্বামী
অসমীয়া সাহিত্যৰ পূৰ্ণ ইতিহাস : হৰিনাথ শৰ্মা দলৈ
অসমীয়া সাহিত্যৰ বুৰঞ্জী : ডিম্বেশ্বৰ নেওগ
অসমীয়া সাহিত্যৰ বুৰঞ্জী : দেবেন্দ্ৰ নাথ বেজবৰুৱা
অসমীয়া সাহিত্যৰ বুৰঞ্জী (প্ৰথম খণ্ড) : বিশ্বেশ্বৰ হাজৰিকা (সম্পা.)
অসমীয়া সাহিত্যৰ বুৰঞ্জী (দ্বিতীয় খণ্ড) : শিৱনাথ বৰ্মন (সম্পা.)
অসমীয়া সাহিত্যৰ ৰূপৰেখা : মহেশ্বৰ নেওগ
অসমীয়া সাহিত্যৰ সমীক্ষাত্মক ইতিবৃত্ত : সত্যেন্দ্ৰনাথ শৰ্মা
বৈষ্ণৱ যুগৰ অসমীয়া সাহিত্য : ভুবনেশ্বৰী বৈশ্য
মধ্যযুগৰ অসমীয়া ভাষাৰ ৰূপতাত্ত্বিক বিশ্লেষণ : লক্ষী হাজৰিকা
শ্ৰীকৃষ্ণ কীৰ্তন : লীলাৱতী শইকীয়া বৰা (সম্পা.)
Aspects of Early Assamese Literature : Banikanta Kakati (ed.)
Assamese: Its Formation and Development : Banikanta Kakati

বুনিয়াদী পাঠ্য
ASM-HC-1026
অসমীয়া সাহিত্যৰ বুৰঞ্জী
(উত্তৰ-শংকৰী যুগ - অৰুনোদই যুগ)
মূল্যাংক : ৮০

(উদ্দেশ্য : পূৰ্ববৰ্তী পাঠ্যৰ ধাৰাবাহিক স্বৰূপে প্ৰস্তুত কৰা এই পাঠ্যৰ অধ্যয়নৰ যোগেদি ছাত্ৰ-ছাত্ৰীসকলক উত্তৰ শংকৰী যুগ, প্ৰাক্ অৰুনোদই, অৰুনোদই যুগৰ পটভূমিৰ জ্ঞান লভাৰ লগে লগে সেই সেই সময়ছোৱাৰ গুৰুত্বপূৰ্ণ সাহিত্যিকৰ ৰচনাৰ সৈতে পৰিচিত হ'ব।)

প্ৰথম গোট : উত্তৰ-শংকৰী যুগ (সপ্তদশ আৰু অষ্টাদশ শতিকা) :	২০
ঐতিহাসিক আৰু সাহিত্যিক পটভূমি আৰু বৈশিষ্ট্য	
দ্বিতীয় গোট : উত্তৰ-শংকৰী যুগৰ সাহিত্য :	২০
চৰিত সাহিত্য, ব্যৱহাৰিক সাহিত্য আৰু বুৰঞ্জী সাহিত্য	
তৃতীয় গোট : প্ৰাক্-অৰুনোদই আৰু অৰুনোদই যুগ (ঊনবিংশ শতিকা) :	২০
ঐতিহাসিক আৰু সাহিত্যিক পটভূমি আৰু বৈশিষ্ট্য	
চতুৰ্থ গোট : প্ৰাক্-অৰুনোদই আৰু অৰুনোদই যুগৰ সাহিত্য :	২০
মণিৰাম দেৱান, কাশীনাথ তামুলী ফুকন আৰু বিশ্বেশ্বৰ বৈদ্যাপিণ, নাথান ব্ৰাউন, আনন্দৰাম ঢেকিয়াল ফুকন, হেমচন্দ্ৰ বৰুৱাৰ সাহিত্যকৃতি	

সহায়ক গ্ৰন্থ (নিৰ্বাচিত) :

- অৰুনোদই : মহেশ্বৰ নেওগ (সম্পা.)
অসমীয়া সাহিত্যৰ পূৰ্ণ ইতিহাস : হৰিনাথ শৰ্মা দলৈ
অসমীয়া সাহিত্যৰ বুৰঞ্জী : ডিম্বেশ্বৰ নেওগ
অসমীয়া সাহিত্যৰ বুৰঞ্জী (দ্বিতীয় খণ্ড) : শিৱনাথ বৰ্মন (সম্পা.)
অসমীয়া সাহিত্যৰ ৰূপৰেখা : মহেশ্বৰ নেওগ
অসমীয়া সাহিত্যৰ সমীক্ষাত্মক ইতিবৃত্ত : সত্যেন্দ্ৰনাথ শৰ্মা

বৰ্গীয় ঐচ্ছিক পাঠ্য
ASM-HG-1016
অসমীয়া ভাষাৰ ইতিহাস
মূল্যাংক : ৮০

(উদ্দেশ্য : এই পাঠ্যত অসমীয়া ভাষাৰ ক্ৰমবিকাশৰ ধাৰণা বিভিন্ন পাঠৰ জৰিয়তে দিয়া হৈছে।)

প্ৰথম গোট : অসমীয়া ভাষাৰ উদ্ভৱ আৰু যুগবিভাজন	20
দ্বিতীয় গোট: প্ৰাচীন অসমীয়া ভাষাৰ ভাষাগত বৈশিষ্ট্য : চৰ্যাপদ, মাধৱ কন্দলি : ৰামায়ণ, শংকৰদেৱ : দশম	20
তৃতীয় গোট : মধ্যযুগৰ অসমীয়া ভাষাৰ ভাষাগত বৈশিষ্ট্য : বুৰঞ্জী, চৰিত পুথি, মন্ত্ৰ পুথি	20
চতুৰ্থ গোট : আধুনিক অসমীয়া ভাষাৰ ভাষাগত বৈশিষ্ট্য	20
আনন্দৰাম ঢেকিয়াল ফুকন : অচমিয়া লৰাৰ মিত্ৰ হেমচন্দ্ৰ বৰুৱা : আত্মজীৱন চৰিত লক্ষ্মীনাথ বেজবৰুৱা : বুঢ়ী আইৰ সাধু	

সহায়ক গ্ৰন্থ (নিৰ্বাচিত) :

- অসমীয়া কথা সাহিত্য (পুৰণি ভাগ) : বিৰিধিঃ কুমাৰ বৰুৱা
অসমীয়া গদ্য-সাহিত্যৰ গতি-পথ (প্ৰথম খণ্ড) : হৰিনাথ শৰ্মা দলৈ
অসমীয়া ব্যাকৰণ আৰু ভাষাতত্ত্ব : কালিৰাম মেধি
অসমীয়া ভাষাৰ ইতিহাস : ৰমেশ পাঠক
অসমীয়া ভাষাৰ উদ্ভৱ, সমৃদ্ধি আৰু বিকাশ : উপেন্দ্ৰ নাথ গোস্বামী
অসমীয়া ভাষাৰ ৰূপতত্ত্ব : লীলাৱতী শইকীয়া বৰা
আনন্দৰাম ঢেকিয়াল ফুকন : অসমীয়া লৰাৰ মিত্ৰ (দ্বিতীয় আৰু তৃতীয় কাণ্ড) : যোগেন্দ্ৰ নাৰায়ণ ভূঞা (সম্পা.)
উদ্ভৱকালীন অসমীয়া ভাষা : সুবাসনা মহন্ত
বুঢ়ী আইৰ সাধু : লক্ষ্মীনাথ বেজবৰুৱা
মধ্যযুগৰ অসমীয়া ভাষাৰ ব্যাকৰণ : দীপ্তি ফুকন পাটগিৰি
শ্ৰীশ্ৰীশংকৰদেৱ : আদি দশম : নবীন চন্দ্ৰ শৰ্মা (সম্পা.)
স্নাতকৰ কথাবন্ধ : মহেশ্বৰ নেওগ (সম্পা.)
Assamese: Its Formation and Development : Banikanta Kakati
Studies in Assamese Vocabulary : Ramesh Pathak
The Origin and Growth of the Assamese Language : Dimbeswar Neog

দ্বিতীয় ষাণ্মাসিক
বুনিয়াদী পাঠ্য
ASM-HC-2016
ভাষাবিজ্ঞান পৰিচয়
মূল্যাংক : ৮০

(উদ্দেশ্য : এই পাঠ্যৰ জৰিয়তে ছাত্ৰ-ছাত্ৰীয়ে ভাষা-বিজ্ঞানৰ আধাৰত ভাষা বিশ্লেষণৰ বিভিন্ন শাখা, স্তৰ আৰু ধৰণৰ লগতে ভাষা অধ্যয়নৰ ইতিহাসৰ সৈতে পৰিচিত হ'ব।)

প্ৰথম গোট : ভাষাবিজ্ঞানৰ সাধাৰণ পৰিচয়	20
ভাষাবিজ্ঞানৰ সংজ্ঞা, ভাষাবিজ্ঞানৰ লগত ভাষাতত্ত্ব আৰু ব্যাকৰণৰ সম্পৰ্ক	
দ্বিতীয় গোট : ভাষাবিজ্ঞানৰ শাখা-প্ৰশাখা	20
বৰ্ণনাত্মক ভাষাবিজ্ঞান, ঐতিহাসিক ভাষাবিজ্ঞান, তুলনামূলক ভাষাবিজ্ঞান, বিৰোধমূলক ভাষাবিজ্ঞান, সমাজ-ভাষাবিজ্ঞান, মনো-ভাষাবিজ্ঞান, উপভাষাবিজ্ঞান	
তৃতীয় গোট : ভাষাবিজ্ঞানৰ অধ্যয়নৰ স্তৰ	20
ধ্বনিতত্ত্ব, ৰূপতত্ত্ব, শব্দার্থতত্ত্ব, বাক্যতত্ত্ব	
চতুৰ্থ গোট : ভাষা সম্পৰ্কীয় চিন্তা-চৰ্চা আৰু অধ্যয়নৰ ইতিহাস :	20
পাণিনীয় ধাৰা, গ্ৰীক ধাৰা	

সহায়ক গ্ৰন্থ (নিৰ্বাচিত) :

আধুনিক ভাষাবিজ্ঞান পৰিচয় : ফণীন্দ্র নাৰায়ণ দত্তবৰুৱা

ধ্বনি-বিজ্ঞানৰ ভূমিকা : গোলোক চন্দ্ৰ গোস্বামী

ব্যাকৰণ : প্ৰাচ্য আৰু পাশ্চাত্য : খগেশ সেন ডেকা

ভাষা আৰু ভাষা-চিন্তা : নগেন ঠাকুৰ

ভাষা-বিজ্ঞান : উপেন্দ্ৰ নাথ গোস্বামী

ভাষা-বিজ্ঞান প্ৰৱেশ : বসন্ত কুমাৰ ভট্টাচাৰ্য

ভাষা-বিজ্ঞানৰ ভূমিকা : ৰমেশ পাঠক

ভাষাবিজ্ঞানৰ জিলিকনি : প্ৰণীতা দেৱী

ভাষার্থ বিজ্ঞান : ভগৱান মৰল

A Short History of Linguistics : R. H. Robins

Linguistics : David Crystal

বুনিয়াদী পাঠ্য
ASM-HC-2026
সাহিত্য-সমালোচনা
মূল্যাংক : ৮০

(উদ্দেশ্য : এই পাঠ্যই প্ৰাচ্য আৰু পাশ্চাত্য সাহিত্যতত্ত্বৰ কেতবোৰ চৰ্চিত দিশ নতুনকৈ চোৰাত ছাত্ৰ-ছাত্ৰীসকলক সহায় কৰিব।)

প্ৰথম গোট : বস, ধ্বনি, গুণ, ৰীতি : সংজ্ঞা আৰু স্বৰূপ	20
দ্বিতীয় গোট : কবিতাত কল্পনাৰ স্থান, চিত্ৰকল্পবাদ, প্ৰতীকবাদ	20
তৃতীয় গোট : ট্ৰেজেডি, এবছাৰ্ড আৰু ব্ৰেখ্‌টীয় নাট্য ধাৰা	20
চতুৰ্থ গোট : চুটিগল্প আৰু উপন্যাস : ৰূপ-বৈচিত্ৰ্য	20

সহায়ক গ্ৰন্থ (নিৰ্বাচিত) :

আধুনিকতাবাদ আৰু অন্যান্য প্ৰবন্ধ : হৰেকৃষ্ণ ডেকা
উপন্যাস : প্ৰহ্লাদ কুমাৰ বৰুৱা
চুটিগল্প : উদয় দত্ত
ট্ৰেজেডী বিচাৰ : শৈলেন ভৰালী
ধ্বনি আৰু বসতত্ত্ব : মুকুন্দ মাধৱ শৰ্মা
নন্দনতত্ত্ব প্ৰাচ্য আৰু পাশ্চাত্য : ত্ৰৈলোক্যনাথ গোস্বামী
নাটক আৰু অসমীয়া নাটক : শৈলেন ভৰালী
সাহিত্য আলোচনা : ত্ৰৈলোক্যনাথ গোস্বামী
সাহিত্য উপক্ৰমণিকা : মহেন্দ্ৰ বৰা
সাহিত্যৰ তত্ত্ব আৰু প্ৰয়োগ : বিমল মজুমদাৰ
সাহিত্য দৰ্পন : বিশ্বনাৰায়ণ শাস্ত্ৰী
সাহিত্যৰ বাদ-বৈচিত্ৰ্য : নগেন শইকীয়া (সম্পা.)
সাহিত্য বিচাৰ : ৰামমল ঠাকুৰীয়া
সাহিত্য সমালোচনা তত্ত্ব : অঞ্জন কুমাৰ ওজা (সম্পা.)
সাহিত্য : সংজ্ঞা আৰু আংগিক : পৰাগ কুমাৰ ভট্টাচাৰ্য
Romantic Imagination : C. M. Bowra

বৰ্গীয় ঐচ্ছিক পাঠ্য
ASM-HG-2016
অসমীয়া সাহিত্যৰ ইতিহাস
(আৰম্ভণিৰ পৰা অষ্টাদশ শতিকা পৰ্যন্ত)
মূল্যাংক : ৮০

(উদ্দেশ্য : এই পাঠ্যৰ জৰিয়তে ছাত্ৰ-ছাত্ৰীয়ে প্ৰাক্-শংকৰী যুগ, শংকৰী যুগ আৰু উত্তৰ শংকৰী যুগৰ সাহিত্যৰ পটভূমি আৰু বিশিষ্ট সাহিত্য-
কৃতিৰ ধাৰণা লাভ কৰিব।)

প্ৰথম গোট : লোক সাহিত্য	20
সংজ্ঞা, সাধাৰণ বৈশিষ্ট্য : অসমীয়া লোক সাহিত্যৰ শ্ৰেণী বিভাগ আৰু প্ৰতিটো বিভাগৰ আলোচনা	
দ্বিতীয়গোট : প্ৰাক্-শংকৰী যুগৰ সাহিত্য	20
পটভূমি, সাধাৰণ বৈশিষ্ট্য, কবিসকল আৰু তেওঁলোকৰ সাহিত্যৰাজি	
তৃতীয়গোট : শংকৰী যুগৰ সাহিত্য	20
পটভূমি, সাধাৰণ বৈশিষ্ট্য, বৈষ্ণৱ আৰু পাঁচালী কবিসকল আৰু তেওঁলোকৰ সাহিত্যকৃতি	
চতুৰ্থ গোট : উত্তৰ-শংকৰী যুগৰ সাহিত্য	20
পটভূমি, সাধাৰণ বৈশিষ্ট্য: চৰিত সাহিত্য, ব্যৱহাৰিক সাহিত্য আৰু বুৰঞ্জী সাহিত্য	

সহায়ক গ্ৰন্থ (নিৰ্বাচিত) :

অসমৰ বৈষ্ণৱ ধৰ্ম আৰু সাহিত্য : কনক চন্দ্ৰ চহৰীয়া
অসমৰ লোক সাহিত্য : শশী শৰ্মা
অসমীয়া জন সাহিত্য : প্ৰফুল্লদত্ত গোস্বামী
অসমীয়া পাঞ্চালী গীত : নবীন চন্দ্ৰ শৰ্মা
অসমীয়া লোক সাহিত্য : প্ৰহ্লাদ কুমাৰ বৰুৱা (সম্পা.)
অসমীয়া লোক সাহিত্যৰ ৰূপৰেখা : লীলা গগৈ
অসমীয়া সাহিত্যৰ পূৰ্ণ ইতিহাস : হৰিনাথ শৰ্মা দলৈ
অসমীয়া সাহিত্যৰ বুৰঞ্জী : ডিম্বেশ্বৰ নেওগ
অসমীয়া সাহিত্যৰ বুৰঞ্জী (প্ৰথম খণ্ড) : বিশ্বেশ্বৰ হাজৰিকা (সম্পা.)
অসমীয়া সাহিত্যৰ বুৰঞ্জী (দ্বিতীয় খণ্ড) : শিৱনাথ বৰ্মন (সম্পা.)
অসমীয়া সাহিত্যৰ ৰূপৰেখা : মহেশ্বৰ নেওগ
অসমীয়া সাহিত্যৰ সমীক্ষাত্মক ইতিবৃত্ত : সত্যেন্দ্ৰনাথ শৰ্মা
গোৱালপৰীয়া লোকগীত সংগ্ৰহ : বীৰেন্দ্ৰনাথ দত্ত
গোৱালপৰীয়া লোক-সংস্কৃতি আৰু লোকগীত : ধীৰেন দাস
বৈষ্ণৱ যুগৰ অসমীয়া সাহিত্য : ভুবনেশ্বৰী বৈশ্য

তৃতীয় ষাণ্মাসিক
বুনিয়াদী পাঠ্য
ASM-HC-3016
অসমীয়া সাহিত্য-প্ৰৱেশ
মূল্যাংক : ৮০

(উদ্দেশ্য : অসমীয়া সাহিত্যৰ এনে কিছুসংখ্যক সৃজনীমূলক আৰু সমালোচনামূলক লেখা ইয়াত সন্নিবিষ্ট কৰা হৈছে, যিয়ে সাহিত্যৰ
বসাস্বাদনৰ বাট ছাত্ৰ-ছাত্ৰীসকলৰ বাবে মুকলি কৰিব।)

প্ৰথম গোট : সাধুকথা, কবিতা আৰু গল্প

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লক্ষ্মীনাথ বেজবৰুৱা (সংগ্ৰাহক) : চম্পাৰতীৰ সাধু
দেৱকান্ত বৰুৱা : লাচিত বৰফুকন
হেম বৰুৱা : মমতাৰ চিঠি
নৱকান্ত বৰুৱা : এটা প্ৰেমৰ পদ্য
হীৰেন ভট্টাচাৰ্য : শৰ সন্ধান
চৈয়দ আব্দুল মালিক : দুখন ভৰি
মহিম বৰা : টোপ

দ্বিতীয় গোট : প্ৰবন্ধ আৰু সমালোচনা

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সত্যনাথ বৰা : জীৱনৰ অমিয়া
বেণুধৰ শৰ্মা : মকৰা পেস্কাৰ
হীৰেন গোহাঁই : মানুহ শংকৰদেৱ

তৃতীয় গোট : আত্মজীৱনী, জীৱনী আৰু উপন্যাস

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ভবেন্দ্ৰ নাথ শইকীয়া : জীৱন বৃত্ত (প্ৰথম অধ্যায়)
কৃষ্ণকান্ত সন্দিকৈ (আব্দুছ ছাত্তাৰ প্ৰণীত গ্ৰন্থ) : ব্যক্তিগত পুথিভঁৰাল
হোমেন বৰগোহাঞি : সাউদৰ পুতেকে নাও মেলি যায় (দ্বিতীয় অধ্যায়)

চতুৰ্থ গোট : ভ্ৰমণ সাহিত্য আৰু ব্যক্তিগত ৰচনা

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বিৰিঞ্চি কুমাৰ বৰুৱা : কথা চহকী মাৰ্কিন ডেকাৰ সংগসুখ
হেম বৰুৱা : মেকং নৈ দেখিলো (প্ৰথম অধ্যায়)
দেৱব্ৰত দাস : আশা আৰু সান্ত্বনাৰ কথা

সহায়ক গ্ৰন্থ (নিৰ্বাচিত) :

- অসমীয়া চুটি গল্পৰ প্ৰবাহ : লীলাৱতী শইকীয়া বৰা (সম্পা.)
কাঠনিবানী ঘাট : মহিম বৰা
গদ্যৰেখা : অজিত ভৰালী (সম্পা.)
জীৱন বৃত্ত : ভবেন্দ্ৰনাথ শইকীয়া
প্ৰফেছৰ বৰুৱাৰ চিঠি : বিৰিঞ্চি কুমাৰ বৰুৱা
বুঢ়ী আইৰ সাধু : লক্ষ্মীনাথ বেজবৰুৱা (সংগ্ৰাহক)
মেকং নৈ দেখিলো : হেম বৰুৱা
বৰ্মণীয় : নৱকান্ত বৰুৱা
সঞ্চয়ন : মহেশ্বৰ নেওগ (সম্পা.)
সাঁউদৰ পুতেকে নাও মেলি যায় : হোমেন বৰগোহাঞি
সাৰথি : সত্যনাথ বৰা
সাহিত্যৰ অভিব্যক্তি : কামালুদ্দিন আহমেদ
হিয়াৰ পখিলাবোৰ, তৃতীয় খণ্ড : দেৱব্ৰত দাস
হীৰেন গোহাঁই বচনাৱলী ১ : শোণিত বিজয় দাস আৰু মুনীন বায়ন (সম্পা.)

বুনিয়াদী পাঠ্য
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অসমীয়া কবিতাৰ চানেকি
মূল্যাংক : ৮০

(উদ্দেশ্য : এই পাঠ্যই প্ৰাক্শংকৰী, শংকৰী, বমন্যাসিক আৰু আধুনিক কাব্য/কবিতাৰ সৈতে ছাত্ৰ-ছাত্ৰীসকলক পৰিচিত কৰাব।)

প্ৰথম গোট :	মাধৱ কন্দলী :	চিত্ৰকূটৰ চিত্ৰ (ৰামায়ণৰ পৰা)	20
	দুৰ্গাবৰ :	মায়া অযোধ্যাৰ সৃষ্টি আৰু চিত্ৰাৱলী চতুৰ্দশীৰ খেলা	
দ্বিতীয় গোট :	শংকৰদেৱ :	শৰৎ বৰ্ণনা (দশমস্কন্ধ ভাগৱতৰ পৰা)	20
	ৰাম সৰস্বতী :	দ্রৌপদীৰ বিলাপ	
তৃতীয় গোট :	চন্দ্ৰকুমাৰ আগৰৱালা :	প্ৰকৃতি	20
	ৰঘুনাথ চৌধাৰী :	অন্তিম জ্যোতি	
	দেৱকান্ত বৰুৱা :	মনোৰমা	
চতুৰ্থ গোট :	নৱকান্ত বৰুৱা :	পলস	20
	অজিত বৰুৱা :	আজি আকৌ মেজাংকৰিৰ এঙাচোলা পিন্ধি	
	নীলমণি ফুকন :	ব্ৰহ্মপুত্ৰত সূৰ্যাস্ত	

সহায়ক গ্ৰন্থ (নিৰ্বাচিত) :

- অসমীয়া সাহিত্যৰ বুৰঞ্জী (দ্বিতীয় খণ্ড) : শিৱনাথ বৰ্মন (সম্পা.)
অসমীয়া সাহিত্যৰ বুৰঞ্জী (পঞ্চম খণ্ড) : ৰঞ্জিত কুমাৰ দেৱ গোস্বামী (সম্পা.)
অসমীয়া সাহিত্যৰ বুৰঞ্জী (ষষ্ঠ খণ্ড) : হোমেন বৰগোহাঞি (সম্পা.)
আধুনিক অসমীয়া কবিতা : কামালুদ্দিন আহমেদ
আধুনিক কবিতা : হৰেকৃষ্ণ ডেকা
কবিতা মঞ্জৰী : নিৰ্মলপ্ৰভা বৰদলৈ (সম্পা.)
যোৱা শতিকাৰ কবিতা অসমীয়া নৱন্যাসী সাহিত্যৰ পৰম্পৰা : দিলীপ বৰুৱা

বুনিয়াদী পাঠ্য
ASM-HC-3036

অসমৰ সংস্কৃতি

মূল্যাংক : ৮০

(উদ্দেশ্য : এই পাঠ্যৰ জৰিয়তে অসমৰ সংস্কৃতিৰ লোকাচাৰ, ধৰ্মীয় পৰম্পৰা, উৎসৱ-পাৰ্বন, পৰিবেশ্য কলা, স্থাপত্য-ভাস্কৰ্য-চিত্ৰকলাৰ জ্ঞান লভাৰ লগতে বৃহত্তৰ অসমীয়া জাতি গঠন প্ৰক্ৰিয়াৰ আভাস পাব।)

প্ৰথম গোট	: সংস্কৃতিৰ সংজ্ঞা আৰু স্বৰূপ আৰু বৃহত্তৰ অসমীয়া জাতি গঠন প্ৰক্ৰিয়া	20
দ্বিতীয় গোট	: সামাজিক লোকাচাৰ, ধৰ্মীয় পৰম্পৰা আৰু উৎসৱ-পাৰ্বন (লোকাচাৰ : জন্ম, মৃত্যু আৰু বিবাহৰ লগত জড়িত; ধৰ্মীয় পৰম্পৰা : শৈৱ, শাক্ত আৰু বৈষ্ণৱ; উৎসৱ পাৰ্বন : কৃষিৰ লগত জড়িত)	20
তৃতীয় গোট	: অসমীয়া পৰিবেশ্য কলা আৰু পৰম্পৰাগত খেল-ধেমালি	20
চতুৰ্থ গোট	: অসমৰ স্থাপত্য, ভাস্কৰ্য আৰু চিত্ৰকলা	20

সহায়ক গ্ৰন্থ (নিৰ্বাচিত) :

অসমৰ জনকৃষ্টি : যোগেশ দাস

অসমৰ জনগোষ্ঠীয় সামাজিক লোকাচাৰ : উপেন ৰাভা হাকাচাম, প্ৰফুল্ল কুমাৰ নাথ (সম্পা.)

অসমৰ জনজাতি : প্ৰমোদ চন্দ্ৰ ভট্টাচাৰ্য (সম্পা.)

অসমৰ জাতি আৰু সংস্কৃতি : পৰমানন্দ ৰাজবংশী (সম্পা.)

অসমৰ পুথিচিত্ৰ : নৰেন কলিতা

অসমৰ মানুহৰ নৃ-বৈজ্ঞানিক পৰিচয় : ভুৱন মোহন দাস

অসমৰ লোক-সংস্কৃতি : বিৰিঞ্চি কুমাৰ বৰুৱা

অসমৰ লোক-সংস্কৃতি : নিৰ্মলপ্ৰভা বৰদলৈ

অসমৰ সংস্কৃতি : লীলা গগৈ

অসমৰ সংস্কৃতি-সমীক্ষা : নবীন চন্দ্ৰ শৰ্মা আৰু কনক চন্দ্ৰ চহৰীয়া (সম্পা.)

অসমত শৈৱ সাধনা আৰু শৈৱ সাহিত্য : হৰিনাথ শৰ্মা দলৈ

অসমীয়া জাতিৰ ইতিবৃত্ত : অসম সাহিত্য সভা

অসমীয়া জাতিৰ ইতিহাস : অসম সাহিত্য সভা

অসমীয়া সংস্কৃতিৰ জনজাতীয় বৰঙণি : নাহেন্দ্ৰ পাদুৱা

পুৰণি অসমীয়া সমাজ আৰু সংস্কৃতি : মহেশ্বৰ নেওগ

লোক-সংস্কৃতি : নবীন চন্দ্ৰ শৰ্মা

সত্ৰ-সংস্কৃতিৰ ৰূপৰেখা : কেশৱানন্দ দেৱগোস্বামী

সংমিশ্ৰণত অসমীয়া সংস্কৃতি : আব্দুছ ছাত্তাৰ

Bihu Springtime Festival of Assam : Prafulladatta Goswami

History and Civilization of the People of Assam : P. C. Choudhury

The Assamese : Audrey Cantile

দক্ষতা বিকাশ পাঠ্য

ASM-SE-3014

ব্যৱহাৰিক অসমীয়া

মূল্যাংক : ৮০

(উদ্দেশ্য : অসমীয়া বিষয়ৰ জ্ঞানেৰে একোগৰাকী ছাত্ৰ-ছাত্ৰীৰ পৰৱৰ্তী জীৱনৰ বৃত্তিকপে গ্ৰহণ কৰিব পৰা বিশেষ বিষয়ৰ প্ৰাথমিক আৰু প্ৰায়োগিক জ্ঞান এই পাঠ্যত থাকিব।)

প্ৰথম গোট	:	আৰ্হি পাঠ : পদ্ধতি আৰু কৌশল	20
দ্বিতীয় গোট	:	ছপা আৰু বৈদ্যুতিন মাধ্যমৰ বাবে বিজ্ঞাপন লেখন, ইংৰাজী হিন্দী বিজ্ঞাপনৰ অসমীয়া অনুবাদ	20
তৃতীয় গোট	:	অনুবাদ : সংবাদ, প্ৰবন্ধ, সাক্ষাৎকাৰ	20
চতুৰ্থ গোট	:	চিত্ৰনাট্য নিৰ্মাণ : সাহিত্যৰ চিত্ৰায়ণ	20

সহায়ক গ্ৰন্থ (নিৰ্বাচিত) :

অসমীয়া আখৰ জেঁটনিৰ কথা : শিৱনাথ বৰ্মন

আৰ্হি পাঠকৰ হাত পুথি : অসম সাহিত্য সভা

কি লিখি কেন লিখি : নীৰেন্দ্ৰ নাথ চক্ৰবৰ্তী

গণজ্ঞাপন : তত্ত্ব ও প্ৰয়োগে : পাৰ্থ চট্টোপাধ্যায়

ব্যৱহাৰিক অসমীয়া ব্যাকৰণ : উপেন ৰাভা হাকাচাম

বিজ্ঞান লেখকৰ হাতপুথি : দীনেশ চন্দ্ৰ গোস্বামী

বিষয় চলচিত্ৰ : সত্যজিৎ ৱায়

লেখক ও সম্পাদকৰ অভিধান : সুভাষ ভট্টাচাৰ্য (সম্পা.)

সেকাল একালৈৰ সংবাদ পৰিবেশনেৰ ধাৰা ও বিচিত্ৰ সংবাদ : বৈদ্যনাথ বন্দোপাধ্যায়

বৰ্গীয় ঐচ্ছিক পাঠ্য
ASM-HG-3016
অসমীয়া নাটক আৰু মঞ্চকলা
মূল্যাংক : ৮০

(উদ্দেশ্য : এই পাঠ্যৰ জৰিয়তে লোকনাট্য, প্ৰচেনিয়াম, বিকল্প মঞ্চৰ স্বৰূপ সম্পৰ্কে অৱগত হোৱাৰ লগতে মঞ্চ আৰু অভিনয়ৰ আনুষংগিক
দিশসমূহৰ জ্ঞানো লাভ কৰিব।)

- প্ৰথম গোট :** পৰম্পৰাগত অসমীয়া মঞ্চ আৰু নাট্যৰীতি 20
লোকনাট্য আৰু ইয়াৰ পৰিৱেশন— পুতলা নাচ, ওজাপালি, কুশান গান, ভাওনা
(লোকনাট্য মানে কি, লোকজীৱনৰ সৈতে লোকনাট্যৰ সম্পৰ্ক, লোকনাট্যৰ
বিষয়বস্তু, উপস্থাপন কৌশল, মঞ্চ আৰু অভিনয়— আহাৰ্য, সাত্ত্বিক, বাচিক, আংগিক)
- দ্বিতীয় গোট :** অসমৰ প্ৰচেনিয়াম মঞ্চ আৰু ইয়াৰ ইতিহাস (আৰম্ভণিৰ পৰা ১৯৪৭ লৈকে) 20
- তৃতীয় গোট :** আধুনিক অসমীয়া নাটকৰ পৰিৱেশন 20
মঞ্চসজ্জা, সাজসজ্জা আৰু অংগসজ্জা, আলোকসম্পাত, আৱহ সংগীত, অভিনয়
- চতুৰ্থ গোট :** অসমৰ বিকল্প মঞ্চ আৰু পৰিৱেশন 20
বাটৰ নাট, অনাতাঁৰ নাট, মুকাভিনয়, একাংকিকা নাটক আৰু ভ্ৰাম্যমাণ নাটক

সহায়ক গ্ৰন্থ (নিৰ্বাচিত) :

অসমৰ লোকনাট : নবীনচন্দ্ৰ শৰ্মা
অসমীয়া নাট্য সাহিত্যৰ জিলিঙনি (আদিৰ পৰা ১৯৬৭ পৰ্যন্ত) : হৰিশ্চন্দ্ৰ ভট্টাচাৰ্য
অসমীয়া নাট্য সাহিত্য : সত্যেন্দ্ৰনাথ শৰ্মা
অসমীয়া লোক-নাট্য পৰম্পৰা : শৈলেন ভৰালী
ছশ বছৰৰ অসমীয়া নাটক : পৰম্পৰা আৰু পৰিৱৰ্তন : অজিত শইকীয়া (সম্পা.)
থিয়েটাৰে আলো : তত্ত্ব ও প্ৰয়োগ : ৰঞ্জিতকুমাৰ মিত্ৰ
থিয়েটাৰ দৃশ্যৰ বিকাশ ও সমীক্ষা : ৰঞ্জিতকুমাৰ মিত্ৰ
নাট্যচিন্তা-নাট্যচৰ্চা : ভূপেন গোস্বামী
নাট্যশিল্প আৰু অভিনয় তত্ত্ব : অপৰ্ণ বেজবৰুৱা
নাটক আৰু মঞ্চকলা : অজিত ভৰালী
মঞ্চলেখা : অতুলচন্দ্ৰ হাজৰিকা
মঞ্চ দৃশ্যৰ পৰিকল্পনা ও নিৰ্মাণ : ৰঞ্জিতকুমাৰ মিত্ৰ
Bhaona : The Ritual Play of Assam : M. Neog
Indian Theatre : N. Jain
Key Concept in Drama and Performance : K. Pickering
Music and Drama : A.D. Ranade
Performance Studies : An Introduction : R. Schechner

চতুৰ্থ ষাণ্মাসিক

বুনিয়াদী পাঠ্য

ASM-HC-4016

তুলনামূলক ভাৰতীয় সাহিত্য

মূল্যাংক : ৮০

(উদ্দেশ্য : এই পাঠ্যৰ জৰিয়তে শিক্ষার্থীসকলক তুলনামূলক সাহিত্যৰ পটভূমি আৰু পৰিচয়ৰ লগতে আধুনিক যুগৰ ভাৰতীয় সাহিত্যৰ লগত পৰিচয় কৰি দিয়া হ'ব।)

প্ৰথম গোট : তুলনামূলক সাহিত্যৰ পৰিচয় 20
সংজ্ঞা, উৎস আৰু বিকাশ, অধ্যয়ন ক্ষেত্ৰ, বিভিন্ন শাখা (School), অধ্যয়নৰ তাৎপৰ্য, শেহতীয়া ধাৰা

দ্বিতীয় গোট : তুলনামূলক ভাৰতীয় সাহিত্যৰ পৰিচয় 20
ভাৰতীয় ধাৰণা আৰু ইতিহাস, তুলনামূলক ভাৰতীয় সাহিত্যৰ ভিত্তি আৰু বিকাশ, অধ্যয়ন ক্ষেত্ৰ আৰু প্ৰাসংগিকতা

তৃতীয় গোট : চুটিগল্প 20
অভাগীৰ স্বৰ্গ : শৰৎচন্দ্ৰ চট্টোপাধ্যায়
ৰাপচি : উষা প্ৰিয়স্বদা
গান্ধী : বেছগাহাল্লি ৰামা

চতুৰ্থ গোট : উপন্যাস 20
নিৰ্মলা : মুন্সী প্ৰেমচন্দ
পথেৰ পাচালী : বিভূতিভূষণ বন্দোপাধ্যায়

সহায়ক গ্ৰন্থ (নিৰ্বাচিত) :

আধুনিক বাংলা সাহিত্য : মোহিতলাল মজুমদাৰ

আধুনিক ভাৰতীয় সাহিত্য : শৈলেন ভৰালী

এমুঠি অনুদিত ভাৰতীয় গল্প : হাফিজ আহমেদ

তুলনাত্মক সাহিত্য : দিলীপ বৰা

তুলনামূলক ভাৰতীয় সাহিত্য : নীৰাজনা মহন্ত বেজবৰা

দস কঁহানিয়া : উষা প্ৰিয়স্বদা

নিৰ্মলা : মুন্সী প্ৰেমচন্দ

পথেৰ পাচালী : বিভূতিভূষণ বন্দোপাধ্যায়

প্ৰেমচন্দ ঔৰ উনকা যুগ : ৰামবিলাস শৰ্মা

বংগ সাহিত্যে উপন্যাসেৰ ধাৰা : শ্ৰীকুমাৰ বন্দোপাধ্যায়

ভাৰতীয় সাহিত্যৰ তুলনামূলক অধ্যয়ন : প্ৰফুল্ল কুমাৰ নাথ

Comparative Literature : Theory and Practice : Amiya Dev (ed.)

The Idea of Comparative Literature in India : Amiya Dev

বুনিয়াদী পাঠ্য
ASM-HC-4026
অসমীয়া ভাষাৰ সমাহৰণ : আৰ্য ভাষা আৰু আৰ্য-ভিন্ন ভাষা
মূল্যাংক : ৮০

(উদ্দেশ্য : এই পাঠ্যৰ জৰিয়তে সংস্কৃত, প্ৰাকৃত, বাংলা, ওড়িয়া আদি আৰ্যভাষাৰ সৈতে অসমীয়া ভাষাৰ সম্পৰ্ক নিৰূপণ কৰিব পৰা হ'ব। সেইদৰে অসমীয়া ভাষাত টাই-আহোম, বড়ো, ৰাভা, খাচী ইত্যাদি আৰ্য-ভিন্ন ভাষাৰ প্ৰভাৱ আৰু উপাদানৰ বিষয়ে ইয়াত আলোচনা কৰা হ'ব।)

প্ৰথম গোট : উদ্ভৱকালীন অসমীয়া ভাষা	20
আৰ্য-ভিন্ন থলুৱা জনগোষ্ঠী, আৰ্যসকলৰ অসমলৈ প্ৰব্ৰজন, অসমীয়া ভাষা-সম্প্ৰদায়ৰ গঠন	
দ্বিতীয় গোট : ভাৰতীয় আৰ্যভাষাৰ লগত অসমীয়া ভাষাৰ সম্বন্ধ	20
অসমীয়া ভাষাত মাগধী প্ৰাকৃত আৰু অন্যান্য প্ৰাকৃতৰ উপাদান	
তৃতীয় গোট : আৰ্য-ভিন্ন ভাষাৰ লগত অসমীয়া ভাষাৰ সম্বন্ধ	20
অষ্ট্ৰিক, তিব্বতবৰ্মীয় আৰু দ্ৰাবিড় ভাষা-পৰিয়ালৰ উপাদান	
চতুৰ্থ গোট : সাম্প্ৰতিক অসমীয়া ভাষাত আৰ্য আৰু আৰ্য-ভিন্ন ভাষাৰ উপাদান	20

সহায়ক গ্ৰন্থ (নিৰ্বাচিত) :

অসমৰ ভাষা : ভীমকান্ত বৰুৱা
অসমীয়া আৰু অসমৰ তিব্বতবৰ্মীয় ভাষা : উপেন ৰাভা হাকাচাম
অসমীয়া আৰু অসমৰ ভাষা : বিশ্বজিৎ দাস আৰু ফুকন বসুমতাৰী (সম্পা.)
অসমীয়া, বাংলা আৰু উড়িয়া ভাষা : তুলনামূলক অধ্যয়ন : দীপ্তি ফুকন পাটগিৰি
অসমীয়া ব্যাকৰণ আৰু ভাষাতত্ত্ব : কালিৰাম মেধি
অসমীয়া ভাষাৰ উদ্ভৱ, সমৃদ্ধি আৰু বিকাশ : উপেন্দ্ৰ নাথ গোস্বামী
অসমীয়া ভাষাৰ মৌলিক বিচাৰ : দেৱানন্দ ভৰালি
উদ্ভৱকালীন অসমীয়া ভাষা : সুবাসনা মহন্ত
পালি-প্ৰাকৃত-অপভ্ৰংশ ভাষা আৰু সাহিত্য : নগেন ঠাকুৰ
Assamese: Its Formation and Development : Banikanta Kakati
Introduction to Prakrit : A.C. Woolner
Sino-Tibetan : A Compectus : Poul K. Benedict
Studies in Sino-Tibetan Languages : S.N. Goswami

বুনিয়াদী পাঠ্য
ASM-HC-4036
অসমীয়া গদ্য সাহিত্য
(আৰম্ভণিৰ পৰা অষ্টাদশ শতিকালৈ)
মূল্যাংক : ৮০

(উদ্দেশ্য : ছাত্ৰ-ছাত্ৰীৰ মনত অসমীয়া গদ্য সাহিত্য সম্পৰ্কে স্পষ্ট ধাৰণা গঢ়ি তুলিবৰ বাবে শংকৰদেৱৰ নাটৰ গদ্যৰ পৰা বুৰঞ্জীৰ গদ্যলৈকে পাঠ ইয়াত সন্নিবিষ্ট কৰা হৈছে।)

প্ৰথম গোট : শংকৰদেৱৰ 'ৰুক্মিণী হৰণ' নাটৰ অন্তৰ্গত ৰুক্মিণীৰ প্ৰেমপত্ৰ মাধৱদেৱৰ 'অৰ্জুন ভঞ্জন' নাটৰ অন্তৰ্গত নন্দ-যশোদাৰ কলহ বৰকৰতী পুথিৰ বায়ুকৰতী মন্ত্ৰ	২০
দ্বিতীয় গোট : ভট্টদেৱৰ কথাগীতা(প্ৰথম অধ্যায়): অৰ্জুনৰ বিষাদ যোগ গোপালচৰণ দ্বিজৰ শ্ৰীভক্তি ৰত্নাকৰ কথা : গুৰু-সেৱা মাহাত্ম্য ৰঘুনাথ মহন্তৰ শ্ৰীৰামায়ণ কথা: ৰামৰ বন গমন	২০
তৃতীয় গোট : কথা গুৰুচৰিত: গুৰু-শিষ্যৰ মণিকাঞ্চন সংযোগ সাতসৰী অসম বুৰঞ্জী: অসমৰ বণোদ্যম	২০
চতুৰ্থ গোট : সুকুমাৰ বৰকাথৰ 'হস্তী বিদ্যাৰ্ণৱ' : হাতীৰ লক্ষণ সপ্তদশ শতিকাৰ চামধৰা গড়ৰ ৰণজয়ৰ শিলৰ ফলি বদন চন্দ্ৰ বৰফুকনলৈ চন্দ্ৰকান্ত সিংহ স্বৰ্গদেউৰ গোপনীয় পত্ৰ	২০

সহায়ক গ্ৰন্থ (নিৰ্বাচিত) :

অসমীয়া কথা সাহিত্য : বিৰিঞ্চি কুমাৰ বৰুৱা
অসমীয়া গদ্য সাহিত্যৰ গতিপথ : হৰিনাথ শৰ্মাদলৈ
অংকমালা : সত্যেন্দ্ৰনাথ শৰ্মা
অংকাৱলী : কালিৰাম মেধি
ক্ৰমবিকাশত অসমীয়া কথাশৈলী : প্ৰফুল্ল কটকী
গুৰু চৰিত কথা : মহেশ্বৰ নেওগ
প্ৰাচ্য শাসনাৱলী : মহেশ্বৰ নেওগ (সম্পা.)
সাতসৰী অসম বুৰঞ্জী : সূৰ্যকুমাৰ ভূঞা (সম্পা.)
স্নাতকৰ কথাবন্ধ : মহেশ্বৰ নেওগ (সম্পা.)
Hastibidyarnava: Pratap Ch. Choudhury (ed.)

দক্ষতা বিকাশ পাঠ্য

ASM-SE-4014

সৃজনীমূলক সাহিত্য

মূল্যাংক : ৮০

(উদ্দেশ্য : এই পাঠ্যৰ জৰিয়তে কবিতা আৰু গল্প লিখাৰ প্ৰাথমিক আৰু ব্যৱহাৰিক জ্ঞান প্ৰদান কৰা হ'ব।)

প্ৰথম গোট : 20

কল্পনাৰ সংজ্ঞা আৰু পৰিসৰ

কল্পনাৰ কৰ্ষণ

সৃজনীমূলক সাহিত্য ৰচনাৰ প্ৰয়োজনীয় যোগ্যতা

দ্বিতীয় গোট : 20

আধুনিক কবিতা : সংজ্ঞা আৰু বৈশিষ্ট্য

আধুনিক কবিতাৰ পটভূমি

আধুনিক কবিতাৰ ভাষা

তৃতীয় গোট : 20

গল্পৰ বীজ ৰোপণ

গল্প ৰচনাৰ বাবে ক্ষেত্ৰ অধ্যয়ন

গল্পৰ নিৰ্মাণ

চতুৰ্থ গোট : 20

কবিতা আৰু গল্পৰ আৰ্হি প্ৰস্তুতকৰণ

সহায়ক গ্ৰন্থ (নিৰ্বাচিত) :

আধুনিক অসমীয়া কবিতা : কামালুদ্দিন আহমেদ

আধুনিক বাংলা কাব্য পৰিচয় : দীপ্তি ত্ৰিপাঠী

আধুনিকতাবাদ আৰু অন্যান্য প্ৰবন্ধ : হৰেকৃষ্ণ ডেকা

কবিতাৰ ক্লাস : নীৰেদ্ৰ নাথ চক্ৰবৰ্তী

ৰমন্যাসবাদ : মহেন্দ্ৰ বৰা

সৃজনীমূলক সাহিত্য : প্ৰেৰণা আৰু আৰ্হি : অতনু ভট্টাচাৰ্য

Romantic Imagination : C M Bowra

বৰ্গীয় ঐচ্ছিক পাঠ্য
ASM-HG-4016
আধুনিক অসমীয়া গীতি সাহিত্য
মূল্যাংক : ৮০

(উদ্দেশ্য : এই পাঠ্যৰ জৰিয়তে আধুনিক অসমীয়া গীতি সাহিত্যৰ বিভিন্ন পৰ্বৰ যুগমীয়া গীতৰ সৈতে ছাত্ৰ-ছাত্ৰীৰ পৰিচয় আৰু অন্তৰংগতা স্থাপন কৰাৰ কথা চিন্তা কৰা হৈছে।)

প্ৰথম গোট :		20
	অসমীয়া আধুনিক গীতি সাহিত্যৰ ইতিহাস	
দ্বিতীয় গোট :		20
	হেৰা আমাৰ জন্মভূমি	: লক্ষ্মীনাথ বেজবৰুৱা
	মোৰ গানত জ্বলে শত যুগৰ কত অভিমান	: জ্যোতিপ্ৰসাদ আগৰৱালা
	পূজোঁ আহাঁ আই মাতৃ	: পাৰ্বতিপ্ৰসাদ বৰুৱা
	অ' অসমীয়া ডেকা দল	: বিষ্ণুপ্ৰসাদ ৰাভা
তৃতীয় গোট :		20
	নিয়ৰৰে ফুল এপাহ ফুলিল	: নৱকান্ত বৰুৱা
	হে দোলা	: ভূপেন হাজৰিকা
	হএওঁৰা জেতুকী	: ৰুদ্ৰ বৰুৱা
	কাউৰী পৰে	: কেশৱ মহন্ত
চতুৰ্থ গোট :		20
	বহুদিন বকুলৰ গোন্ধ পোৱা নাই	: তফজ্জুল আলি
	সন্ধিয়াৰ আকাশত বগলি উৰে	: নিৰ্মলপ্ৰভা বৰদলৈ
	মাহ হালধিৰে নোৱালে ধুৱালে	: দ্বিজেন্দ্ৰমোহন শৰ্মা
	তোমাৰ বাবেই আছোঁ বাট চাই	: কীৰ্তিকমল ভূঞা

সহায়ক গ্ৰন্থ (নিৰ্বাচিত) :

- অসমীয়া আধুনিক গীতৰ বিকাশত আকাশবাণীৰ ভূমিকা : কীৰ্তিকমল ভূঞা
অসমীয়া আধুনিক গীতৰ সংগীতকাৰসকল : তফজ্জুল আলি
কেশৱ মহন্তৰ গীত সমগ্ৰ : মনজ্যোৎস্না মহন্ত গোস্বামী (সম্পা.)
গান আৰু কবিতা সমগ্ৰ : নৱকান্ত বৰুৱা
জ্যোতিপ্ৰসাদ ৰচনাৱলী : নগেন শইকীয়া (সম্পা.)
পাৰ্বতিপ্ৰসাদ বৰুৱা ৰচনাৱলী : পৰনাত্ম শৰ্মা(সম্পা.)
ফুলৰ এই মেলাতে : নিৰ্মলপ্ৰভা বৰদলৈ
বহুদিন বকুলৰ গোন্ধ পোৱা নাই : তফজ্জুল আলি
বিষ্ণুপ্ৰসাদ ৰাভা ৰচনা সম্ভাৰ (প্ৰথম খণ্ড) : যোগেশ দাস (সম্পা.)
বেজবৰুৱাৰ গ্ৰন্থাৱলী : অসম সাহিত্য সভা
ভূপেন হাজৰিকাৰ গীত আৰু জীৱন ৰথ : দিলীপকুমাৰ দত্ত

পঞ্চম ষাণ্মাসিক
বুনিয়াদী পাঠ্য

ASM- HC-5016

অসমীয়া নাটক আৰু পৰিৱেশন শৈলী
(আৰম্ভণিৰ পৰা অষ্টাদশ শতিকালৈ)
মূল্যাংক : ৮০

(উদ্দেশ্য : এই পাঠৰ জৰিয়তে ছাত্ৰ-ছাত্ৰীসকলে অসমীয়া নাটকৰ ইতিহাসৰ ৰূপৰেখাৰ বিষয়ে অৱগত হোৱাৰ লগতে প্ৰতিনিধিত্বমূলক নাটক বিশেষৰ পৰিৱেশন শৈলীৰ বিষয়েও জানিব পাৰিব।)

- প্ৰথম গোট : অসমীয়া নাটকৰ চমু ইতিহাস 20
লোকনাট্য; অংকীয়া নাট আৰু বুমুৰা
উত্তৰ স্বাধীনতা যুগৰ নাটক (মহাকাব্যিক নাটক, এবচাৰ্ড নাটক, লোককলাৰ সমল অন্তৰ্ভুক্ত নাটক)
অসমীয়া নাটকৰ পৰিৱেশন শৈলীৰ ইতিহাস : বিভিন্ন ধৰণৰ মঞ্চ (পৰিৱেশনৰ স্থান), দৃশ্যসজ্জা, মঞ্চসজ্জা,
নাটকৰ আহাৰ্য, অভিনয় শৈলী আদিৰ স্বৰূপ আৰু বিকাশ
- দ্বিতীয় গোট : অংকীয়া নাট আৰু পৰিৱেশন 20
ৰুক্মিণী হৰণ : শংকৰদেৱ
(অংকীয়া নাটৰ আহাৰ্য, মুখা, গায়ন-বায়ন সম্পৰ্কে বিশেষকৈ জানিব লাগিব)
- তৃতীয় গোট : প্ৰাক-স্বাধীনতা যুগৰ অসমীয়া নাটক আৰু পৰিৱেশন 20
নীলাম্বৰ : প্ৰসন্নলাল চৌধুৰী
(মঞ্চসজ্জা, আলোকসম্পাত, অভিনয়ৰীতি সম্পৰ্কে বিশেষকৈ জানিব লাগিব)
- চতুৰ্থ গোট : উত্তৰ-স্বাধীনতা যুগৰ অসমীয়া নাটক আৰু পৰিৱেশন 20
আহাৰ : অৰুণ শৰ্মা
উৰুখা : কৰুণা ডেকা
(মঞ্চৰীতি, অভিনয়ৰীতি, উপস্থাপন শৈলী সম্পৰ্কে বিশেষকৈ জানিব লাগিব)

সহায়ক গ্ৰন্থ (নিৰ্বাচিত) :

- অসমৰ লোকনাট : নবীনচন্দ্ৰ শৰ্মা
অসমীয়া নাটক : স্বৰাজোত্তৰ কাল : শৈলেন ভৰালী
অসমীয়া নাট্য সাহিত্য : সত্যেন্দ্ৰনাথ শৰ্মা
অসমীয়া নাট্য সাহিত্যৰ জিলাঙনি (আদিৰ পৰা ১৯৬৭ পৰ্যন্ত) হৰিশ্চন্দ্ৰ ভট্টাচাৰ্য
আধুনিক অসমীয়া নাটক : পৰীক্ষা নিৰীক্ষা আৰু বিভিন্ন ধাৰা : কুলদা কুমাৰ ভট্টাচাৰ্য
আহাৰ : অৰুণ শৰ্মা
উদ্ভট নাটক : বিনোদ শৰ্মা
নাটক আৰু অভিনয় প্ৰসংগ : সত্যপ্ৰসাদ বৰুৱা
নাটক আৰু মঞ্চকলা : অজিত ভৰালী

প্রসংগ নাটকঃ পোনা মহন্ত
ভৰতৰ নাট্যশাস্ত্ৰঃ অসম নাট্য সন্মিলন
মঞ্চলেখাঃ অতুলচন্দ্ৰ হাজৰিকা
মঞ্চ দৃশ্যৰ বিকাশ ও সমীক্ষাঃ ৰঞ্জিতকুমাৰ মিত্ৰ
An Anatomy of Drama : M. Boulton
Bhaona : The Ritual Play of Assam : M. Neog (s.l)
Performance Theory : R. Schechner
Theory of Performance Studies : P. Auslanu

বুনিয়াদী পাঠ্য
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অসমীয়া ব্যাকৰণ
মূল্যাংক : ৮০

(উদ্দেশ্য : এই পাঠ্যত উচ্চ ব্যাকৰণৰ ৰীতি অনুযায়ী অসমীয়া ভাষাৰ বৈয়াকৰণিক বিশ্লেষণ কৰা হ'ব।)

প্ৰথম গোট	: অসমীয়া ব্যাকৰণৰ ইতিহাস, ব্যাকৰণৰ শ্ৰেণীবিভাগ, ব্যাকৰণৰ উপাদান : ধ্বনি, ৰূপ, শব্দ আৰু বাক্য	20
দ্বিতীয় গোট	: অসমীয়া ভাষাৰ ধ্বনিতত্ত্ব : বিভাজ্য ধ্বনি : স্বৰ ধ্বনি, ব্যঞ্জন ধ্বনি অবিভাজ্য ধ্বনি : শ্বাসাঘাত, সন্ধি, অনুনাসিকতা, সুৰ-লহৰ	20
তৃতীয় গোট	: অসমীয়া ভাষাৰ ৰূপতত্ত্ব : বচন, লিংগ, নাম বিভক্তি, ক্ৰিয়া বিভক্তি	20
চতুৰ্থ গোট	: অসমীয়া ভাষাৰ বাক্যতত্ত্ব : অসমীয়া বাক্যৰ শ্ৰেণী বিভাজন, অসমীয়া বাক্যৰ গাঁঠনিক বিশ্লেষণ - নিকটস্থ অঙ্গ বিচাৰ, খণ্ডবাক্য গঠনৰ নিয়ম	20

সহায়ক গ্ৰন্থ (নিৰ্বাচিত) :

- অসমীয়া বৰ্ণপ্ৰকাশ : গোলোক চন্দ্ৰ গোস্বামী
অসমীয়া ব্যাকৰণ আৰু ভাষাতত্ত্ব : কালিৰাম মেধি
অসমীয়া ব্যাকৰণৰ মৌলিক বিচাৰ : গোলোক চন্দ্ৰ গোস্বামী
অসমীয়া ভাষাৰ ব্যাকৰণ : উপেন্দ্ৰ নাথ গোস্বামী
অসমীয়া ভাষাৰ ৰূপকথা : উপেন্দ্ৰ নাথ গোস্বামী
অসমীয়া ভাষাৰ ৰূপতত্ত্ব : লীলাৱতী শইকীয়া বৰা
উচ্চতৰ অসমীয়া ব্যাকৰণ : ৰমেশ পাঠক
ব্যাকৰণ আৰু প্ৰাকৃতিক বিজ্ঞান : ৰমেশ পাঠক
ব্যৱহাৰিক ধ্বনি বিজ্ঞান : দীপংকৰ মৰল
ব্যাকৰণ : প্ৰাচ্য আৰু পাশ্চাত্য : খগেশ সেন ডেকা
ভাষাবিজ্ঞান উপক্ৰমণিকা : অৰ্পণা কোঁৱৰ
Assamese: Its Formation and Development : B.K. Kakati
Syntactic Structure : Noam Chomsky

বিষয় সম্পর্কীয় ঐচ্ছিক পাঠ্য

(এই ঐচ্ছিক পাঠ্য ছাত্র-ছাত্রীয়ে চাৰিটা বিষয় সম্পর্কীয় ঐচ্ছিক পাঠ্য ASM-HE-5016, ASM-HE-5026, ASM-HE-5036, ASM-HE-5046-ৰ মাজৰ পৰা যিকোনো দুটা পাঠ্য বাছি ল'ব পাৰিব)

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অসমীয়া লোক-সাহিত্য অধ্যয়ন

মূল্যাংক : ৮০

(উদ্দেশ্য : এই পাঠ্যৰ জৰিয়তে ছাত্র-ছাত্রীয়ে লোক সাহিত্যৰ স্বৰূপ আৰু অসমীয়া লোকসাহিত্যৰ বিভিন্ন সমলৰ সৈতে পৰিচিত হ'ব।)

প্রথম গোট : লোকসাহিত্যৰ প্ৰকৃতি বিচাৰ আৰু শ্ৰেণী বিভাগ : গেয় আৰু কথ্য, প্ৰাচীন আৰু সমকালীন, আঞ্চলিক আৰু জনগোষ্ঠীয়	20
দ্বিতীয় গোট : প্ৰবাদ-পটন্তৰ, জনশ্ৰুতি-সাধুকথা, মন্ত্ৰসাহিত্য, নিচুকনি আৰু খেল-ধেমালিৰ গীত-মাত (অসমীয়া আৰু অসমীয়াৰ নৃগোষ্ঠীয় উপভাষাত ৰচিত গীত-মাতৰ বিশেষ প্ৰসংগত)	20
তৃতীয় গোট : মালিতা আৰু কাহিনী গীত : আখ্যানমূলক, বুৰঞ্জীমূলক, ব্যঙ্গাত্মক, সমকালীন, খণ্ডিত মালিতা (অসমীয়া আৰু অসমৰ নিৰ্বাচিত জনগোষ্ঠীৰ গীত-মাতৰ বিশেষ প্ৰসংগত)	20
চতুৰ্থ গোট : অনুষ্ঠানমূলক, উৎসৱকেন্দ্ৰিক, স্ততিমূলক, ধৰ্মকেন্দ্ৰিক, প্ৰেম আৰু বিৰহ বিষয়ক (বাৰমাহী গীত), (অসমীয়া আৰু অসমৰ নিৰ্বাচিত জনগোষ্ঠীৰ গীত-মাতৰ বিশেষ প্ৰসংগত)	20

সহায়ক গ্ৰন্থ (নিৰ্বাচিত) :

অলৌ গুটি-তলৌ গুটি : অসমৰ খেল-ধেমালিৰ গীত-মাত : উপেন ৰাভা হাকাচাম (সম্পা.)

অসমীয়া জনসাহিত্য : প্ৰফুল্লদত্ত গোস্বামী

অসমীয়া লোক-সাহিত্যৰ ৰূপৰেখা : লীলা গগৈ

কামৰূপী লোকগীতি সংগ্ৰহ : হেমন্ত কুমাৰ শৰ্মা (সম্পা.)

গোৱালপৰীয়া লোকগীত সমগ্ৰ : বীৰেন্দ্ৰনাথ দত্ত (সম্পা.)

দৰঙী লোকগীত সংগ্ৰহ : কনক চন্দ্ৰ চহৰীয়া (সম্পা.)

বাৰমাহৰ তেৰ গীত : প্ৰফুল্লদত্ত গোস্বামী

হেনা-হুচা : অসমীয়া জনজাতীয় / জনগোষ্ঠীয় লোকসাহিত্যৰ সংকলন (প্ৰথম আৰু দ্বিতীয় খণ্ড) : উপেন ৰাভা হাকাচাম (সম্পা.)

বিষয় সম্পর্কীয় ঐচ্ছিক পাঠ্য
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অসমীয়া ৰমন্যাসবাদী কবিতা
মূল্যাংক : ৮০

(উদ্দেশ্য : ঊনবিংশ শতিকাৰ শেহৰ ফালে অসমীয়া কবিতাত যি ৰমন্যাসিকতাৰ সূচনা হৈছিল, এই পাঠ্যৰ জৰিয়তে তাৰ বিভিন্ন পৰ্ব ছাত্ৰ-ছাত্ৰীসকলে অনুধাৱন কৰিব পাৰিব।)

প্ৰথম গোট : লক্ষ্মীনাথ বেজবৰুৱা : ভ্ৰম চন্দ্ৰকুমাৰ আগৰৱালা : নিয়ৰ মফিজুদ্দিন আহমদ হাজৰিকা : আত্মন হেমচন্দ্ৰ গোস্বামী : প্ৰিয়তমাৰ চিঠি	20
দ্বিতীয় গোট : ৰঘুনাথ চৌধাৰী : কেতেকী (প্ৰথম তৰংগ) অম্বিকাগিৰী ৰায়চৌধুৰী : মানৱায়তন ৰত্নকান্ত বৰকাকতি : বিশ্বহৰণ যতীন্দ্ৰনাথ দুৱৰা : সোণোৱালী দেশ	20
তৃতীয় গোট : শৈলধৰ ৰাজখোৱা : বিদায় পৰত নলিনীবালা দেৱী : পৰশমণি জ্যোতিপ্ৰসাদ আগৰৱালা : বিশ্বশিল্পী	20
চতুৰ্থ গোট : ডিম্বেশ্বৰ নেওগ : শাপমুক্তা বিনন্দ চন্দ্ৰ বৰুৱা : হে জননী ভাৰতবৰ্ষ অতুল চন্দ্ৰ হাজৰিকা : লালকিল্লা	20

সহায়ক গ্ৰন্থ (নিৰ্বাচিত) :

- অম্বিকাগিৰী ৰায়চৌধুৰী : সত্যেন্দ্ৰনাথ শৰ্মা (সম্পা.)
অসমীয়া কবিতা : কৰবী ডেকা হাজৰিকা
কবি চন্দ্ৰকুমাৰ : কবীন ফুকন
কবি চৌধাৰী আৰু চৌধাৰীদেৱৰ কবিতা : কমলেশ্বৰ শৰ্মা
কবিতামঞ্জৰী : বিশ্ববিদ্যালয় প্ৰকাশন বিভাগ, গুৱাহাটী বিশ্ববিদ্যালয়
কবিতাৰ কথা : নিৰ্মলপ্ৰভা বৰদলৈ
কবিতাৰ ভাষা আৰু অন্যান্য প্ৰবন্ধ : উপেন্দ্ৰনাথ শৰ্মা
চন্দ্ৰকুমাৰৰ কবিতা সমগ্ৰ : নগেন শইকীয়া
প্ৰবন্ধ (১৯৭৩-২০১৫) : ৰঞ্জিৎ কুমাৰ দেৱ গোস্বামী
ৰঘুনাথ চৌধাৰীৰ কাব্য বিচাৰ : উমেশ ডেকা আৰু নীলমোহন ৰয় (সম্পা.)
ৰমন্যাসবাদ : মহেন্দ্ৰ বৰা
ৰমন্যাসবাদ আৰু লক্ষ্মীনাথ বেজবৰুৱাৰ কবিতা : কামালুদ্দিন আহমেদ
প্ৰঞ্জা-সিন্ধু কবি মফিজুদ্দিন : আনিছ উজ্জামান (সম্পা.)

বিষয় সম্পর্কীয় ঐচ্ছিক পাঠ্য

ASM-HE-5036

শংকৰদেৱ

মূল্যাংক : ৮০

(উদ্দেশ্য : অসমীয়া সাহিত্যৰ যুগন্ধৰ প্ৰতিভা শংকৰদেৱৰ বৰগীত, কীৰ্তনঘোষা, কাব্য আৰু নাট সম্পৰ্কে ছাত্ৰ-ছাত্ৰীসকলে জ্ঞান লাভ কৰিব।)

প্ৰথম গোট : শংকৰদেৱৰ সাহিত্যৰ পৰিচয় আৰু পটভূমি	২০
দ্বিতীয় গোট : বৰগীত :	২০
(১) নাৰায়ণ কাহে ভকতি	
(২) সাৰঙ্গ পাণি হে	
কীৰ্তনঘোষা :	
(১) গজেন্দ্ৰ উপাখ্যান	
(২) শিশু লীলা	
তৃতীয় গোট : হৰিশ্চন্দ্ৰ উপাখ্যান	২০
চতুৰ্থ গোট : পাৰিজাত-হৰণ নাট	২০

সহায়ক গ্ৰন্থ (নিৰ্বাচিত) :

অনুনাদ : শ্ৰীমন্ত শংকৰ আৰু অসমীয়া সংস্কৃতি : ৰঞ্জিত কুমাৰ দেৱগোস্বামী (সম্পা.)

অসমৰ বৈষ্ণৱ সাহিত্য আৰু দৰ্শন : অণিমা দত্ত

পুৰণি অসমীয়া সাহিত্য : বাণীকান্ত কাকতি

প্ৰবন্ধ গানৰ পৰম্পৰাত বৰগীত : বাপচন্দ্ৰ মহন্ত

মহাপুৰুষ শংকৰদেৱ : নবীন চন্দ্ৰ শৰ্মা

শংকৰী সাহিত্যৰ সমীক্ষা : ভৱ প্ৰসাদ চলিহা (সম্পা.)

শংকৰদেৱ (১ম আৰু দ্বিতীয় খণ্ড) : মহেশ্বৰ নেওগ

শংকৰদেৱ অধ্যয়ন প্ৰসঙ্গ : কেশৱানন্দ দেৱগোস্বামী

শংকৰদেৱ অধ্যয়নৰ গ্ৰন্থপঞ্জী : বিমল মজুমদাৰ (সম্পা.)

শংকৰদেৱৰ কৃতি আৰু কৃতিত্ব : শিৱনাথ বৰ্মন

শংকৰদেৱৰ সাহিত্য প্ৰতিভা : হৰিনাথ শৰ্মা দলৈ

শ্ৰীমন্ত শংকৰদেৱৰ সমাজ আৰু সংস্কৃতি : প্ৰদীপজ্যোতি মহন্ত (সম্পা.)

বিষয় সম্পর্কীয় ঐচ্ছিক পাঠ্য

ASM-HE-5046

অসমীয়া কল্পবিজ্ঞান সাহিত্য

মূল্যাংক : ৮০

(উদ্দেশ্য : এই পাঠ্যৰ জৰিয়তে ছাত্ৰ-ছাত্ৰীসকলে কল্পবিজ্ঞানৰ স্বৰূপ সম্পৰ্কে জ্ঞাত হোৱাৰ লগতে অসমীয়া কল্পবিজ্ঞান চুটিগল্প, অসমীয়া কল্পবিজ্ঞান উপন্যাস আৰু অসমীয়া কল্পবিজ্ঞান নাটকৰ বসাস্বাদন কৰিব পাৰিব।)

প্রথম গোট : বিজ্ঞান সাহিত্য আৰু কল্পবিজ্ঞান সাহিত্য : এটা তুলনামূলক পৰিচয় কল্পবিজ্ঞান সাহিত্যৰ চমু ইতিহাস অসমীয়া কল্পবিজ্ঞান সাহিত্যৰ চমু ইতিহাস	20
দ্বিতীয় গোট : অসমীয়া কল্পবিজ্ঞান চুটিগল্পৰ অধ্যয়ন : 'বিৰচতীয়াৰ দেশ' : হৰিপ্রসাদ বৰুৱা 'আৰাজ' : সৌৰভ কুমাৰ চলিহা	20
তৃতীয় গোট : অসমীয়া কল্পবিজ্ঞান উপন্যাসৰ অধ্যয়ন : ইলেকট্ৰনিক নামৰ ল'ৰাটো : শান্তনু তামুলী শব্দ নিৰন্তৰ শব্দ : দীনেশ চন্দ্ৰ গোস্বামী	20
চতুৰ্থ গোট : অসমীয়া কল্পবিজ্ঞান নাটকৰ অধ্যয়ন : বিন্দু : হিমেন্দ্ৰ বৰঠাকুৰ	20

সহায়ক গ্ৰন্থ (নিৰ্বাচিত) :

- অসমীয়া বিজ্ঞান সাহিত্য : দীনেশ বৈশ্য (সম্পা.)
অসমীয়া বিজ্ঞান সাহিত্য : অতীতৰ পৰা বৰ্তমানলৈ : ক্ষীৰধৰ বৰুৱা (সম্পা.)
ইলেকট্ৰনিক নামৰ ল'ৰাটো : শান্তনু তামুলী
বিজ্ঞান সাহিত্য : অসমীয়া বিজ্ঞান সাহিত্যৰ বিভিন্ন ধাৰা : প্রমোদ চন্দ্ৰ নেওগ
বিংশ শতিকাৰ অসমীয়া বিজ্ঞান সাহিত্য : পৰমানন্দ মহন্ত
মইনা : হৰিপ্রসাদ বৰুৱা
হিমেন্দ্ৰ বৰঠাকুৰৰ নাট্যসম্ভাৰ আৰু আলোচনা : নিশিগন্ধা তালুকদাৰ (সম্পা.)

শব্দ নিবন্ধৰ শব্দ : দীনেশ চন্দ্ৰ গোস্বামী

সৌৰভ কুমাৰ চলিহা বচনাৱলী : শোণিত বিজয় দাস, মুনীন বায়ন (সম্পা.)

Science Fiction : Adam Charles Roberts

Science Fiction : Brian Baker

ষষ্ঠ ষাণ্মাসিক
বুনিয়াদী পাঠ্য
ASM-HC-6016
অসমীয়া চুটিগল্প আৰু উপন্যাস
মূল্যাংক : ৮০

(উদ্দেশ্য : ছাত্ৰ-ছাত্ৰীসকলে এই পাঠ্যৰ জৰিয়তে অসমীয়া চুটিগল্প আৰু উপন্যাসৰ ধাৰা সম্পৰ্কে অৱহিত হোৱাৰ লগে লগে অসমীয়া ভাষাৰ গুৰুত্বপূৰ্ণ গল্প আৰু উপন্যাসৰ বসাস্বাদনৰ লগতে ইয়াৰ বিদ্যায়তনিক গুৰুত্ব উপলব্ধি কৰিব।)

প্ৰথম গোট : অসমীয়া চুটিগল্পৰ ধাৰা	20
দ্বিতীয় গোট : অসমীয়া উপন্যাসৰ ধাৰা	20
তৃতীয় গোট : চুটিগল্প লক্ষ্মীধৰ শৰ্মা : নীনা যোগেশ দাস : বৰদেউতা পূৰ্বী বৰমুদৈঃ ৰাজনীতি নুবুজা মানুহ	20
চতুৰ্থ গোট : উপন্যাস মামণি ৰয়ছম গোস্বামী : দঁতাল হাতীৰ উঁয়ে খোৱা হাওদা	20

সহায়ক গ্ৰন্থ (নিৰ্বাচিত) :

অসমীয়া চুটিগল্প : ঐতিহ্য আৰু বিৱৰ্তন : অপূৰ্ব বৰা (সম্পা.)
আধুনিক গল্প সাহিত্য : ত্ৰৈলোক্যনাথ গোস্বামী
উপন্যাস আৰু অসমীয়া উপন্যাস : গোবিন্দ প্ৰসাদ শৰ্মা
এশ বছৰৰ অসমীয়া উপন্যাস : নগেন ঠাকুৰ (সম্পা.)
দঁতাল হাতীৰ উঁয়ে খোৱা হাওদা : মামণি ৰয়ছম গোস্বামী
শ্ৰেষ্ঠ অসমীয়া চুটিগল্প : শৈলেন ভৰালী (সম্পা.)

বুনিয়াদী পাঠ্য
ASM-HC-6026
অসমীয়া লিপিৰ ইতিহাস
মূল্যাংক : ৮০

(উদ্দেশ্য : এই পাঠ্যৰ জৰিয়তে ছাত্ৰ-ছাত্ৰীসকলে অসমীয়া লিপিৰ ইতিহাসৰ আভাস পোৱাৰ লগতে অসমৰ শিলালিপি, অসমৰ তাম্ৰলিপি
সম্পৰ্কেও জ্ঞান লাভ কৰিব।)

- প্ৰথম গোট : লিপিৰ পৰিচয় আৰু ভাৰতীয় লিপি; অসমীয়া লিপিৰ
উদ্ভৱ আৰু বিকাশ 20
- দ্বিতীয় গোট : অসমৰ শিলালিপি : পৰিচয়মূলক অধ্যয়ন —সুৰেন্দ্ৰ বৰ্মাৰ
উমাচল লিপি, ভূতি বৰ্মাৰ বৰগঙ্গা লিপি, হৰ্জৰ বৰ্মাৰ
তেজপুৰ লিপি, কাণাই বৰশীবোৱা লিপি, সমুদ্ৰপালৰ
আমবাৰী লিপি, গছতলৰ লিপি 20
- তৃতীয়গোট : অসমৰ তাম্ৰলিপি : পৰিচয়মূলক অধ্যয়ন— ভাস্কৰ বৰ্মাৰ ডুবি আৰু নিধনপুৰ শাসন, হৰ্জৰ বৰ্মাৰ হায়ুংথল
শাসন, বনমাল বৰ্মাৰ তেজপুৰ আৰু পৰ্বতীয়া শাসন, বলবৰ্মাৰ নগাঁও আৰু হাওৰাঘাট শাসন 20
- চতুৰ্থ গোট : অসমীয়া হাতেলিখা পুথিৰ লিপি :
গড়গঞা লিপি, বামুণীয়া লিপি, কায়থেলী লিপি; হাতেলিখা পুথিৰ লিখন কলা আৰু লেখন সামগ্ৰী 20

সহায়ক গ্ৰন্থ (নিৰ্বাচিত) :

- অসমীয়া প্ৰাচীন লিপি : সৰ্বেশ্বৰ কটকী
অসমীয়া লিপি : উপেন্দ্ৰনাথ গোস্বামী
অসমীয়া লিপিতত্ত্ব অধ্যয়ন : সতীশ চন্দ্ৰ ভট্টাচাৰ্য্য
অসমীয়া লিপিৰ পৰিচয় : কনক চন্দ্ৰ চহৰীয়া
পাঠ-সমীক্ষা (সূত্ৰ আৰু প্ৰয়োগবিধি) : মালিনী গোস্বামী
পাঠ-সমীক্ষা প্ৰসংগত : ৰামচৰণ ঠাকুৰীয়া
প্ৰাচ্য শাসনাবলী : মহেশ্বৰ নেওগ
বিশ্বলিপিৰ ভূমিকা : নাৰায়ণ দাস (সম্পা.)
Development of Script in Ancient Kamrup : T.P. Verma
Inscriptions of Ancient Assam : M. M. Sarma : (ed.)
Kamrupa Sasanavali : D. Sarma (Ed.)
The Evolution of Assamese Script: Mahendra Bora

বিষয় সম্পর্কীয় ঐচ্ছিক পাঠ্য

(এই ষাণ্মাসিকৰ ছাত্ৰ-ছাত্ৰীয়ে পাঁচটা বিষয় সম্পর্কীয় ঐচ্ছিক পাঠ্য ASM-HE-6016, ASM-HE-6026, ASM-HE-6036, ASM-HE-6046, ASM-HE-6056- ৰ মাজৰ পৰা যিকোনো দুটা পাঠ্য বাছি ল'ব পাৰিব)

ASM-HE-6016

লক্ষ্মীনাথ বেজবৰুৱা

মূল্যাংক : ৮০

(উদ্দেশ্য : এই পাঠ্যৰ জৰিয়তে ছাত্ৰ-ছাত্ৰীসকলে সাহিত্যৰথী লক্ষ্মীনাথবেজবৰুৱাৰ সৃষ্টিশীল আৰু চিন্তামূলক লেখাৰ আভাস পাব।)

প্ৰথম গোট : কবিতা (কবিতা, মালতী, বীণবৰাগী ১ম তৰংগ)	20
দ্বিতীয় গোট : সুৰভি (বাপিবাম, লাওখোলা, মলক গুইন্ গুইন্)	20
তৃতীয় গোট : আত্মজীৱনী (মোৰ জীৱন সোঁৱৰণ, প্ৰথম ভাগ)	20
চতুৰ্থ গোট : তত্ত্বকথা : গীতা-তত্ত্ব লঘু ৰচনা : কৃপাবৰ বৰুৱাৰ উইল	20

সহায়ক গ্ৰন্থ (নিৰ্বাচিত) :

অসমীয়া সাহিত্যৰ ঐতিহ্য আৰু লক্ষ্মীনাথ বেজবৰুৱা : তৰণী ডেকা, কামালুদ্দিন আহমেদ (সম্পা.)

কালান্তৰৰ দোমোজাত বেজবৰুৱা : হীৰেন গোহাঁই

বেজবৰুৱাৰ সাহিত্য প্ৰতিভা : বাণীকান্ত শৰ্মা (সম্পা.)

ৰমন্যাসবাদ আৰু লক্ষ্মীনাথ বেজবৰুৱাৰ কবিতা : কামালুদ্দিন আহমেদ

লক্ষ্মীনাথ বেজবৰুৱা : অসম প্ৰকাশন পৰিষদ

লক্ষ্মীনাথ বেজবৰুৱাৰ সাহিত্য প্ৰতিভা : বিশ্বনাৰায়ণ শাস্ত্ৰী

সাহিত্যৰথী : প্ৰফুল্ল কটকী

Lakshminath Bezbaroa the Sahityarathi of Assam : Maheswar Neog (ed.)

বিষয় সম্পর্কীয় ঐচ্ছিক পাঠ্য
ASM-HE-6026
বাণীকান্ত কাকতি
মূল্যাংক : ৮০

(উদ্দেশ্য : এই পাঠ্যৰ জৰিয়তে বাণীকান্ত কাকতিৰ সমালোচনামূলক আৰু চিন্তামূলক প্ৰবন্ধৰ সৈতে ছাত্ৰ-ছাত্ৰীসকল পৰিচিত হ'ব পাৰিব।)

প্ৰথম গোট : বৰগীত বধকাব্য নামঘোষা	20
দ্বিতীয় গোট : আৰ্যাবৰ্ত আৰু পুৰণি অসম কবিৰ অহৈতুকী প্ৰীতি বেজবৰুৱা	20
তৃতীয় গোট : কথা-কবিতা তুমি নাৰী হৃদয়	20
চতুৰ্থ গোট : জাতীয় চৈতন্য নীৰ সাধনা আমাৰ নতুন সাহিত্য	20

সহায়ক গ্ৰন্থ (নিৰ্বাচিত) :

প্ৰসংগ বাণীকান্ত : ভবেন বৰুৱা

বাণীকান্ত ৰচনাৱলী : মহেশ্বৰ নেওগ (সম্পা.)

বাণীকান্তৰ পৰা ভবেন বৰুৱালৈ : শৈলেন ভৰালী

সাহিত্য আৰু চেতনা : হীৰেন গোহাঁই

Banikanta Kakati : The Man And His Works : Tabu Taid
and Ranjit Dev Goswami (eds.)

বিষয় সম্পর্কীয় ঐচ্ছিক পাঠ্য
ASM-HE-6036
অসমীয়া শিশু আৰু কিশোৰ সাহিত্য
মূল্যাংক : ৮০

(উদ্দেশ্য : এই পাঠ্যৰ জৰিয়তে ছাত্ৰ-ছাত্ৰীসকল শিশু-কিশোৰ উপযোগী পদ্য, কাব্য, সাধুকথা, নাটক, প্ৰবন্ধ আৰু মহাকাব্যৰ সৈতে পৰিচিত হ'ব পাৰিব।)

প্রথম গোট : প্রচলিত : কপৌটি এ	20
জ্যোতিপ্ৰসাদ আগৰৱালা : 'জ্যোতি বামায়াণ'ৰ বামৰ জন্ম অংশ	
নৰকান্ত বৰুৱা : কোনে	
নিৰ্মলপ্ৰভা বৰদলৈ : ব'দালি এ ব'দ দে	
দ্বিতীয় গোট : প্ৰফুল্লদত্ত গোস্বামী : বিলাতী হোজা	20
ভবেন্দ্ৰনাথ শইকীয়া : মৰমৰ দেউতা	
তৃতীয় গোট : মিত্ৰদেৱ মহন্ত : মৌ-মহাভাৰত	20
হোমেন বৰগোহাঞি : স্মৃতি-শক্তি আৰু চিন্তা-শক্তি	
চতুৰ্থ গোট : প্ৰবীণা শইকীয়া : অজান দেশত এলিচ	20
বন্দিতা ফুকন : গৰমৰ বন্ধত সোণটি	

সহায়ক গ্ৰন্থ (নিৰ্বাচিত) :

অজান দেশত এলিচ : প্ৰবীণা শইকীয়া

অসমীয়া শিশু সাহিত্যৰ সংক্ষিপ্ত ইতিহাস : উপেন্দ্ৰ বৰকটকী

কিতাপ পঢ়াৰ আনন্দ : হোমেন বৰগোহাঞি

গৰমৰ বন্ধত সোণটি : বন্দিতা ফুকন

জ্যোতিপ্ৰসাদ বচনাৱলী : নগেন শইকীয়া (সম্পা.)

নৰকান্ত বৰুৱাৰ শিশু সাহিত্য সমগ্ৰ : গগণ চন্দ্ৰ অধিকাৰী (সম্পা.)

নিৰ্মলপ্ৰভা বৰদলৈৰ শিশু সাহিত্য সমগ্ৰ : গগণ চন্দ্ৰ অধিকাৰী (সম্পা.)

বিলাতী হোজা : প্ৰফুল্লদত্ত গোস্বামী

মৰমৰ দেউতা : ভবেন্দ্ৰনাথ শইকীয়া

মৰুৱা ফুল : নৰকান্ত বৰুৱা

মৌ-মহাভাৰত : মিত্ৰদেৱ মহন্ত

Children's Literature : A Very Short Introduction : Kimberley Reynolds

Reading Children: Essays on Children's Literature : Rimi B Chatterjee & Nilanjana Gupta (eds.)

বিষয় সম্পর্কীয় ঐচ্ছিক পাঠ্য
ASM-HE-6046
অসমীয়া ভাষাৰ উপভাষা
মূল্যাংক : ৮০

(উদ্দেশ্য : এই পাঠ্যত অসমীয়া ভাষাৰ বিভিন্ন আঞ্চলিক আৰু সামাজিক উপভাষাৰ বিষয়ে আলোচনা কৰা হৈছে। তদুপৰি উপভাষা প্ৰয়োগ সম্বলিত পাঠ সংযোগৰ জৰিয়তে এনে উপভাষাৰ সাহিত্যিক প্ৰয়োগৰ ধাৰণা ছাত্ৰ-ছাত্ৰীক দিবলৈ চেষ্টা কৰা হৈছে।)

প্ৰথম গোট	ঃ উপভাষাৰ সংজ্ঞা আৰু স্বৰূপ : উপভাষাৰ নিৰ্মাণ প্ৰক্ৰিয়া, উপভাষা অধ্যয়নৰ প্ৰয়োজনীয়তা	20
দ্বিতীয় গোট	ঃ অসমীয়া ভাষাৰ ভিন্নতা : আঞ্চলিক উপভাষা, সামাজিক উপভাষা, নৃগোষ্ঠীয় উপভাষা	20
তৃতীয় গোট	ঃ অসমীয়া ভাষাৰ আঞ্চলিক উপভাষাবোৰৰ ভাষিক বৈশিষ্ট্য : উজনি আৰু নামনি	20
চতুৰ্থ গোট	ঃ অসমীয়া সাহিত্যত উপভাষাৰ প্ৰয়োগ : গুণাভিৰাম বৰুৱা : ৰাম-নবমী (পঞ্চম অংক, দ্বিতীয় দৰ্শন) সৌৰভ কুমাৰ চলিহা : হাঁহিচম্পা শীলভদ্র : সহযাত্ৰী	20

সহায়ক গ্ৰন্থ (নিৰ্বাচিত) :

অসমীয়া আৰু অসমৰ ভাষা-উপভাষা : উপেন ৰাভা হাকাচাম
অসমীয়া ভাষাৰ উদ্ভৱ, সমৃদ্ধি আৰু বিকাশ : উপেন্দ্ৰ নাথ গোস্বামী
উপভাষা আৰু অসমৰ উপভাষা : দীপ্তি ফুকন পাটগিৰি (সম্পা.)
উপভাষা বিজ্ঞান : দীপংকৰ মৰল
এহাত ডাবা : সৌৰভকুমাৰ চলিহা
কামৰূপী উপভাষা : এটি অধ্যয়ন : বিভা ভৰালী
গুণাভিৰাম বৰুৱা : ৰাম-নবমী : প্ৰসেনজিৎ চৌধুৰী (সম্পা.)
গোৱালপৰীয়া উপভাষা : ৰূপ বৈচিত্ৰ্য : বিভা ভৰালী আৰু কল্পনা তালুকদাৰ (সম্পা.)
শীলভদ্র : মধুপুৰৰ মধুকৰ (শীলভদ্রৰ নিৰ্বাচিত গল্প) : মুনীন বায়ন (সম্পা.)
A Study on Kamrupi - A Dialect of Assamese : Upendra Nath Goswami
Dialectology : Peter Trudgill

বিষয় সম্পর্কীয় ঐচ্ছিক পাঠ্য

ASM-HE-6056

প্রকল্প

মূল্যাংক : ১০০

এই কাকতখনৰ বাবে ছাত্ৰ-ছাত্ৰীয়ে বিভাগীয় শিক্ষকৰ তত্ত্বাৱধানত কোনো গুৰুত্বপূৰ্ণ স্থান, উৎসৱ-পাৰ্বণ, লোকাচাৰ, লোকপৰিৱেশ্য কলা, লোক সাহিত্য, লোকভাষা আদি যিকোনো এটা বিষয়ত প্রকল্প প্ৰস্তুত কৰিব লাগিব। প্রকল্পৰ শব্দসংখ্যা ৪০০০-৫০০০ ৰ ভিতৰত হ'ব লাগিব। বিভাগৰ মুৰব্বী/ অধ্যাপক/অধ্যাপিকাই তত্ত্বাৱধায়কৰ সহযোগত মূল্যায়নৰ ব্যৱস্থা কৰি প্রকল্পটি আৰু নম্বৰ তালিকা বিশ্ববিদ্যালয়ৰ পৰীক্ষা নিয়ন্ত্ৰকলৈ প্ৰেৰণ কৰিব। এই প্রকল্পৰ মুঠ 100 নম্বৰৰ ভিতৰত 80 নম্বৰ প্রকল্পৰ বাবে আৰু 20 নম্বৰ মৌখিক পৰীক্ষাৰ বাবে ধাৰ্য কৰা হৈছে।

SYLLABUS
EDUCATION

FOR

M. A.CBCS COURSE (Revised syllabus)

Effective from Academic session July 2020

Approved by Academic Council on 08/02/2020

GAUHATI UNIVERSITY
GUWAHATI

Course Outcome of M.A. Education under CBCS Curriculum

- It aims to develop a holistic and multidimensional understanding of the topics.
- It attempts to approach new areas of learning, develop competencies in the students.
- It aims in opening various avenues for self-discovery, academic understanding and employment.

Instruction on teaching method: The classroom transaction of all the papers will be done through lectures, group discussions, experiential exercises, projects, presentations, workshops, seminars and hands on experiences. Students would be encouraged to develop an understanding of real life issues and participate in the programs and practices in the social context. To this end, practicum is incorporated as an important component in many of the papers. Use of ICT and mass media and web based sources is highly recommended to make the teaching learning process interactive and interesting.

Evaluation: The mode of evaluation would be through a combination of external and internal assessment in the ratio of 80: 20 respectively. Equal weightage will be given to all the units while setting of questions papers in external examination. Along with routine examinations, classroom participations, class assignments, project work, and presentations would also be a part of the overall assessment of the student.

List of Papers

Semester	Course Code	Paper Name	Credits
I	1016	Sociological Foundation of Education	6
	1026	Psychological Perspectives of Education	6
	1036	Comparative Education	6
	1046	Educational Technology	6
	1054	VAC (Group Discussion and Co-curricular Activities)	4
II	2016	Social Psychology and Group Dynamics	6
	2026	Educational Planning and Management	6
	2036	Measurement and Evaluation in Education	6
	2046	Psychological Laboratory Practical	6
	2054	VAC (Educational Entrepreneurship, Soft Skill Development)	4
III	3016	Educational Statistics	6
	3026	Problems and Issues in Education	6
	3036	Elective 1 – Abnormal Psychology	6
	3046	Elective 2 – Continuing Education	6
	3056	Elective 3 – Developmental Psychology	6
	3066	Open Course: Stress Management and Mental Health (For Gauhati University)	6
	3076	Environmental Education (For other Colleges)	6
	3084	VAC- (Teaching Skills)	4

IV	4016	Philosophical Foundation of Education	6
	4026	Methodology of Educational Research	6
	4036	Curriculum Development	6
	4046	Elective 1 – Economics of Education	6
	4056	Elective 2 – Guidance and Counselling	6
	4066	Elective 3 – Teacher Education	6
	4074	VAC (Project/Field Trip)	4

□ **This is to be noted that the students of MA 3rd semester will have to select one elective paper out of three options. Open course (paper – 3066) is only for the students of Gauhati University education department . In lieu of the Open course (paper-3066), the students studying M.A. in the different colleges and also the Post graduate (Education) students of IDOL have to take the paper 3076 (Environmental education).**

1st SEMESTER

Course Code - 1016

Total Marks: Internal – 20

End Semester – 80

Total – 100

**Course Name – Sociological
Foundations of Education**

Contact Hours: 6 per week

Nature of the Course – Core

Total Credit – 6

Objectives:

- 1) To enable the students to understand the Social Context of Education and its operational dimensions as a system.
- 2) To enable the students to understand about Culture, its different aspects and relationship with Social Change
- 3) To enable the students to understand current social problems and issues in Education.
- 4) To enable the students to understand about Social Groups and their relevance in Society

Units Contents

Unit-1 Sociology of Education

Concept, Nature and Scope. Theories of Sociology-Functionalist Theory, Conflict Theory and Integrationist Theory. Relationship and differences between Educational Sociology and Sociology of Education.

Unit-2 Culture

Concept, Nature and functions. Types of Culture- Material and Non-Material or Spiritual, Primitive and Modern. Composite Culture, Multiculturalism, Culture and Personality. Cultural Change- Concept, nature and Factors. Social Change- Concept, Nature, Factors and Theories-Evolutionary Theories, Cyclical Theories, Functionalists Theories and Conflict Theories. Education as an Instrument of Socio Cultural Change.

Unit -3 Socialization and Social Stratification

Concept, Nature and Stages of Socialization. Agents of Socialization- Family, School, Peer Group, State and Religion. Importance of Socialization. School as a Social System.

Concept , Nature and Types of Social Stratification and Social Mobility. Relationship of Education with Social Stratification and Social Mobility.

Unit -4 Social Control and Social Order

Concept, Nature and Purpose of Social Control .Types of Social Control-Formal and Informal. Agencies of Social Control.

Concept, Nature and Approaches of Social Order. Problem of Social Order . Theories of 'Unity of Society' - Value Consensus theory and Conflict theory.

Unit-5 Social Organization and Disorganization

Concept and Nature of Social Organization .Types of Social Organization- Formal and Informal. Interrelationship and differences between formal and informal Organizations. Concept and Nature of Social Disorganization. Factors and Types of Social Disorganization. Education as a media in Prevention of Social Disorganization.

Selected Readings :

- Brown, F.J. : Educational Sociology (Prentice Hall, INC, Englewood Cliffs, N.J. Charles E. Tuttle Company, Tokyo, 1961)
 - Ogburn, William F & Nimkoff, Meyer F : A Handbook of Sociology (Eurasia Publishing House, Pvt. Ltd. Ram Nagar, New Delhi, 1947)
 - Durkheim, E. Education and Sociology, New York, The Free Press, 1966
 - Hemlata, T. Sociology Foundation of Education, New Delhi, Kanishka Publisher, 2002
 - S.S. Mathur – Social Psychology, VINOD PUSTAK MANDIR, AGRA-2, Latest Edition
 - McDavid John W & Harari Herbert – Social Psychology Individuals, Groups, Societies
 - Cook L, A. & Cook, E. Sociological Approach to Education, New York, McGraw Hill, 1970
 - Chandra S. And Sarma R.K., Sociology of Education, Atlantic Publishers and Distributors, New Delhi, 7996.
 - Saikia. P., Sociological Foundation of Education, DVS Publishers. Guwahati. New Delhi, 2019
-

Course Code - 1026

Total Marks: Internal – 20

End Semester – 80

Total – 100

**Course Name – Psychological
Perspective of Education**

Contact Hours: 6 per week

**Nature of the Course – Core
Credit – 6**

Total

Objectives:

1. To acquaint the learners with the process of Learning and Learning theories and the importance of motivation in learning
2. To familiarize the students with the concept of intelligence and creativity.
3. To acquaint the students with the traits and types of personality and some personality disorders.
4. To help the students to understand the learners with Learning Disabilities (LD) and help them to acquire the techniques of teaching students with LD

Units Contents

Unit-1 The Process of Learning

- Meaning, definitions and nature of Learning
- Factors affecting learning
- Theories of learning- S-R theories (Connectionism, Classical Conditioning, Operant conditioning), Cognitive Field theory (Gestalt), Theories of Constructivism (Social and Cognitive)
- Educational implications of theories of learning

Unit-2 Motivation in Learning

- Meaning, definitions and functions of motivation
- Intrinsic and Extrinsic motivation
- Theories of motivation- Maslow's self actualization theory, Mc. Clelland Achievement Motivation Theory
- Strategies to enhance motivation in the class

Unit-3 Intelligence and Creativity

- Meaning, definitions and nature of intelligence, influence of Heredity and Environment on intelligence
- Types of intelligence- Social Cultural, emotional and multiple intelligence
- Piaget's theory of cognitive development

- Meaning, and nature of creativity, characteristics of a creative person, identification of creative potential, role of the teacher in nurturing creativity

Unit-4 Understanding Personality

- Meaning, definitions and nature of personality
- Meaning of types and traits of personality
- Theories of personality with special reference to Freud, Allport, Carl Rogers and Cattell
- Determinants of Personality : Genetic, social and cultural

Unit-5 Learning Disabilities and Learner's Needs

- Learning Disabilities (LD)- Meaning and definitions, characteristics of Learning Disabled students
- Causes of Learning Disabilities, Identification and types of Learning Disabilities
- Educational provisions for Learning Disabilities
- Specialised approaches and techniques of teaching students with Learning Disabilities

Selected readings

- Chauhan, S.S: Advanced Educational Psychology, Vikash Publishing House Pvt. Ltd. 1991
- Crow, L.D. & Crow, A. : Educational Psychology, Eurasia Publishing, N.D. 1963
- Comer Ronald & Gould Elizabeth: Psychology around us. Wiley India. New Delhi, 2011
- Fernandes, M.M : The Advanced Educational Psychology: The Psychology of the Learner. Himalaya Publishing House, Mumbai. 2008
- Mangal, S.K: Advanced Educational Psychology. Prantice Hall of India. New Delhi. 2004
- Woolfolk Anita: Educational Psychology. Pearson. New Delhi. 2011

Course Code -1036

Total Marks: Internal – 20

End Semester – 80

Total – 100

Course Name –

Comparative Education

Contact Hours: 6 per week

Nature of the Course – Core

Total

Credit – 6

Objectives:

- 1) To acquaint the students with the need and importance of comparative education.
- 2) To enable the students to develop and understanding of the educational system of India and a few other countries.
- 3) To enable the students to understand the existing educational system of developed and developing countries.

Units

Contents

Unit-1	Comparative education- Meaning, need and importance of the study, Determinants of National System of Education, Steps involved in Comparative Education, Relevance of Comparative Education, Comparative Education in Indian context with Reference to Primary, Secondary and Higher and Teacher Education
Unit-2	England- National Education System of England, Pattern of Administration, Primary Education, Secondary Education, Higher Education and Teacher Education
Unit-3	Japan- National Education System of Japan, Pattern of Administration, Primary Education, Secondary Education, Higher Education and Teacher Education
Unit-4	USA- National Education System of USA, Pattern of Administration, Primary Education, Secondary Education, Higher Education and Teacher Education
Unit-5	Germany- National Education System of Germany, Pattern of Administration, Primary Education, Secondary Education, Higher Education and Teacher Education

Selected Readings :

- Hans, Nicholas, Comparative Education, University Book Stall, 5 Anachari Road, New Delhi-110002
 - Chaube, S.P., Comparative Education, Prasad & Sons, Agra-3
 - Kandel, I.L., The new Era in Education, Houghton Mifflin Co. Boston
 - Kenneth, R.K., Education in USA, Alven Redman Ltd., London
 - Russel, J.D. & Judd, C.H., The Americal Education System, Houghton Mifflin Co. Boston
 - Alexender, W.P. Education in England, Newness Publishing Company Ltd. London

 - Curtis, S.J. History of Education in Great Britain, University Tutorial Press Ltd. London
 - Keenleyside H.L. & Thomas A.F. History of Japanese Education and Present Education system, H Kueido Press, Tokyo
-

Course Code: 1046

Total Marks: Internal-20

End Semester-80

Total-100

Course Name- Educational Technology

Contact Hours: 6 per week

Nature of the Course- Core

Total Credit – 6

Objectives:

1. To enable the students to understand the theoretical base of Educational Technology
2. To acquaint the students with the effective teaching learning process
3. To make the students able to use instructional media in the classroom
4. To make the students understand the innovations in the educational process

Units

Contents

Unit – 1 Conceptual Bases of Educational Technology

- Meaning, definition and scope of Educational Technology.
- Forms and Types of Educational Technology.
- Role of Educational Technology in Distance Education.
- Approaches to Educational Technology.
- Instructional Design-Training Psychology, Cybernetic and Systems Approach

Unit – 2 Programmed Instruction

- Meaning, Scope, Importance of Programmed Instruction
- Fundamental principles of Programmed Instruction
- Styles of Programming- Linear, Branching and Mathetics, Use of Prime, Prompts and cues
- Development of Programmed Instructional Material

Unit -3 The Fundamental Bases of Teaching and Learning

- Meaning, Nature and Characteristics of teaching, Marks of Good Teaching.
- Phases of teaching-Pre-active, Interactive, Post-active, Strategies, Methods and Devises of Teaching.
- The Nature of Learning. Steps in the Learning Process.
- Levels of Teaching Learning-Memory, Understanding and Reflective level,
- Models of Teaching: Meaning and Classification,

Unit – 4 Micro Teaching and Classroom Interaction

- Meaning, Definition and Importance of Micro Teaching
- Micro Teaching Cycle, Use of Different Skills in Micro Teaching,
- Practice and Evaluation of Micro Teaching
- Classroom Interaction and Flanders’s Interaction Analysis Category System (FIACS),
- Practice of FIACS in the Classroom

Unit- 5 Emerging Trends in Educational Technology

- Virtual Reality in Education , Flipped Classroom, Blended Learning,
- EDUSAT, INFLIBNET
- Gamification in Education, Smart Learning Environment (SLEs)
- e-learning tools, M-Learning
- Computer Managed Learning (CML), Computer Aided Evaluation (CAE),
- Open Educational Resources, MOOC, NPTEL, SWAYAM

N.B.- Internal Assessment will be done on the basis of performance in Micro Teaching and Flander’s Interaction Analysis Category System (FIACS)

Suggested Readings:

- Aggarwal, J.C.: 2005,*Educational Technology*
 - Bhatia & Bhatia: 1997,
 - *The Principles and Methods of Teaching* , Doaba House, New Delhi
 - Sampath, K., Paneerselvam, A. & Santhanam, S: *Introduction to Educational Technology*, Steerling Publishers Private Limited
 - Madankar, R.R.: 2016, *Technology of Teaching and Teacher Behaviour* , Neelkamal Publications Pvt.Ltd., Hyderabad
-

Course Code - 1054

**Course Name – Group Discussion
& Co curricular activities**

Contact Hours: 4 per week

Nature of the Course – Value added

Total Credit – 4

Objectives:

- (1) To develop the team spirit among the students
- (2) To develop the skill of leadership
- (3) To develop the adjustment capacity of the students

Contents:

The students will have to participate in Group discussion under the guidance of a teacher on topics related –

- (1) Review of latest educational news
- (2) Literacy programmes
- (3) School education
- (4) Higher education
- (5) Swaccha Bharat Abhiyan
- (6) National Policy on Education
- (7) Developing ecological behaviour
- (8) Gender issues

Co curricular activities- (1) Debating

- (2) Public speaking
 - (3) Drawing & painting
 - (4) Music and dance
 - (5) Drama & Skit
 - (6) Sports
 - (7) Recitation
-

2nd SEMESTER

Course Code - 2016

Total Marks: Internal – 20

End Semester – 80

Total – 100

Course Name – Social Psychology and Group Dynamics

Contact Hours: 6 per week

Nature of the Course – Core

Total

Credit – 6

Objectives:

- 1) To enable the students to understand the concept of Social Psychology and Group Dynamics.
- 2) To enable the students to understand the process of Inter-personal and Inter-group Relationships.
- 3) To enable the students to understand the nature of Social Conflict.
- 4) To enable the students to understand the process of Social Interaction and its relevance to education.
- 5) To enable the students to enhance Self-Awareness and Self-Identity
- 6) To enable the students to apply Social Psychology to the classroom and to positive well-being and education.

Units Contents

Unit 1: Social Psychology

Concept, Nature and Historical Background of Social Psychology .Scope of Social psychology. Importance of Social Psychology .Relationship of Social Psychology with other Social Sciences like General Psychology, Sociology, Economics, Abnormal Psychology and Cultural Anthropology. Methods and Techniques of social psychology with special reference to Observation, Introspection, Experimental, Case History, Survey, Correlation, Sociometry, and Questionnaire. Relationship between Individual and Society.

Unit 2: Social Interaction and Interpersonal Perception

Concept, Nature , Levels of Social interaction. Forms of Social interaction-Communication, Cooperation, Competition, Conformity, Compliance and Obedience.

Concept and Nature of Interpersonal Perception .Areas of Interpersonal Perception-Person Perception and Social Perception- their Concepts and Nature. Aspects of Social Perception-Non Verbal Cues, Attribution and Impression Formation.

Interpersonal Attraction – Concepts and Nature. Theories of Interpersonal Attraction-Cognitive and Reinforcement .Determinants of Attraction.

Unit 3: Beliefs and Attitudes

Concept, Nature and Determinants of Beliefs and Attitudes. Factors of Attitude formation
Attitude formation- Learning, Experience and Genes.

Attitude Change-through Cognitive Dissonance, Persuasion, Dual Process models of
Persuasion, Propaganda, and Counter Propaganda. Theories of Attitude Change-
reinforcement Theory, Cognitive Dissonance theory and Psycho –Analysis. Resistance of
Attitude to Change, its causes.

Unit 4: Stereotyping, Prejudices and Discrimination

Concept, nature and causes of Stereotyping, Prejudices and Discrimination.

Kinds, Formation and Advantages of Stereotype. Discrimination on the basis of Stereotype
and Prejudice. Kinds of Prejudice. Methods to Control Over prejudice. prejudice based on
Gender. Gender stereotypes, discrimination against female, Sexual harassment. Role of
Education on Stereotyping and Prejudice and discrimination.

Unit 5: Social Group and Leadership

Concept and Types of Social Group. Group Structure, Group Size, Group Cohesiveness,
Group Morale. Group Dynamics and its application. Intergroup Conflict and its factors.
Reduction of Intergroup Conflict. Leadership- Characteristics, Types and Functions.
Leadership Training.

Suggested Readings:

- Richard J, Crisp & Rhiannon N Turner, Essential Social Psychology (Third Edition) – SAGE Publication (2014), Los Angeles/London/New Delhi/Singapore
- Frank W Schneider, Jamie A Gruman, Larry M. Coutts Applied Social Psychology (Twelfth Edition) - SAGE Publication (2012), Los Angeles/London/New Delhi/Singapore
- Robert A Barron & Nyla Branscombe, Social Psychology (13th Edition) Pearson, 2014
- B. Kuppuswamy, Introduction to Social Psychology, Asian Publishing House
- Mathur, S.S. Social Psychology, Agrawal Publications, 2011

Course Code - 2026

Total Marks: Internal – 20

End Semester – 80

Total – 100

**Course Name – Educational
Planning and Management**

Contact Hours: 6 per week

Nature of the Course – Core

Total Credit – 6

Objectives:

- 1) To develop an understanding on the basic concept of Educational Management.
- 2) To enable the student to know about the resource and resource management in education.
- 3) To understand the issues and challenges of educational planning.
- 4) To enable the student to know about the financial resources and financial management in education.
- 5) To acquaint the students with the recent issues in educational management.

Units

Contents

Unit-1

Educational Management – concept and nature

- Meaning Nature and scope of Educational Management
- Educational Management, Administration and Organization, their differences and relationship
- Principles of Educational Management
- Management process in education- planning, organizing, directing, supervising and controlling
- Teachers as managers- classroom management and managerial skills of teachers

Unit-2 Resource Management in Education

- Meaning of Resource – need of resource management in education
- Types of resources – Material resource, Human Resource and Financial resource
- Importance of financing education at different levels
- Resource mobilization in educational institution
- Personnel management in education
- Staff development in education – professional preparation of teachers, teachers behaviour

Unit 3 Educational Planning

- Meaning Nature and Importance of educational planning
- Principles of educational planning

- Approaches of educational planning- Social demand approach, Manpower requirement approach, Rate of Return approach
- Decentralization of educational planning
- Institutional Planning- Concept, nature, types, importance and procedure of Institutional Planning

Unit 4 Educational Leadership, Supervision and Inspection

- Meaning Nature and styles of leadership
- Teachers as educational leader
- Meaning Nature and scope of educational supervision
- Objectives and functions of educational supervision
- Defects of existing system of supervision and remedies
- Educational Inspection, meaning, aims and principles of effective Inspection
- Qualities of good educational Inspector

Unit-5 Contemporary issues in Educational Management

- Supervision and Inspection in education
- Total Quality Management in Education
- Performance Appraisal of Teachers
- Public Private Partnership in Education- Concept, Scope and Need
- Educational Entrepreneurship and collaboration
- Organizational Climate and Institutional effectiveness- concept and nature

Selected Readings:

- Sharma, R.N. (2007) Educational Administration, Management and Organization, Surjeet Publications, Delhi-110007
- Taj, Hasneen and Bhargava Piyush (2012), Modern Perspectives of Organizational Behaviour, Harprasad Institute of Behavioural Studies, Agra-262007
- Mathu, M.V. (1983), Towards Improved Educational Planning and Administration, Dislogue Publication
- Bhatnagar, R.D. (1986). Educational Administration, Planning and Supervision, Anupam Publications
- Adams, H.P. and Dickey F.G. (1993), Basic Principles of Supervision, American Book Co. New Work
- Bhatnagar, R.P. and Agarwal, V. (2003), Educational Administration, R. Lal Book Depot, Meerut
- Cambell, C.M. (2000), Practical Application of Democratic Administration, Harper and Brothers, New York

Course Code - 2036

Total Marks: Internal – 20

End Semester – 80

Total – 100

**Course Name – Measurement
And Evaluation in Education**

Contact Hours: 6 per week

Nature of the Course – Core

Total Credit – 6

Objectives:

- 1) To enable the students to understand the concept of measurement and evaluation in the field of Education.
- 2) To acquaint the students with different types of measuring instruments and their uses
- 3) To enable the students to understand the principles of test construction and standardization.
- 4) To acquaint the students with the test of Intelligence, Personality and Aptitude and their importance in different fields

Unit

Contents

Unit-1 Concept of Measurement, Evaluation Test Construction and Standardisation

- Meaning Nature, Scope and purpose of Mental Measurement and Evaluation, Measurement in Physical and Behavioural Sciences, Scales of Measurement
- Meaning of Educational and Psychological Test. Criteria of good Psychological test
- Test Construction and Standardisation – Meaning and nature, Selection of subject matter, Item writing, Administration, Item Analysis
- Test Reliability and Validity
- Test Scores, Norms and their uses.

Unit-2

Measurement of Educational Achievement

- Meaning, Nature and Function of Achievement and Achievement Tests
- Objectives of Achievement Test (Bloom's Taxonomy)
- Construction of Achievement Test
- Essay and objective type tests
- Diagnostic Test in Reading and Arithmetic

Unit-3

Measurement of General Intelligence

- Meaning and Nature of Intelligence Test
- Types of Intelligence test (Individual, Group and Performance test)
- Development of Individual test of Intelligence (Binet's Test, 1905-1908), Stanford Revision of the Binet – Simon Intelligence Test. (1911,1916)

Stanford Binet Test (1937) 1960 revision of Stanford Binet Test of Intelligence

- Wechsler Intelligence Scales
- Uses of Intelligence Tests

Unit-4 Measurement of Personality

- Meaning, Nature and uses of Personality Test
- Types of Personality Test (Subjective, Objective, Projective and situational). The nature of the different types of Personality Test
- Subjective technique : (Autobiography, and Case history)
- Objective Technique : (Personality Inventories and Rating Scales)
- Projective Technique : (Rorschach Ink Blot test, Thematic Apperception Test)
- Situational Technique : (Role-playing and Psychodrama)

Unit-5 Measurement of Aptitude

- Meaning, Nature and Uses of Aptitude Tests
- Types of Aptitude Test – General Aptitude Test and Special Aptitude Test
- General Aptitude Test Batteries (General Aptitude Test Batteries, Different Aptitude Test Batteries, Test of Primary Mental Ability)
- Special Aptitude Test (Mechanical Aptitude Test, Clerical Aptitude and Musical Aptitude Test)
- Educational significance of aptitude tests

Selected Readings:

- 1) Anastasi A : Psychological Testing, 1997 Pearson Education Pvt. Ltd., Pratapganj, Delhi 110092
- 2) Asthana Bipin : Measurement and Evaluation in Psychology and Education, Vinod
- 3) Cronbach, L.J : Essentials of Psychological testing – Harper and Row
- 4) Freeman, F, S, : Psychological Testing, Oxford & IBH, Calcutta 5th Edition
- 5) Thorndike and Hagen : Measurement and Evaluation in Psychology and Education
- 6) Singh Arun Kumar : Tests Measurements and Research in Behavioural Sciences

Course Code - 2046

Total Marks: Test & Experiment: 25+25=50

Internal Assessment (Notebook): 20

Viva-voce: 30

Total marks =100

Course Name –Psychological

Contact Hours: 12 per week

Laboratory Practical

Nature of the Course – Core (Laboratory Practical)

Total Credit – 6

Objectives:

- 1) To enable the students to understand the concept of Experimental Psychology.
- 2) To understand about the methods of conducting various Psychological Experiment Tests
- 3) To develop scientific attitude among the Students

Units	Contents
Unit-1	Learning <ol style="list-style-type: none">a) Maze Learningb) Distributed Vs Massed Learningc) Bilateral Transfer – Mirror Drawing
Unit-2	Motivation & Fatigue <ol style="list-style-type: none">a) Effect of Frustration on Performanceb) Knowledge of Resultc) Achievement Motivationd) Mental Work and Fatigue
Unit-3	Memory and Forgetting <ol style="list-style-type: none">a) Logical Memory and Memory of Discrete Materialsb) Comparison of Memorization between Meaningful Material and Non sense Materialc) Short Term Memoryd) Auditory and Visual Memorye) Proactive and Retroactive Inhibition
Unit-4	Attention, Thinking and Imagination <ol style="list-style-type: none">a) Span of Apprehensionb) Division of Attentionc) Concept Formationd) Creative Imagination and Inventione) Creativityf) Ink – Blot Test
Unit-5	Personality – Interest, Intelligence, Aptitude and Reaction Time

- a) Personality Test of Introversion and Extroversion
- b) Measurement of Values
- c) Personality Adjustment Test
- d) Measurement of Interest
- e) Measurement of Verbal and Non-Verbal Intelligence
- f) Differential Aptitude Test (DAT)
- g) Simple Reaction Time
- h) Complex Reaction Time
- i) Associative Reaction Time

- Saikia Lutfun Rasul : Psychological and Psychological Experiments in Education 2018
 - Fox Charles : A Text Book of Practical Psychology
 - Woodworth Robert S & Schlosberg Harold : Experimental Psychology
 - Das P.C. : Experiment and Measurement in Education and Psychology, Guwahati, 2000.
-

Course Code - 2054

**Course Name – Educational
Entrepreneurship, Soft
Skill Development**

Contact Hours: 4 per week

Nature of the Course – Value added

Total Credit – 4

Objectives:

- 1) To develop the knowledge and skill to organize an educational Institution
- 2) To develop the soft skill among the students
- 3) To develop the skill of facing an Interview

Soft skill development

- 1) Facing an Interview
 - 2) Confidence building
 - 3) Time management
 - 4) Communication skill
 - 5) Leadership and Team work
 - 6) Social service
-

3rd SEMESTER

Course Code - 3016

Total Marks: Internal – 20

End Semester – 80

Total – 100

Course Name - Educational Statistics

Contact Hours: 6 per week

Nature of the Course – Core

Total Credit – 6

Objectives:

- To enable the students to understand the different concepts of statistics.
- To familiarize the students with the various methods of Inferential Statistics.
- To enable the students to understand the application of different statistical methods in Research activities.

Unit

Contents

Unit-1 The Normal Distribution

- The Meaning, Nature and Importance of Normal Probability Curve
- Properties of Normal Probability Curve
- Use of Normal Probability Curve
- Table of Areas under the Normal Curve
- Measures of Asymmetry or Divergence from Normality
- Application of Normal Probability Curve

Unit-2 Regression and Correlation

- Regression Equation, Regression and Prediction,
- Product Moment Correlation Scatter Diagram

Unit-3 The Significance of the Other Statistics and the Difference between Means

- The Meaning of Statistical Inference, Need and importance of Statistical Inferences
- The concept of Confidence Interval, t' distribution and degree of freedom, The concept of Standard error of Mean of Large and Small Sample.
- The Significance of the Mean, Median Measures of Variability, Coefficient of Correlation
- Meaning, nature and Uses of Parametric Test, The Meaning of Hypothesis
- Types of Hypothesis (Null and Alternative), Level of Significance, Two Tailed and One Tailed Test of Significance, Type I and Type II Error in Testing Hypothesis
- Significance of the Difference Between Means of Large and Small sample (Correlated and Uncorrelated sample)

Unit-4 Analysis of Variances

- Meaning, Nature and uses of the Analysis of Variances (ANOVA)
- Assumptions of ANOVA
- One Way Analysis of Variances
- Two Way Analysis of Variances
- Differences between One Way and Two Way Analysis of Variances
- Steps in calculating Analysis of Variances
- Limitations of ANOVA

Unit-5 Chi square Test

- Meaning and Nature of Non Parametric Test
- Chi Square test and its nature
- Assumption of Chi Square test
- Uses and Significance of Chi – Square test
- Chi Square as a Goodness of Fit
- Chi Square test of Equality
- Chi Square as a test of Independence
- Testing Null hypothesis of Independence in 2 X2 Contingency Table

Selected Readings :

- Garrett, H. E. Statistics i Psychology and Education, Vakils etc Bombay
 - Guildford, J. P. Fundamental Statistics in Psychology and Education Mc Graw Hill
 - Minium, E.W. : Statistical Reasoning in Psychology and Education, John Willey
 - Mangal, S.K. Statistics in Psychology and Education, Prentice Hall
 - Saha Kaberi : Statistics in Psychology and Education, Asian Publishers
 - Tate, M.W. Statistics in Education, Macmillan
-

Course Code - 3026

Total Marks: Internal – 20

End Semester – 80

Total – 100

**Course Name – Problems and
Issues in Education**

Contact Hours: 6 per week

Nature of the Course – Core

Total Credit – 6

Objectives:

- 1) To familiarize the students with the constitutional provision of education and their implementation.
- 2) To familiarize the students with the various schemes of elementary education including RTE Act 2009
- 3) To familiarize the students with the programmes of secondary education
- 4) To familiarize the students with the value, peace education and human rights education
- 5) To familiarize the students with the various issues of Indian higher education

Unit

Contents

Unit-1

- Educational provisions under Indian constitution and their implementation
- Sarva Shiksha Abhiyan- Objectives, Components and Implementation with reference to Assam
- Mid-Day Meal Scheme
- Primary Education as Fundamental Right
- Right of Children to Free and Compulsory Education Act (RTE) 2009, significance and critical appraisal of the act
- Recruitment of Elementary school teachers- Importance of TET

Unit-2

- Vocationalization of secondary education
- Implementation of RMSA
- Education system in secondary education – Continuous Comprehensive Evaluation, Grading system
- Problems of secondary education in India with reference to Assam
- Gender gap in secondary education
- Focus on secondary education in the recent five year plan

Unit-3

- Value- concept and classification
- Need of Value oriented education in the 21st century

- Policies on value education in India
- Peace Education – meaning and significance
- Status of peace education in the curriculum of higher education
- Role of world organization in promoting peace education – UNO, UNESCO, UNICEF
- Human Rights Education- definition and objectives
- World programmes on Human Rights Education

Unit-4

- Structure of higher education in India
- Institutional framework of higher educational in India – Universities, Institutions of National Importance, Deemed universities, Affiliated college, Autonomous College
- Higher Education through ODL system- Role of IGNOU
- National Knowledge Commission on Higher Education
- Yashpal Committee Report on higher education
- Higher education in the recent Five Year Plan
- Rastriya Uchchattar Shiksha Abhiyan (RUSA)

Unit-5

- Quality Assurance in Indian higher education
- Assessment and Accreditation of higher educational institutions – Role of NAAC
- Examination reforms – Semester system, Choice Based Credit System (CBCS)
- Access, equity and relevance of Indian higher education
- Impact of Globalization on Indian higher education
- Privatization of higher education

Selected Reading

- Lal and Sinha (2007), Development of Indian Education and Its problems, R. Lal Book Depot, Meerut
- Bhatnagar, S and Sexana A. (2006), Modern Indian Education and its Problems, R. Lal Book Depot, Meerut
- Report of the Rastriya Madhyamik Shiksha Abhiyan (RMSA) 2010, Govt. of India, MHRD, New Delhi
- Mahanty, J, Indian Education in Emerging Society, Sterling Publishers, New Delhi
- Aggarwal, Sudher, Human Rights in Psy-social Perspectives, Rakhi Prakashan, Agra
- Rahela, S.P. and Bhargava Vovek, Dimensions of Value Education, H.P. Bhargava Book House, Agra
- Hicks, David, Ed. – Education for Peace, New York Routledge
- Goswami, Dulumoni, Higher Education in India, Growth, Expansion and Issues, DVS Publishers, Guwahati
- Goswami, Dulumoni, Contemporary Issues in Education , EBH Publishers, Guwahati

Course Code - 3036

Total Marks: Internal – 20

End Semester – 80

Total – 100

**Course Name –
Abnormal Psychology**

Contact Hours: 6 per week

Nature of the Course –

Elective -1

Total Credit – 6

Objectives:

- 1) To enable the students to understand the different concepts related to Abnormal Psychology.
- 2) To acquaint them with the causes, symptoms and behavioural problems of the people having abnormal behaviour.
- 3) To enable them to understand the process of diagnosis, prevention and treatment of the people having abnormal behaviour.

Unit Contents

Unit-1 Concept of abnormal behaviour

- The Normal and Abnormal Behaviour
- Meaning, nature symptoms and general causes of Abnormal Behaviour.
- Popular beliefs and misconception. The modern concept of Abnormality.
- Classification of Abnormal Behaviour.
- Scope of Abnormal Behaviour.

Unit-2 Psycho Neurotic Disorder

- Meaning of Psycho- Neurosis, Characteristics of Psychoneurosis, Types of Psycho- Neurotic Disorder.
- Anxiety Neurotic disorders its symptoms, causes and treatment.
- Phobic Neurotic Disorder, its symptoms, causes and treatment.
- Obsessive- Compulsive disorder, its symptoms, causes and treatment.
- Hysteric Neuroses symptoms, causes and treatment.

Unit-3 Psychotic disorder

- Meaning of Psychosis, characteristics of Psychosis, Types of Psychotic Disorder.
- Schizophrenia, its types, Symptoms, causes and treatment.
- Manic – Depressive Psychosis, Symptoms, causes and treatment.
- Incidence and Care of Mental Patient – Hospitalisation (Drug Therapy)
- Physiotherapy.
- Psychotherapy and Psycho analysis.

Unit-4 Conduct Disorder

- Meaning and nature of Conduct Disorder, symptoms, types and Causes.
- Drug Addiction, Symptoms causes and treatment.
- Alcoholism, Symptoms causes and treatment.
- Anti Social personalities and crimes (Juvenile Delinquency, crime and psychopathic personalities), Causes and treatment

Unit-5 Mental mechanism and symptom

- Meaning and nature of Mental Mechanism.
- Mental symptoms (delusions, hallucinations, regression, psychological ailments, memory disorders and emotional disorders, symptoms and types).
- Advantages and Limitations of Mental Mechanism

Selected Reading

- Brown, J.F. The Psychodynamics of Abnormal Behaviour, Tata Mcgraw Hill,
 - Coleman, J.C. Abnormal Psychology and Modern Life, Taraporevala, Bombay, 1964
 - Page, J.D. Abnormal Psychology, Abnormal Psychology, Tata Mcgraw Hill,
 - Prem Prakash Abnormal Psychology, Causes and Remedies, Lakshi Publisher &
-

Course Code - 3046

Total Marks: Internal – 20

End Semester – 80

Total – 100

Course Name – Continuing Education

Contact Hours: 6 per week

Nature of the Course –

Elective -2

Total Credits – 6

- 1) To enable students to understand the concept of continuing education and its relevance to the changing society.
- 2) To acquaint the students understand the major problems of continuing education.
- 3) To make the students understand the major problems of continuing education.
- 4) To enable the students to know about the continuing educational system in U.K., Bangladesh and Thailand.

Unit Contents

Unit-1 Concept and Role of Continuing Education

- Concept, Meaning, objectives, scope and significance of Continuing education.
- Social change through continuing education.
- Role of continuing education in planned development of society.
- Role of universities including open universities for development of Continuing Education.
- Planning, Monitoring, Evaluation and Research in Adult/ Continuing Education.
- Role of Continuing Education in occupational development.

Unit-2 Methodology of Continuing Education

- Methods, Techniques, Aids and devices of continuing education.
- Motivation and method for Adult Learning.
- Factors for Effective learning.
- Role of print and electronic media in Adult/ Continuing Education.
- Auto instructional materials.

Unit-3 Continuing Education Programmes in India

- Fundamental Education. Adult Education. Extension Education. Social Education.
- Farmers Functional Literacy programme (1967), Non-formal Education programme for Women and Youth (1975).
- National Adult Education Programme (1978), National Literacy Mission (1988), Total Literacy Campaign & Post Literacy Campaign.
- Shakshar Bharat Mission with special reference to Assam.
- Continuing education through ODL system.

Unit-4 Organization and Administration of Continuing Education

- Planning and organization of Continuing education programme.
- Training facilities for functionaries available at various levels – National, State, District, Local level.
- UGC policy on Adult/ Continuing and extension education and Lifelong learning.
- Role of NGO in Adult/ Continuing education programme.
- Problems of Continuing Education in India.

Unit-5 Continuing Education in Developing and developed countries

- Continuing Education in Canada, Malaysia and Thailand.

Selected readings:

- Bordia A. And other 9ed). Adult Education in India, Indian Adult Education, New Delhi.
 - Daswani C.J., and Shah S.Y., (eds), Adult Education in India, Selected papers, UNESCO, New Delhi, 2000.
 - Desai A.K. Adult Education in developing countries Directorate of Adult Education, The Long March to Literacy, Government of India, New Delhi – 17.
 - Dutta, S.C., History of Adult Education in India, IAEA, New Delhi, 1986.
 - Lowe John, The education of Adult: A world perspective, Paris UNESCO press, 1975.
 - Ministry of Human Resource Development, New Policy on Education, Government of India, New Delhi – 1986.
 - Shah, S.Y., An Encyclopaedia of Indian Adult Education, National Literacy Mission, MHRD, Government of India, New Delhi – 1999.
 - Training of Adult Education Functionaries: A Handbook, Ministry of Education & Social Welfare, New Delhi – 1977.
 - Department of Adult Education, Learning for participation: an approach to training in adult education, Government of India, New Delhi
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Course Code -3056

Total Marks: Internal – 20

End Semester – 80

Total – 100

Course Name – Developmental Psychology

Contact Hours: 6 per week

Nature of the Course –

Elective -3

Total Credits – 6

Objectives:

- 1) To enable the students to understand the basic concept relating to growth and development.
- 2) To Enable the Students to understand the general principles of Growth and Development.
- 3) To enable the students to understand the general characteristic and problems of each stage and their implication.

Unit	Contents
Unit-1	Developmental Psychology Meaning and scope, Growth and Development: Concept, Prenatal Development, The New Born Child- actions and Reactions of the neonate
Unit-2	a) Infancy – developmental aspects, Emotional, Motor, Sensory, Early Needs and habit formation, b) Childhood- Language Development in Children, Development of Concepts, Speech Development
Unit-3	Children and their Parents- Parental attitudes, Parenting Skills, Problems faced by children of Broken homes and Working Mothers
Unit-4	Physiological Development, Mental Development, Emotional Development, Moral Development, Social Development during Adolescence, influence of family andpeers in their Social Relationship
Unit-5	Personality Development during Adolescences, self concept, self esteem, Personality Deviation, Adjustment Problems and Juvenile Delinquency

Selected Readings :

- Chanda, S. C. (1989) : Child Psychology & Child Development, Loyal Book Depot
 - Cole, L. (1959) : Psychology of Adolescence, Rinehard & Winston, NY.
 - Ferguson, C. A. (1973) : Studies of Child language development, New York : Holt, Rinehart and Winston
 - Goswamee, G. (2008) : Child Development & Child Care, Arun Prakashan
 - Hurlock, E.B. (2000) : Adolescence Development, Mc. Graw Hill NC.
 - Hurlock, E.B. (1978) : Developmental Psychology – a life span approach. The Mc. Graw Hill Publishing company ltd., New delhi
 - Jersild, A. T. (1967) : Psychology of Adolescence, Macmillan, New York
 - Kuppuswamy, B. (1980) : Child Behaviour and Development, 2nd edition, Vikas Publishing House pvt. Ltd.
 - Thomson, G. G. (1969) : Child Psychology. Indian reprint. The Times of India Press, Bombay
-

Course Code - 3066

**Total Marks: Internal – 20
End Semester – 80
Total – 100**

**Course Name –Stress Management
& Mental Health**

Contact Hours: 6 per week

Nature of the Course – Open

Total Credit – 6

Objectives:

- 1) To acquaint the students with the concept of Mental Health and Hygiene and to make them realize the need and importance of mental health and hygiene.
- 2) To develop an understanding of what is adjustment, characteristics of well adjusted person and the problems of adjustment in various life situations.
- 3) To be sensitive towards the adjustment problems of the special children.
- 4) To be aware of the different types of adjustment mechanisms and their role in the preservation of mental health and hygiene.
- 5) To know the meaning of mental well being and to acquaint with the coping mechanisms of mental well being.

Unit	Contents
Unit-1	<p>Concept of Mental Health and Hygiene</p> <ul style="list-style-type: none">• Meaning and nature of Mental Health. Characteristics of a Mentally Healthy Person• Criteria of Mental Health, Mental Health Hazards, Factors affecting Mental Health.• Meaning and definition of Mental Hygiene, Goals of Mental Hygiene, Functions of Mental Hygiene, Need of Mental Hygiene. Difference between Mental Health and Hygiene.
Unit-2	<p>Concept of Mental well being</p> <ul style="list-style-type: none">• Meaning, Definition and nature of Positive Psychology and Mental Well-being as per World Health Organization (WHO). Importance of Mental Well-being.• Component of Mental Well-being (Physical, Social, Environmental, Intellectual, Emotional and Spiritual).
Unit-3	<p>Emotion as a Predictor of Poor Mental Health</p> <ul style="list-style-type: none">• Meaning, symptoms, causes and types of emotion an emotional problem.• Stress - Meaning, Symptoms, causes and its effects.• Frustration and Anger - Meaning, Symptoms, its effects, causes, Reaction to frustration, its effect on Physical and Mental Health.• Conflict – Meaning, Types (Intrapersonal, Interpersonal and unconscious) Causes, symptoms, its effect on Physical and Mental Health.

Unit-4 Management of Stress, Anger, Frustration and Conflict

- Stress Management (Yoga, Meditation and Pranayam and other methods like, allotting time for oneself, Physical activities, Diet, Sleep, Quality Leisure time activities and to learn to accept oneself).
- Some common Psychological means in resolving Conflicts.
- Some common Psychological means in overcoming frustration and anger.

Unit-5 Adjustment Process

- Meaning and nature of Adjustment Process (Mechanism). Different types of Adjustment Mechanism, (Aggression, Compensation, Sublimation, Identification, Rationalisation, Regression, Repression, Fantasy, Displacement and Projection).
- Advantages and Limitations of Adjustment Mechanism.

Selected Reading

- Boarman, S, 2009, NHS Health and wellbeing : Fina Report London, Department of Health
- Hadfield, J. A. : Psychology and Mental Health
- Hart, B The Psychology of Insanity, University Press Cambridge
- Carroll, H. A. : Mental Hygiene, Dynamics of Adjustment
- Kalein D. B. Mental Hygiene, Prentice Hall

N.B: Open only for Gauhati University students

Course Code - 3076

Total Marks: Internal – 20

End Semester – 80

Total – 100

**Course Name –
Environmental Education**

Contact Hours: 6 per week

Nature of the Course – Core

Total Credit – 6

Objectives:

- 1) To give the students the concept of Environment and its importance
- 2) To enable the students to understand the importance of Environmental Education
- 3) To acquaint the students with different natural and man induced environmental stressors and to help them to acquire the environmental conservation strategies.
- 4) To acquaint the students with the demographic scenario in Indian population and impact of population growth on environment
- 5) To make the students to understand the relationship between Man and Environment and to inculcate in them the environmental values and sustainable development

Unit Contents

Unit-1 Concept of Environment

- Meaning, definitions and characteristics of Environment
- Structure and components of environment, Ecology and Ecosystem
- Relationship between Man and Environment
- Interdependency in environment: Food Chain and Food Web, Factors affecting Food Chain and Food Web

Unit-2 **Environmental Awareness through Education**

- Environmental Education: Meaning, definitions, objectives and guiding principles
- Need and importance of Environmental Education as an interdisciplinary subject
- Education for environmental awareness and attitudinal change
- Strategies of teaching Environmental Education at different levels – Primary, Secondary and Higher.

Unit-3 **Environmental stressors and conservation of environment**

- Environmental degradation and environmental pollution
- Environmental Stressors: Natural and man induced environmental stressors
- Conservation of Environment: Meaning, need, objectives and categories of conservation, types of conservation method
- Environment protection laws and constitutional safeguards in India: Article 51A, The Water (Prevention & Control of Pollution) Act 1974, The Air (Prevention & Control of Pollution) Act 1981, The Environment (Protection) Act 1986

Unit-4 Population and Quality of life

- Population growth in India and its causes
- Population growth and its impact on environmental degradation
- Population Education: Meaning, nature and importance of population education
- Population related policies in India, Population and quality of life

Unit-5 **Environmental Ethics and Sustainable Development**

- Man and his environment through ancient period to present period
- Environmental ethics and values of Environment, Principles of Environmental ethics
- Decline in basic environmental values and its impact on environment
- Striving for a better environment – Concept of Sustainable Development, Environmental Education for sustainable development

Selected readings:

- Chitrabhanu, T.K.: Environmental Education. Authorspress. New Delhi 2007
- Gupta, P.K.: Population Education. R. Lall Book Depot. Meerut. 2004
- Ramakrishnan and Panneeselvam: Environmental Science Education. Sterling Publishers Pvt. Ltd. New Delhi. 2007
- Reddy and Reddy: Environmental Education. Neelkamal Publications Pvt. Ltd. Hyderabad/New Delhi. 2003
- Sharma and Matheshwari: Education for environment and Human Values, R. Lall Book Depot. Meerut. 2005
- Sharma, R.A.: Environmental Education. R. Lall Book Depot. Meerut. 2008

N.B: Open for other colleges having M.A.

Course Code - 3084

Course Name –Teaching Skills

Contact Hours: 4 per week

Nature of the Course - Value added

Total Credit – 4

Objectives:

To acquaint the students with different teaching skills.

Different teaching skills will have to practice by the students through classroom teaching or by micro teaching

4th SEMESTER

Course Code - 4016

Total Marks: Internal – 20

End Semester – 80

Total – 100

**Course Name – Philosophical
Foundations of Education**

Contact Hours: 6 per week

Nature of the Course – Core

Total Credit – 6

Objectives:

- 1) To enable the students to understand the concept of Philosophy of Education
- 2) To enable the students to understand about the Ancient Indian Schools of thought
- 3) To Enable the Students To critically Examine The Concepts of Education In India And Western Philosophical Thoughts
- 4) To acquaint the students to understand the Platonic Philosophy of Education and its Implication

Unit Contents

Unit-1 Philosophy of Educational Philosophy

Concept, Nature and Scope. Philosophy and Science, Philosophy and Education. Functions of Educational Philosophy

Unit-2 Indian Schools of Thought- Vedic period

Educational Philosophy of Upanishads, Salient Features of Nyaya, Shankhya, Yoga, Mimansha, Vedanta and Vaisheshika Philosophy and their Educational Implication

Unit-3 Indian School of Thought- Post Vedic and Medieval Period

Salient features of Buddhist system of educational Philosophy, Jain Philosophy of Education, Islamic System of Educational Philosophy and their Educational Implication

Unit-4 Western Schools of Thought

Salient features of Idealism, Naturalism, Pragmatism, Existentialism, Realism and their Educational implication

Unit-5 Platonic Philosophy of Education

Salient features of Platonic Philosophy of Education and its Implication to Education system – Ancient and Modern

Selected readings

- Shrivastava, K. K. : Philosophical Foundation of Education (Kanishka Publishers, Distributers, New Delhi, 2003)
 - Chaube, S.P. and Akhilesh Choube, Philosophical and Sociological Foundation of Education, Vinod Pustak Mandir, Agra-2
 - Sahu, Bhagirathi : The New Educational Philosophy, Sarup and Sons : New Delhi, 2002
 - Wingo, G. Max: Philosophies of Education, Sterling Publishers Pvt. Ltd. New Delhi, 1975
 - Brubacher J.S : Modern Philosophies of Education, McGRAW-HILL BOOK COMPANY, INC, New York, Toronto London, 1950
 - Chakrabarti, Mohit, Pioneers in Philosophy of Education, Concept Publishing Company: New Delhi, 2002
 - Goswami, Dulumoni, Philosophy of Education, DVS Publishers, Guwahati, 2014
 - Bryan Magee, The Story of Philosophy, The Dorling Kindersley Book, London
-

Course Code - 4026

Total Marks: Internal – 20

End Semester – 80

Total – 100

**Course Name – Methodology
of Educational Research**

Contact Hours: 6 per week

Nature of the Course – Core

Total Credit – 6

Objectives:

- To help the students to understand the concept, types and methods of Educational Research.
- To familiarize the learners with the concept, steps, significance of Review of related literature in Educational Research.
- To acquaint the students with the data collection procedure and the various tools of Educational Research.
- To impart knowledge regarding qualitative and quantitative data analysis.
- To enable students/learners to prepare Research Report.

Unit Contents

Unit-1

- Educational Research – meaning, nature, steps, significance and scope of Educational Research.
- Types of Research – Basic/fundamental research, Applied and Action Research.
- Methods of Educational Research – The Historical Method – Nature of Historical Research; The Descriptive Method – Nature, value, types and steps; The Experimental Method – Nature and steps.

Unit-2

- Review of Related Literature – purpose, steps involved in Review of Literature
- Identification of Review of Literature
- Organising the related literature
- Ethical issues in Social Research

Unit-3

- Design of the study – population, sampling – meaning, nature, types of sampling, representative Vs random sampling, techniques of randomization in sample selections, sample size, random sampling errors and its importance for drawing inference.
- Tools of Educational Research – Observation Schedule, Questionnaire, Interview Schedule, Inquiry forms.

Unit-4

- Qualitative and Quantitative Research – meaning and concept
- Difference between Qualitative and Quantitative Research

- Common aspects Qualitative and Quantitative Research
- Advantages and disadvantages of Qualitative and Quantitative Research
- Qualitative Data Analysis – Organisation of qualitative data, Analysis and Interpretation of qualitative data
- Quantitative Data Analysis – Organisation of Quantitative data, Analysis Quantitative data

Unit-5

- The Research Report: Preparation of the Research Report – General format of Research Report

Selected Readings :

- 1) Best, John W. And Kahn, James V – Research in Education, New Delhi: Prentice Hall of India Pvt.
 - 2) Good, C.V. and Scates D.F. – Methods of Research – Educational, Psychological, Sociological, New York Appleton Century Crofts Inc.
 - 3) Koul Lokesh - Methods of Educational Research, New Delhi: Vikash Publishing House Pvt. Ltd.
 - 4) Young, P.V. – Scientific Social Survey and Research, New York: Prentice Hall
 - 5) Ackoff, Rusell L – the Design of Social research, Chicago: University of Chicago Press
 - 6) B Whitney, L – The elements of Research, New York: Prentice Hall
 - 7) Travers Robert, M.W. – An Introduction of Educational Research, New York: Mac Millan Publishing Co. Inc.
-

Course Code - 4036

Total Marks: Internal – 20

End Semester – 80

Total – 100

Course Name –

Contact Hours: 6 per week

Curriculum Development

Nature of the Course – Core

Total Credit – 6

Objectives:

- To enable the students to understand the concept, needs and scope of curriculum in relating to curriculum development
- To acquaint the students with the bases of curriculum and importance of technology integration in transacting curriculum
- To help the students to identify the problems of existing curriculum and also to enable them with the new trends and innovative practices in curriculum development

Unit Contents

Unit-1 Curriculum Development

- Curriculum – Meaning, nature, needs and scope of curriculum
- Curriculum Development – it's objectives and basic elements
- Factors influencing Curriculum Development Types of Curriculum

Unit-2 Bases for Curriculum Development

- Philosophical, psychological and sociological bases of Curriculum Development
- Cultural, technological and scientific bases of Curriculum Development
- Knowledge and Curriculum
- Competency – based curriculum and concept-based curriculum

Unit-3 ICT and Curriculum Development

- Technology integration in the classroom and its importance
- Different kinds of instructional materials
- Barriers to technology integration in curriculum
- Changing role of the teachers in transacting curriculum

Unit-4 Defects of Curriculum and Curriculum Evaluation

- Defects of existing curriculum and principles of curriculum construction
- Purpose of curriculum evaluation. Curriculum change-meaning, need and strategies
- Factors affecting curriculum change
- Construction of curriculum for different levels

Unit-5 Towards an Effective Curriculum

- Innovative practices and research in curriculum
- Action research approach to Curriculum Development
- Towards an effective curriculum – content modification, process modification, environment modification, response modification
- Curriculum effectiveness and measures of enhancing quality of curriculum

Selected Readings:

- Mamidi, M.R. and S. Ravisankar (1995): Curriculum Development and Educational Technology. Sterling publishers Pvt. Lt. New Delhi-110016
 - Bhalla Navneet (2007): Curriculum Development. Authors press, Laxmi Nagar, Delhi-110092
 - Sharma, R.A (2013): Curriculum Development and instruction, Methods, Instruction, Methods,. R. Lall Book Depot. Meerut.
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Course Code - 4046

Total Marks: Internal – 20

End Semester – 80

Total – 100

Course Name –

Contact Hours: 6 per week

Economics of Education

Nature of the Course –

Elective-1

Total Credit – 6

Objectives:

To make the students aware about the

- 1) Meaning and importance of economics of education
- 2) Recent trends in economics of education
- 3) Education as an consumption and investment and also the input output concept of education
- 4) Cost and benefits of education and their analysis
- 5) Educational planning and manpower planning in education
- 6) Impact of globalization on education and educational finance.

Unit

Contents

Unit-1 Introduction to Economics of Education

- Economics of Education – Meaning, Scope and Significance
- Education and Economic Growth
- Contribution of some economists for the development of economics of education
- Economic Reforms in India and their impact on Education- Effect of Globalization on Education – Trade in Education, Effect of FDI on Education

Unit-2 **Education as consumption and investment**

- Education as Consumption and Investment – meaning and characteristics
- Difficulties in considering education as Consumption/Investment
- Rate of Return in education – Private Return and Social Return
- Input – Output analysis in education

Unit-3 **Cost and Benefit of Education**

- Cost of Education – different types of educational cost-Private cost, Social cost, Opportunity cost and Unit cost of education
- Benefit of Education – classification of benefit of education
- Cost Benefits analysis in education – meaning, application and limitations
- Cost effective analysis – meaning and application in education

Unit-4 **Educational Planning**

- Educational Planning in India – concept, need and goals of educational planning
- Manpower Planning – Concept and Approaches
- Human Capital formation – Meaning and strategies

- Education and employability

Unit-5 Financing Education

- Financing Education at different levels – Importance of funding at different levels and sources of fund.
- Resource mobilization in higher education
- Role of Central and State Governments in funding education.
- Role of Private Sector in funding higher education.

Selected readings:

- Natarajan, S. Introduction to Economics of Education, Sterling Publishers Pvt. Ltd. New Delhi
 - Ahuja, A.K. 2007 Economics of Education, Authors Press, New Delhi
 - Latchanna, G & Hussein JO, 2010, Economics of Education, Discovery Publishing House, New Delhi
 - Rao, D pulla 2010, Economics of Education and Human Development in India, Akansha Publishing House, New Delhi
-

Course Code - 4056

Total Marks: Internal – 20

End Semester – 80

Total – 100

Course Name –

Contact Hours: 6 per week

Guidance and Counselling

Nature of the Course –

Elective-2

Total Credit – 6

Objectives:

- 1) To help students to understand the concept, need and view point of guidance.
- 2) To help students understand principles and problems of different types of guidance
- 3) To help students understand the concept and process of counselling
- 4) To acquaint the students with the aim and principles of guidance programme

Unit

Contents

Unit-1 Guidance & Counselling

- Meaning, and concept, need and importance of Guidance and Counselling
- General principles underlying guidance and counselling. Guidance & Counselling- its relationship
- Role of teacher in Guidance & Counselling

Unit-2 Types of Guidance

- Personal guidance – meaning and concept, need for personal guidance, objectives of personal guidance.
- Vocational guidance – meaning and concept, objectives of vocational guidance.
- Educational guidance – meaning and concept, objectives of educational guidance, educational guidance at secondary level and higher level

Unit-3 Guidance needs of children

- Home centered problems, school centered problems,
- Adjustment needs of Adolescents,
- Counselling in individual situations,
- Group guidance and counselling

Unit-4 Child Guidance Clinic

- Historical background, meaning & objectives. Organization of Child Guidance Clinic,
- Personnel's involved in child guidance clinic, their qualifications and functions

Unit-5 Various Procedures of Guidance

- Case Study Procedure,
- Importance of questionnaire, autobiography, Anecdotal reports, Interview, Cumulative Personal Record in case study.

Selected readings:

- S.K. Kochhar- Guidance and Counselling in College and Universities, Sterling Publishers Pvt. Ltd. N. Delhi. 1989
 - Bhatia, K.K. Principles of Guidance and Counselling, Kalyani Publishers, 2009.
 - Agarwal, Rashmi- Educational Vocational Guidance and Counselling; Principles, Techniques and Programmes, Shipra Publication, 2010.
 - Charls Kiruba & Jyothsna, N.G. – Guidance & Counselling, Neelkamal, Publications Pvt. Ltd. First Edition, 2011
 - Madukar, I- Guidance and Counselling, New Delhi, Author Press.
 - Mc Daniel, H.B. – Guidance in Modern Schools. New York, Harper and R.W.
 - Gururani, G.D. - Guidance and Counselling, Educational Vocational and Career Planning, New Delhi, Akansha Publishing House.
 - Isaacson, L.E. & Boren, D: Career Information, career counselling and career development (5th ed.) Boston: Allyn & Bacon.
 - Janeja, G.K. (1997). Occupatinal Information in Guidance, New Delhi: NCERT.
 - Mohan, S. (1998). Career development in India: Theory, research and development, New Delhi, Vikash Publishing House.
 - Saraswat, R.K. & J.S. (1994). Manual for Guidance Counsellors, New Delhi, NCERT.
-

Course Code - 4066

Total Marks: Internal – 20
End Semester – 80
Total – 100

Course Name –
Teacher Education

Contact Hours: 6 per week

Nature of the Course –

Elective -3

Total Credits – 6

Objectives:

- 1) To enable the students to understand the basic concept of Teacher Education and Teacher Training and development of Teacher Education in India.
- 2) To acquaint the students with pre-service and in service Teacher Education Programme and some central and State level agencies and institutions of Teacher Education in India.
- 3) To accustom the students with the recent trends and innovative practices in Teacher Education.
- 4) To familiarize the students about professionalism and accountability of teachers.
- 5) To acquaint the students with the barriers/challenges of Teacher Education and help them to evolve solutions for resolving the barriers/challenges.

Unit	Contents
Unit-1	Introduction of Teacher Education <ul style="list-style-type: none">• Teacher Education: Concept, Meaning, Significance and Functions of Teacher Education. Objectives of Teacher Education at Primary, Secondary and Higher Education stage.• Development of Teacher Education in India in pre-independence and post-independence period.• Teacher Education vs. Teacher Training.• Structure of Teacher Education in India.
Unit-2	Pre-service and In-service Teacher Education <ul style="list-style-type: none">• Pre-service Teacher Education: meaning, need and importance.• In-service Teacher Education: meaning, definitions, significance and rationale.• Institutions of Pre-service and In-service Teacher Education programmes in India: SIE, University Departments of Education (UDE), Regional Institutes of Education (RIE), Kendriya Hindi Sansthan, Rastriya Sanskrit Sansthan.
Unit-3	Agencies of Teacher Education and role of different agencies <ul style="list-style-type: none">• Central Agencies – UGC, UGC-Human Resource Development Centre, NCERT, IASE, NCTE and their roles.• State level agencies – SCERT, DIET.

- Professional preparation of Teachers: Quality concerns through distance mode –IGNOU, ODL, virtual classes.

Unit-4 Current Trends and Innovative Practices

- National Curriculum Framework for Teacher Education 2009.
- Interdisciplinary approach – integrated courses.
- Internship in Teaching.
- Action Research – definitions, characteristics, types, importance, advantages, steps of Action Research, role of Action Researchers.
- Micro Teaching.
- Inclusive Education and role of Teachers.

Unit-5 Professionalism and Challenges in Teacher Education

- Professionalism- meaning, dimensions, characteristics. Enhancing professionalism of teachers through Teacher Education.
- Professional code of ethics and Teachers’ accountability.
- Performance Appraisal of Teachers.
- Quality indicators of Teacher Education programme.
- Challenges of Teacher Education and remedial measures.

Selected readings:

- Agarwal, S.P. & Agarwal, J.C.: Development of Education in India (vol 4 & 5). Concept Publishing Company. New Delhi.
- Amidon, Edmund, J. & Flanders Ned, A. : The role of the Teachers in the Classroom: A manual for Understanding & Improving Teacher’s Classroom Behaviour. Paul. S Amindon Associates, Minneapolis.
- Bhargava, M. & Saikia, L.R. (2012): Teacher in the 21st Century- Challenges, Responsibility & Credibility. Rakhi Prakashan. Agra.
- Flora, J & Jahitha Begum, A (2011): Teacher Education: Quality Indicators. APN Publishing Corporation, New Delhi.
- Harper, W.R.: The Trend in Higher Education. The University of Chicago Press, Chicago.
- Khanna, Lamba, Saxena & Murthy: Teacher Education Theory and Practice. Doaba House
- Radha Mohan: Teacher Education. PHI Learning Pvt. Ltd. New Delhi.
- Ram, S.: Current Issues in Teacher Education, Karaan Paperbacks, New Delhi.
- Saxena, Mishra & Mohenty : Teacher Education. R. Lall Book Depot. Meerut.
- Sharma, R.A. & S. Chaturvedi (2011): Teacher Education. International Publishing House. Meerut.
- Sharma, Shashi Prabha: Teacher Education, Principles, Theories and Practices. Kanishka Publications, New Delhi.

Course Code - 4074

Course Name –Project / Field Study

Contact Hours: 4 per week

Nature of the Course - Value added

Total Credit – 4

Objectives:

- 1) To develop the ability to conduct research among the students
- 2) To develop the spirit of team work among the students

Each student has to go for field work related to the subject.

**SYLLABUS
OF
EDUCATION**

**FOR
UNDER GRADUATE CBCS COURSE (HONOURS)**



**(Approved by Academic Council on 8th November, 2019
effective from July, 2019)**

**GAUHATI UNIVERSITY
GAUHATI**

Course Structure of B.A. Education (Honours) under CBCS

Gauhati University, Guwahati

Course outcome

- It aims to develop a holistic and multidimensional understanding of the topics.
- It attempts to approach new areas of learning, develop competencies in the students thereby opening various avenues for self-discovery, academic understanding and employment.

Instruction on Teaching Method: The classroom transaction of all the papers will be done through lectures, group discussions, experiential exercises, projects, presentations, workshops, seminars and hands on experiences. Students would be encouraged to develop an understanding of real life issues and participate in the programs and practices in the social context. To this end, practicum is incorporated as an important component in many of the papers. Use of ICT and mass media and web based sources is highly recommended to make the teaching learning process interactive and interesting.

Evaluation: The mode of evaluation would be through a combination of external and internal assessment in the ratio of 80: 20 respectively. Equal weightage will be given to all the units while setting of questions papers in external examination. Along with routine examinations, classroom participations, class assignments, project work, and presentations would also be a part of the overall assessment of the student.

Semester	Core Credit- 14x6=84	AECC 2x4=8	SEC 2x4=8	DSE 4x6=24	GE 4x6=24
I	EDU-HC-1016	English/MIL communication			EDU-HG-1016
	EDU-HC-1026				
II	EDU-HC-2016	Environmental science			EDU-HG-2016
	EDU-HC-2026				
III	EDU-HC-3016		EDU-SE-3014		EDU-HG-3016
	EDU-HC-3026				
	EDU-HC-3036				
IV	EDU-HC-4016		EDU-SE-4014		EDU-HG-4016
	EDU-HC-4026				

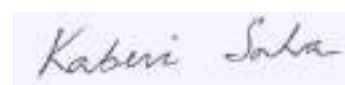
	EDU-HC-4036				
V	EDU-HC-5016			EDU-HE-5016 / EDU-HE-5026	
	EDU-HC-5026			EDU-HE-5036/ EDU-HE-5046	
VI	EDU-HC-6016			EDU-HE-6016/ EDU-HE-6026	
	EDU-HC-6026			EDU-HE-6036/ EDU-HE-6046	

List of Papers
B.A. Education (Honours)

Core Papers			
Sl. No	Course code	Title of the Paper	Credit
1	EDU-HC-1016	Principles of Education	6
2	EDU-HC-1026	Psychological foundations of Education & laboratory practical	4+2
3	EDU-HC-2016	Philosophical and Sociological Foundations of Education	6
4	EDU-HC-2026	Development of Education in India- I	6
5	EDU-HC-3016	Development of Education in India- II	6
6	EDU-HC-3026	Educational Technology and Teaching Methods	6
7	EDU-HC-3036	Value and Peace Education	6
8	EDU-HC-4016	Great Educational Thinkers	6
9	EDU-HC-4026	Educational Statistics & Practical	4+2
10	EDU-HC-4036	Emerging Issues in Education	6
11	EDU-HC-5016	Measurement and Evaluation in Education & Laboratory Practical	4+2
12	EDU-HC-5026	Guidance and Counselling	6
13	EDU-HC-6016	Education and Development	6
14	EDU-HC-6026	Project	6
Discipline Specific Elective Papers (DSE)			
1	EDU-HE-5016	Continuing Education	6
2	EDU-HE-5026	Developmental Psychology	6
3	EDU-HE-5036	Human Rights Education	6

4	EDU-HE-5046	Teacher Education in India	6
5	EDU-HE-6016	Mental Health & Hygiene	6
6	EDU-HE-6026	Special Education	6
7	EDU-HE-6036	Educational Management	6
8	EDU-HE-6046	Women and Society	6
Generic Elective (GE)			
1	EDU-HG-1016	Foundations of Education	6
2	EDU-HG-2016	Psychology of Adolescents	6
3	EDU-HG-3016	Guidance and Counselling	6
4	EDU-HG-4016	History of Education in India	6
Skill Enhancement Course (SEC)			
1	EDU-SE- 3014	Public speaking skill	4
2	EDU-SE-4014	Writing Bio-data and facing an Interview	4
Ability Enhancement Compulsory Course (AECC)			
1		English/MIL Communication	
2		Environmental Science	

Signature



(Kaberi Saha)

Prof. & HoD of Education,
GU

1st SEMESTER (HONOURS)

EDU-HC-1016

PRINCIPLES OF EDUCATION

Total Marks: 100 (External: 80 and Internal: 20)

Credit-6

Course Objectives:

After completion of this course the learner will be able to:

- Acquaint the students with the sound principles of education
- Acquaint the students with the important concepts of Education, Curriculum, Democracy, Discipline and Freedom.
- Develop knowledge about different Aims of Education, various types of Curriculum, Correlation of Studies and Forms of Discipline.
- Familiarise the students with democratic idea of modern education.

Course contents

Units	Contents
Unit-1	Meaning and Concept of Education <ul style="list-style-type: none">• Meaning, nature and scope of education.• Forms of education- Formal, Informal and Non-formal education and their agencies• School and its functions, relationship between school and society.• Distance and Open Education with special reference to India.• Functions of education.
Unit-2	Aims of education <ul style="list-style-type: none">• Meaning and importance of Aims.• Determinants of aims.• Historical retrospect.• Social Vs Individual aim.• Vocational and Liberal aim• Democratic, Citizenship, Moral and Complete living as an aim of education
Unit- 3	Curriculum <ul style="list-style-type: none">• Concept and nature of Curriculum• Importance of Curriculum.• Types of Curriculum.• Principles of Curriculum Construction• Correlation of Studies—Meaning, Types and importance.• Co-curricular activities- Meaning, Types and importance.
Unit-4	Discipline and Freedom <ul style="list-style-type: none">• Meaning and importance

	<ul style="list-style-type: none"> • Discipline Vs. Order • Forms of discipline • Place of reward and punishment in schools • Concept of free-discipline. • Maintenance of discipline in school.
Unit-5	Democracy and Education <ul style="list-style-type: none"> • Meaning of Democracy in Education • Democracy and the Education of Masses • The child in democratic education. • Role of Teachers and the Administrators in Democracy. • Methods of teaching in Democracy

Recommended Readings:

- Ross J.S. – *The Ground Work of Educational Theory.*
- Raymont T-- *Principles of Education.*
- Safaya R.N. & Shaiyda B.D -- *Development of Educational Theory and Practice.*
- Bhatia & Bhatia – *Theory and Principles of Education*
- Agarwal J.C. – *Theory and Principles of Education.*
- Chatterjee S. – *Principles and Practice of Modern Education*
- Baruah J. -- *Sikshatatta.*

EDU-HC-1026
PSYCHOLOGICAL FOUNDATIONS OF EDUCATION
Total Marks: 100 (External: 80 and Internal: 20)
Credit-6

Course Objectives:

After completion of this course the learner will be able to:

- Make the students understand the relationship between education and psychology.
- Explain the need of educational psychology in teaching learning process.
- Describe the nature and theories of learning and role of motivation in learning.
- Understand the concept of memory, forgetting, attention and interest.
- Understand intelligence, its theories, measurement, and concept of emotional intelligence.
- Acquaint with different types of personality and the adjustment mechanism.

Course contents

Units	Contents
Unit-1	<p>Psychology and Education:</p> <ul style="list-style-type: none"> • Meaning and nature of Psychology • Relation between education and psychology • Educational Psychological-Nature,Scope,Methods— Observation,Experimentation,Case study method • Importance of Educational Psychology in teaching –learning process
Unit-2	<p>Learning and Motivation:</p> <ul style="list-style-type: none"> • Learning -Meaning and nature • Theories of learning—Connectionism, Classical conditioning, Operant conditioning and Theory of Insightful learning • Laws of learning--law of readiness, law of exercise ,law of effect • Factors affecting learning • Motivation-meaning, role in learning
Unit-3	<p>Memory, Attention and Interest:</p> <ul style="list-style-type: none"> • Memory—Meaning, nature and types • Economy in memorization • Forgetting—meaning and causes • Attention-concept, characteristics, determinants and types • Interest-Meaning, relation between Attention and Interest • Role of attention and Interest in learning

Unit-4	Intelligence, Creativity and personality <ul style="list-style-type: none"> • Intelligence-Meaning, nature and theories :Two-factor theory, Group factor theory • Creativity-concept, characteristics • Personality—meaning and nature • Theories of personality-Type and trait theory
Unit-5	Laboratory Practical Recall and Recognition, Trial and Error learning, Span of attention (The three practical will be done in Psychological laboratory, there will be 2 credits for practical class)

Recommended Readings:

- Baron,R.A(2001)Psychology, Prentice Hall,NewDelhi
- Bichler,R.F and Snowman,J(1993)-Psychology Applied to Teaching ,Boston, Houghton Mifflin
- Skinner, Charles,(2012) E- Educational Psychology , Prentice Hall,New Delhi
- Chauhan,S.S - Advanced Educational Psychology, Vikash Publishing House Pvt.Ltd.,New Delhi
- Crow A and Crow A – Educational Psychology, Prentice Hall,New Delhi
- Guilford,J.P - General Psychology,D.VanNostrand Company Inc.
- Mangal, S.K.(2009)- Advanced Educational Psychology, PHI Learning Private Limited,New Delhi
- Kuppuswamy B(2013) :Advanced Educational Psychology, ,Sterling Publishers Private Limited,New Delhi
- Saikia, L.R. 2018 : Psychological and Statistical experiments in Education

EDU-HC-1016
FOUNDATIONS OF EDUCATION
Total Marks: 100 (External: 80 and Internal: 20)
Credit-6

Course Objectives:

After completion of this course the learner will be able to

- Acquaint with the principles of education
- Gain knowledge about different various Forms and Aims of Education
- Understand the concept and importance of Discipline and Freedom.
- Acquire knowledge about the concept of Emotional and National Integration and International Understanding.

Course contents

Units	Content
Unit-1	<p>Concept of Education</p> <ul style="list-style-type: none"> • Meaning ,Nature and Scope of education • Forms of education- • Formal education, Informal and Non formal education- Meaning and Nature. School as an agency of formal education • Aims of education, Meaning and importance of Aims. Types of Aims- • Social Vs Individual aim. • Vocational and Liberal aim • Democratic aim of education.
Unit-2	<p>Philosophy and Education</p> <ul style="list-style-type: none"> • Philosophy: Meaning, Nature and Scope • Philosophy of Education: Meaning and Scope • Relationship between education and philosophy • Impact of philosophy on education
Unit-3	<p>Psychology and Education</p> <ul style="list-style-type: none"> • Meaning and nature of Psychology • Relation between education and psychology • Educational Psychological-Nature, Scope, Method Observation, Experimentation, Case study method • Importance of Educational Psychology in teaching –learning process
Unit-4	<p>Education for National Integration and International understanding</p> <ul style="list-style-type: none"> • Meaning and Nature of National Integration and International understanding • Role of education in development of National Integration and International understanding. • Globalization and its impact in developing International cooperation
Unit-5	<p>Sociology and Education</p> <ul style="list-style-type: none"> • Concept and methods of Sociology, Educational Sociology: Meaning, Nature, Scope and Importance, Relation between education and sociology

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|--|---|
| | <ul style="list-style-type: none">• Social group: Meaning, Nature and Classification, Importance of Primary and Secondary Groups• Concept of socialization, Education as a socialization process |
|--|---|

Recommended Readings:

- Ross J.S. – *The Ground Work of Educational Theory*.
- Raymont T-- *Principles of Education*.
- Safaya R.N. & Shaiyda B.D. -- *Development of Educational Theory and Practice*.
- Bhatia & Bhatia – *Theory and Principles of Education*
- Agarwal J.C. – *Theory and Principles of Education*.
- Chatterjee S. – *Principles and Practice of Modern Education*
- Baruah J. -- *Sikshatatta*.
- Goswami, D, 2014- *Philosophy of Education, DVS Publishers, Guwahati*

2nd SEMESTER (HONOURS)

EDU-HC-2016

PHILOSOPHICAL AND SOCIOLOGICAL FOUNDATION OF EDUCATION

Total Marks: 100 (External: 80 and Internal: 20)

Credit-6

Course Objectives:

After completion of this course the learner will be able to:

- Know the concept of philosophy and its relationship with education.
- Understand the educational implications of different Indian schools of philosophy.
- Understand the educational implications of different Western schools of philosophy.
- Know the concept of sociology and its relationship with education.
- Develop understanding about the concept of educational sociology, social groups and socialisation.

Course contents

Units	Contents
Unit-1	Philosophy and Education <ul style="list-style-type: none">• Philosophy: Meaning, Nature and Scope• Philosophy of Education: Meaning and Scope• Relationship between education and philosophy• Impact of philosophy on education
Unit-2	Various Indian Schools of Philosophy and Education <ul style="list-style-type: none">• Vedic Philosophy: Different concepts of Vedic philosophy, Implication in education• Yoga and Philosophy: Different types, Astangika Yoga, Implication in education• Buddhist Philosophy: Four principles, Implication in education
Unit-3	Various Western Schools of Philosophy and Education <ul style="list-style-type: none">• Idealism: Meaning, Principles, Implication in education• Naturalism: Meaning, Principles, Implication in education• Pragmatism: Meaning, Principles, Implication in education
Unit-4	Sociology and Education <ul style="list-style-type: none">• Concept and methods of Sociology, Educational Sociology: Meaning, Nature, Scope and Importance, Relation between education and sociology• Social group: Meaning, Nature and Classification, Importance of Primary and Secondary Groups• Concept of socialization, Education as a socialisation process
Unit-5	Socio-cultural Context of Education <ul style="list-style-type: none">• Social Change: Meaning, Nature and Factors• Education as an instrument of Social Change• Culture: Meaning, Nature, Cultural change and Cultural Lag

	<ul style="list-style-type: none"> • Relation between education and culture • Social Organisation: Meaning and Types • Social Disorganisation: Meaning, Causes and Remedies

Recommended Readings:

- Bhatia & Narang (2013). *Philosophical and Sociological Bases of Education*. Ludhiana: Tandon Publications.
- Brown, F. J. (1954): *Educational Sociology (2nd Edition)*. New York: Prentice Hall.
- Brubacher, John S. (1962). *Modern Philosophies of Education*. McGraw Hill: New Delhi.
- Chanda, S.S. & Sharma, R. K. (2002). *Sociology of Education*. New Delhi: Atlantic Publishers.
- Chandra S. S., R. Sharma, & Rejendra K (2002). *Philosophy of Education*. New Delhi: Atlantic Publishers.
- Goswami, Dulumoni (2013). *Philosophy of Education*. Guwahati: DVS Publishers.
- Ogburn, W.F. & Nimkoff, W.F. (1966). *A handbook of Sociology*. New Delhi: Eurasia Publishing House (Pvt.) Ltd.
- Rao, C. N. Shankar (2005). *Sociology-Principles of Sociology with an introduction to Social Thought*. New Delhi: S. Chand & Company.
- Ravi, S. S. (2015). *Philosophical and Sociological Bases of Education*. New Delhi: Prentice Hall India Pvt. Ltd.
- Saikia, Polee (2017). *Sociological Foundations of Education*. Guwahati: DVS Publishers.
- Singh, Y. K. (2007). *Philosophical Foundation of Education*. New Delhi: APH Publishing Corporation.

EDU-HC-2026
DEVELOPMENT OF EDUCATION IN INDIA-I
Total Marks: 100 (External: 80 and Internal: 20)
Credit-6

Course Objectives:

After completion of this course the learner will be able to:

- Recount the concept of Ancient Indian education system
- Describe the education system in Ancient India, particularly Vedic Education
- Examine the education system in Medieval India.
- Analyse the education system during British Period

Course contents

Units	Content
Unit-1	<p>Education in Ancient and Medieval India</p> <ul style="list-style-type: none"> • Education in Ancient India <ul style="list-style-type: none"> - The Vedic System of Education: Concept and Salient Features - Education in the <i>Arthashastra</i> of Kautilya • Education during Buddhist Period <ul style="list-style-type: none"> - General Features of Buddhist Education - Ancient Universities and Centres of Education: Taxila, Nalanda, Vikramshila, Varanasi, • Education in Medieval India <ul style="list-style-type: none"> • The Islamic System of Education <ul style="list-style-type: none"> - General Features of Muslim Education - Defects of Muslim Education
Unit-2	<p>Education in British India: The Beginning</p> <ul style="list-style-type: none"> • Indigenous Education at the Beginning of British Rule • Educational Activities of Missionaries in Assam • The East India Company's Role • The Charter Act of 1813 • The Anglicists-Orientalists Controversy • Macaulay's Minute, 1835 • Downward Filtration Theory
Unit-3	<p>Education in British India: In 19th Century</p> <ul style="list-style-type: none"> • Wood's Despatch of 1854 <ul style="list-style-type: none"> - Background of the Despatch - Recommendations - Implementation of the Despatch • Indian Education Commission-1882 <ul style="list-style-type: none"> - Appointment of Indian Education Commission - Its Terms of Reference - Major Recommendations - Criticism of the Commission
Unit-4	<p>Rise of Nationalism and its impact on education</p> <ul style="list-style-type: none"> • Indian University Commission- 1902, Major Recommendations - Lord Curzon's Education policy on Primary, Secondary and Higher

	<p>Education</p> <ul style="list-style-type: none"> - Government of India's Resolution on Educational Policy-1904, The University Act of 1904 • Gokhale's Bill for Compulsory Primary Education- 1910-1912 - Impact of Compulsory Primary Education Movement in Assam: Assam Elementary Education Act-1926 • Calcutta University Commission-1917, Major Recommendations
Unit-5	<p>Education in British India: A Period of Experiment</p> <ul style="list-style-type: none"> • Hartog Committee Report-1929, Major Recommendations • Basic Education-1937, Background - Wardha Education Conference-1937 - Salient Features of Basic Education - Criticism of the Basic Education • The Sargent Report- 1944

Recommended Readings:

- Chaube, S.P. and Chaube, A. (2005). Education in Ancient and Medieval India. New Delhi: Vikas Publishing House Pvt. Ltd.
- Dash, B.N. (2014). History of Education in India. New Delhi: Dominant Publishers and Distributors Pvt. Ltd.
- Ghosh, Suresh C. (2007). History of Education in India. New Delhi: Rawat Publications.
- Aggarwal, J.C. (2004). Landmarks in the History of the Modern Indian Education. New Delhi: Vikas Publishing House Pvt. Ltd.
- Thakur, A.S. and Thakur, A. (2015). Development of Education System in India: Problems and Prospects. Agra: Agarwal Publications.

EDU-HG-2016
PSYCHOLOGY OF ADOLESCENTS
Total Marks: 100 (External: 80 and Internal: 20)
Credit-6

Course Objectives:

After completion of this course the learner will be able to:

- Enable the students to understand the period of adolescence
- Enable the students to understand the significance of the adolescence period in human life
- Enable the students to know about various problems associated with this stage
- Enable the students to understand the development aspects of adolescence, importance of adolescence period and problems associated with this stage.

Course contents

Units	Contents
Unit-1	Introduction to adolescent psychology <ul style="list-style-type: none"> • Meaning and definition of adolescence • Need and importance of studying adolescent psychology • Adolescence – age of transition • Is adolescence a period of storm and stress?
Unit-2	Physical and mental development <ul style="list-style-type: none"> • Characteristics of physical development • Characteristics of mental development • Educational implications of physical and mental development
Unit-3	Social development <ul style="list-style-type: none"> • Characteristics of social development • Influence of peers in social development • Factors affecting social adjustment
Unit-4	Emotional and personality development <ul style="list-style-type: none"> • Characteristics of emotional development • Personality changes during adolescence • Adjustment problems of adolescence
Unit-5	Delinquency <ul style="list-style-type: none"> • Meaning , Nature and types of delinquency • Causes of delinquency – biological, psychological and sociological • Role of school, family and society in preventing delinquency • Prevention and control of drug addiction

Recommended Readings:

- Chaube. S.P. Developmental Psychology, New Delhi, Neelkamal Publications Ltd.
- Cole, L. Psychology of Adolescence, New York, Rinehart and Winston

- Goswami, G. (2008) Child Development and Child Care, Guwahati, Arun Prakashan
- Hurllock, E.B. Developmental Psychology-A Life span approach, Tata McGraw Hill Publishing Com. Ltd.

3rd SEMESTER (HONOURS)

EDU-HC-3016

DEVELOPMENT OF EDUCATION IN INDIA-II

Total Marks: 100 (External: 80 and Internal: 20)

Credit-6

Course Objectives:

After completion of this course the learner will be able to:

- Understand the Educational situation during the time of Independence
- Explain the recommendations and educational importance of different Education Commission and Committees in post Independent India
- Analyse the National Policy on Education in different tomes
- Accustom with the recent Educational Development in India

Course Content:

Units	Content
Unit-1	Development of Indian Education the post independence period <ul style="list-style-type: none">• Educational Provisions of the Indian Constitution and their Implementation• University Education Commission – 1948<ul style="list-style-type: none">- Appointment of University Education Commission- Aims and Recommendations of the Commission- Evaluation of the Recommendations
Unit-2	Development of Secondary Education in the Post-Independent Period <ul style="list-style-type: none">• Dr. Tara Chand Committee-1948<ul style="list-style-type: none">- Major Recommendations• Secondary Education Commission-1952-53<ul style="list-style-type: none">- Terms and Condition- Aims and Objectives of Secondary Education- Defects of Secondary Education- Recommendations of the Commission- Evaluation of the Recommendations of the Commission
Unit-3	Indian Education Commission-1964-66 <ul style="list-style-type: none">• Reasons for appointing Indian Education Commission• Major Recommendations of Indian Education Commission on:<ul style="list-style-type: none">- National Objectives of Education- National Pattern of Education- National Curriculum- Text Book- Method of Teaching- Teaching Personnel and Teacher Status- Teacher Education- Guidance and Counselling

	<ul style="list-style-type: none"> - Examination and Evaluation • Critical assessment and Relevance of the recommendations in Present Education System.
Unit-4	<p>National Policies on Education in Post Independent India</p> <ul style="list-style-type: none"> • National Policy on Education-1968 • National Policy on Education-1986: Recommendations, National System of Education • Review of National Policy of Education <ul style="list-style-type: none"> - Ramamurthy Review Committee, 1990 - Janardan Reddy Committee Report, 1991 • Revised National Policy of Education-1992
Unit-5	<p>Recent Developments and programmes in Indian Education</p> <ul style="list-style-type: none"> • The National Knowledge Commission Report <ul style="list-style-type: none"> - Background and Recommendations • Report of the Committee to Advise on Renovation and Rejuvenation of Higher Education <ul style="list-style-type: none"> - Recommendations • National Curriculum Framework, 2005 • Government Programmes of Education: SSA, RMSA, RUSA • Right to Education (RTE) • Quality Control of Higher Education: NAAC- Its Objectives and Roles.

Recommended Readings

- Dash, B.N. (2014). History of Education in India. New Delhi: Dominant Publishers and Distributors Pvt. Ltd.
- Ghosh, Suresh C. (2007). History of Education in India. New Delhi: Rawat Publications.
- Aggarwal, J.C. (2004). Landmarks in the History of the Modern Indian Education. New Delhi: Vikas Publishing House Pvt. Ltd.
- Thakur, A.S. and Thakur, A. (2015). Development of Education System in India: Problems and Prospects. Agra: Agarwal Publications.

EDU-HC-3026
EDUCATIONAL TECHNOLOGY AND TEACHING METHODS
Total Marks: 100 (External: 80 and Internal: 20)
Credit-6

Course Objectives:

After completion of this course the learner will be able to:

- Make the students understand the objective of educational technology in teaching learning process
- Acquaint the students with innovations in the field of education through technology
- Make the students understand about various methods and devices of teaching
- Acquaint students with levels, effectiveness of teaching and classroom management
- Make the students understand the strategies of effective teaching as a profession.

Course contents

Units	Contents
Unit:1	<p>Educational technology:</p> <ul style="list-style-type: none"> • Meaning and nature of Educational technology • Components of Educational Technology- Hardware and Software and Systems Approach • Instructional Technology-Difference between Educational Technology and Instructional Technology, Programmed Instruction
Unit:2	<p>Information and Communication Technology in teaching-learning</p> <ul style="list-style-type: none"> • Concept, nature and components of communication technology • Marks of effective classroom communication • Barriers of effective classroom communication • Application of ICT in teaching-learning • Resources of learning- Projected and Non-projected resources, Internet, E-learning, EDUSAT, INFLIBNET and Social media
Unit:3	<p>Models of teaching</p> <ul style="list-style-type: none"> • Concept, nature and characteristics • Inquiry model • Personalized system of instruction • Computer Assisted Instructions(CAI), Team teaching, Collaborative teaching, Cooperative mastery learning
Unit:4	<p>Methods and techniques of teaching</p> <ul style="list-style-type: none"> • Teaching learning process- Meaning and Nature of teaching and learning • Criteria of good teaching • Teaching Methods- lecture method, play way method, Activity method, Discussion, Project method, problem solving method

	<ul style="list-style-type: none"> • Teaching techniques- Maxims of teaching, devices of teaching-Narration, Illustration, Questioning
Unit:5	Lesson Planning and Micro Teaching <ul style="list-style-type: none"> • Lesson plan –Its meaning and Importance • Types of Lessons- Knowledge Lesson, Skill Lesson, Appreciation Lesson • Herbartian Steps of Lesson Planning • Criteria of a good lesson plan • Micro teaching- meaning and components

Recommended Readings:

- Aggarwal J.C. (2005). Educational Technology, New Delhi: Vikash Publishing House Pvt. Ltd.
- Chauhan, S. S. (2008): Innovations in Teaching-learning Process, New Delhi: Vikash Publishing House Pvt. Ltd.
- Joshi , A.: Models of teaching, Agra: H.P. Bhargava, Book House
- Kochhar, S. K. (1996). Methods and Techniques of Teaching. New Delhi: Sterling Publishers Pvt. Ltd.
- Mangal S.K. and Mangal Verma (2009). Essentials of Educational Technology, New Delhi
- Passi, B.K.: Becoming Better teacher, Micro Teaching Approach, Ahmedabad, Sahitya Mudranalaya
- Sharma, R.A. (2000). Teaching Foundation of Education. Meerut: R. Lall Book Depot
- Siddiqui, M.H.: Models of teaching, New Delhi: APH Publishing Corporation
- Singh, Amarjit: Classroom Management, New Delhi: Kanishka Publishers

EDU-HC-3036
VALUE AND PEACE EDUCATION
Total Marks: 100 (External: 80 and Internal: 20)
Credit-6

Course Objectives:

After completion of this course the learner will be able to:

- Understand the concept and meaning of value.
- Become aware about the role of educational institutions in building a value based society.
- Understand the meaning and concept of peace and its importance in human life.
- Understand the meaning and importance of peace education and its relevance at national and international level.
- Identify the different issues/ challenges in imparting peace education.
- Identify the strategies and skills in promoting peace education at institutional level.

Course contents

Unit	Contents
Unit-1	<p>Value</p> <ul style="list-style-type: none"> • Concept and characteristics of value. • Sources of values • Impact of globalization on culture and values. • Importance of values in human life
Unit-2	<p>Types of values, their characteristics, functions and educational significance</p> <ul style="list-style-type: none"> • Core values. • Social values • Moral values • Religious and spiritual values. • Aesthetic values. • Personal values
Unit-3	<p>Value education</p> <ul style="list-style-type: none"> • Concept, characteristics, Objectives and Importance of value education. • Value education at different stages – <ul style="list-style-type: none"> - Primary - Secondary - Higher education. • Role of teacher and family in imparting value education.
Unit-4	<p>Peace education</p> <ul style="list-style-type: none"> • Meaning, definition and characteristics of peace. • Importance of peace in human life.

	<ul style="list-style-type: none"> • Teacher’s role in promoting peace. • Concept, need and characteristics of peace education • Curricular contents of peace education at different levels – Primary, Secondary and Higher Education • Strategies and skills in promoting peace education • Relevance of peace education in national and international context
Unit-5	<p>Challenges of Peace education and Role of Different Organisations</p> <ul style="list-style-type: none"> • Challenges of peace education • Role of national and international organizations for promoting peace education – <ul style="list-style-type: none"> - International Institute for Peace(IIP), - UNESCO, - International Peace Bureau (IBP), - UNO - UNICEF, - Global Peace Foundation(GPF), - Mahatma Gandhi Institute of Education for Peace and Sustainable Development.

Recommended Readings:

- Agarwal, J.C. (2005), *Education for Values, Environment and Human rights*, New Delhi, Shipra Publication.
- Chakrabarty, M. (1997), *Value education: Changing Perspective*, Krishna Publishers Distribution, New Delhi.
- Chitakra, M.G (2007), *Education and Human Values*, New Delhi APH Publishing Corporation.
- Mishra, L (2009), *Peace education ,Framework for teachers*, APH Publishing Corporation, Ansari road , Dariyaganj New Delhi.
- Panda. P.K. (2017), *Value Education*, Nivedita Book Distributors, Jotiya Guwahati, Assam.
- Rajput, J. S. (2002), *Human Values in School Education*, New Delhi, Anmol Publication.
- Singh, S. P. (2011), *Education for World Peace*, Discovery Publishing House, New Delhi.
- Suryanarayana.N.V.S.(2017), *Education and Human Values*, Nuvedita Book Distributors, Guwahati Jotiya, Assam

EDU-HG-3016
GUIDANCE AND COUNSELLING
Total Marks: 100 (External: 80 and Internal: 20)
Credit-6

Course Objectives:

After completion of this course the learner will be able to:

- Help the students to understand the concept, need and importance of Guidance and Counselling
- Enable the students to know the different types and approaches to Guidance and Counselling
- Acquaint the students with the organization of guidance service and school guidance clinic
- Enable the learners to understand the challenges faced by the teacher as guidance worker.

Course contents

Units	Contents
Unit-1	Introduction to Guidance <ul style="list-style-type: none"> • Meaning, objectives and scope of guidance • Need and principles of guidance • Types of guidance and their importance : Educational guidance, Vocational guidance, Personal guidance, Social guidance, Health guidance
Unit-2	Introduction to Counselling <ul style="list-style-type: none"> • Meaning, objectives and scope of counselling • Need and principles of counselling • Types of counselling : Directive, Non-directive and Eclectic counselling • Relation between Guidance and Counselling
Unit-3	Organization of guidance service <ul style="list-style-type: none"> • Meaning of guidance service • Need and principles of organizing guidance service • Components of guidance service: counselling service, techniques of counselling service • Qualities of a good counsellor
Unit-4	Guidance needs of students <ul style="list-style-type: none"> • Guidance needs of students in relation to home-centred and school-centred problems • Group guidance and Group counselling • Guidance for CWSN • School Guidance Clinic
Unit-5	School guidance programme <ul style="list-style-type: none"> • Importance of guidance and counselling cells in educational institutions

	<ul style="list-style-type: none">• Follow-up Services• Role of the Head of the institution and parents in guidance and counselling• Challenges and functions of the teacher as guidance provider/ counsellor
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Recommended Readings:

- Agarwal, Rashmi (2010): Educational, Vocational guidance and Counselling, Principles, Techniques and programmes. Shipra Publication.
- Aggarwal J.C. (1989): Educational and Vocational Guidance and Counselling, Doaba House, New Delhi.
- Bhatia, K. K. (2009): Principles of Guidance and Counselling, Kalyani Publishers.
- Goswami, M. (2015): Nirdexona aru Paramorxodan, Ashok book stall, Panbazar. Guwahati
- Kalita, Utpal (2017): Nirdexona aru Poramorxodan, Shanti Publication, Panbazar, Guwahati.
- Kochhar, S. K. (2010): Educational and vocational guidance in secondary schools, Starling Publishers, New Delhi.

EDU-SEC- 3014
PUBLIC SPEAKING SKILL

Credit – 4

Course Outcome:

After completing this course, students will be able to acquire the capacities of public speaking skill.

In-semester assessment:

Students shall prepare a write-up based on topic selected for speech. No Sessional examination is required for this paper.

Guidelines:

- The students will be trained on public speaking
- Teachers will give demonstrations on public speaking
- It will cover – Style of presentation, voice modulation, body language, communication with audience, eye contact
- Topics of speech will be selected by the students discussing with teachers.
- Topic of write-up will be decided by the internal examiner.
- Word limit for the write-up is maximum 2000.
- Evaluation (Public Speaking Skill+Write-up of the speech) will be done by an External Examiner.

4th SEMESTER (HONOURS)

EDU-HC-4016

GREAT EDUCATIONAL THINKERS

Total Marks: 100 (External: 80 and Internal: 20)

Credit-6

Course Objectives:

After completion of this course the learner will be able to:

- Enable the students to learn the Philosophy of life of different Educational Thinkers and their works.
- Enable the students to learn about the views of thinkers in educational context.
- Enable the students to learn about relevance of some of their thoughts at present day context.

Course contents

Units	Topics
Unit-1	Educational Thoughts of Srimanta Sankardeva <ul style="list-style-type: none">- Brief Life Sketch and Philosophy of Life- Views of Sankardeva on Education and practices.- Educational system of Satras and Namgharas and their relevance in modern era
Unit-2	Educational Thoughts of Mahatma Gandhi and Rabindranath Tagore <ul style="list-style-type: none">• Mahatma Gandhi<ul style="list-style-type: none">- Brief Life Sketch and Philosophy of Life- Views of Gandhiji on Educational Philosophy and practices- Gandhiji's Nai Talim.• Rabindranath Tagore<ul style="list-style-type: none">- Brief Life Sketch and Philosophy of Life- Views of Tagore on Educational Philosophy and practices- Tagore's Vishvabharati
Unit-3	Educational Thoughts of A.P.J. Abdul Kalam <ul style="list-style-type: none">- Brief Life Sketch and Philosophy of Life- Views of Kalam on Educational Philosophy and practices- Kalam's Education Model for the 21st Century
Unit-4	Educational Thoughts of Rousseau and Froebel <ul style="list-style-type: none">• Jean Jacques Rousseau<ul style="list-style-type: none">- Brief Life Sketch and Philosophy of Life- Views of Rousseau on Educational Philosophy and practices- Rousseau's Negative Education• Fredric Wilhelm August Froebel<ul style="list-style-type: none">- Brief Life Sketch and Philosophy of Life- Views of Froebel on Educational Philosophy and practices- Froebel's Kindergarten.

Unit-5	<p>Educational Thoughts of John Dewey and Madam Maria Montessori</p> <ul style="list-style-type: none"> • John Dewey <ul style="list-style-type: none"> - Brief Life Sketch and Philosophy of Life - Views of Dewey on Educational Philosophy and practices - Dewey's Concept of Democratic Education • Madam Maria Montessori <ul style="list-style-type: none"> - Brief Life Sketch and Philosophy of Life - Views of Montessori on Educational Philosophy and practices - Montessori's Children House.
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Recommended Readings

- Abdul Kalam, A. P. J. (1998): India 2020, A Vision for the New Millennium. Penguin Books India Ltd.
- Bezbarua, L. (2004): Mahapurush Sri Sankardev aru Sri Madhavdev. Guwahati: Jyoti Prakashan.
- Dewey, John (2014): Democracy and Education. Akar Books.
- Goswami, Dr. Renu: A Text book on Great Educators and Educational Classics. Guwahati Lawyar's Book Stall.
- Saikia, I. & Kalita .U. (2016): Prachya Aaru Pachayatyar Sikshabidsakal. Guwahati, Shanti Prakashan.
- Narang, C. L. & Bhatia, K. K. (2013): Philosophical and Sociological Bases of Education (Revised Edition). Ludhina, Tandon Publications.
- Neog, M. (1998): Sankaradeva and his Times: Early History of the Vaisnava Faith and Movement in Assam (3rd edition). Guwahati: Lawyer's Book Stall.

EDU-HC-4026
EDUCATIONAL STATISTICS AND PRACTICAL
Total Marks: 100 (External: 80 and Internal: 20)
Credit-6

Course Objectives:

After completion of this course the learner will be able to:

- Develop the basic concept of Statistics,
- Be acquainted with different statistical procedures used in Education.
- Develop the ability to represent educational data through graphs.
- Familiarize the students about the Normal Probability Curve and its applications in Education.

Course contents

Units	Topics
Unit-1	Basics of Educational Statistics <ul style="list-style-type: none"> • Statistics- Meaning, Nature and Functions • Need of statistics in Education • Measures of central tendency and their uses • Mean, Median and Mode from ungrouped and grouped data • Measures of variability –Concept, Types and their uses, merits and demerits • Quartile Deviation, Average Deviation, Standard deviation-(grouped and ungrouped data-short method), Combined SD
Unit-2	Graphical presentations of data <ul style="list-style-type: none"> • Usefulness of Graphical presentations of data, • Basic principle of constructing a graph, • Different types of graph –histogram, polygon, • Cumulative frequency percentage curve (Ogive), Smoothed graph.
Unit-3	Co-efficient of Correlation and Percentiles <ul style="list-style-type: none"> • Coefficient of correlation – Meaning and types, • Computation of, co-efficient of correlation by Rank difference method & Product-moment method and interpretation of result • Calculation of Percentile and Percentile Rank
Unit-4	Normal Probability Curve and Its Application <ul style="list-style-type: none"> • Normal Probability Curve: Its Meaning, Properties and Uses • Table of Area under NPC • Applications of Normal Probability Curve • Divergence from Normality: Skewness and Kurtosis

Unit-5	Statistical Practical <ul style="list-style-type: none">• To determine the Mean Median and Mode• Graphical Representation – Polygon, Histogram and Pie diagram
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Recommended Readings:

- Garrett, H.E. — Statistics in Psychology and Education, Mumbai, Vakils, Feffer and Simons Pvt. Ltd.
- Mangal, S.K. — Statistics in Psychology and Education, New Delhi- Prentice Hall of India.
- Saha, Kaberi—Statistical Analysis in Education and Psychology, Mani Manik Publishers.
- Binod, K. Sahu — Statistics in Psychology and Education, New Delhi, Kalyani Publishers.
- Goswami, Marami – Measurement and Evaluation in Psychology and Education, Hyderabad, Neel Kamal Publications.

EDU-HC-4036
EMERGING ISSUES IN EDUCATION
Total Marks: 100 (External=80 and Internal=20)]
Credit-6

Objectives:

After completion of this unit, students will able to-

- Make the students acquaint with major emerging issues national, state, and local
- Acquaint the students with the various issues in education that are emerging in the recent years in the higher education system
- Address the various problems and challenges of education in India at all levels.

Course contents

Units	Contents
Unit-1	Social Inequality in Education and Constitutional Safeguards <ul style="list-style-type: none"> • Concept of Social Inequality • Constitutional Provision for Ensuring Equality in Education • Education of Socially Disadvantaged Section: SCs, STs and Minorities , Education of people of Char area of Assam • Education for Backward Children, Child Labour, Street Children and Slum Dwellers • Gender Disparity and Rural-Urban Disparity in Education
Unit-2	Liberalization, Privatization and Globalization of Education <ul style="list-style-type: none"> • Liberalization: Concept and its impact on education • Privatization: Concept and its impact on education • Globalization: Concept and its impact on education • Public-private Partnership • Education as investment
Unit-3	Issues related to Students <ul style="list-style-type: none"> • Youth Unrest: Concept, Causes and Remedies • Campus Disturbance: Concept, Causes and Remedies • Examination Anxiety: Concept, Causes and Remedies • Issues related to Educated Unemployment.
Unit-4	Environmental Education and Population Education <ul style="list-style-type: none"> • Main Environmental Issues: Global Warming, Ozone Depletion and Environmental Pollution • Role of Environmental Education for Sustainable Development • Role of Different Stakeholders (Government and Non-Government Organisations, Women, Media) in Environmental Protection • Population Explosion: Its Causes and Consequences • Population Education for Population Control

Unit-5	<p>Multi-Cultural Education and Alternative Education</p> <ul style="list-style-type: none"> • Concept, Objectives and Need of Multi-Cultural Education • Curriculum and Instruction of Multi-Cultural Education • Issues related to Multi-Cultural Education • Concept of Alternative Education and its related Issues • Role of NIOS and Sakshar Bharat Mission in Alternative Education • Role of IGNOU and KKHSOU in Alternative Higher Education • MOOC and its related Issues.
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Recommended Readings:

- Aggarwal J. C. (1997). *Development and Planning of Modern Education*. New Delhi: Vikas Publishing House Ltd.
- Chandel and Nand (2011). *Population Education*. Agra: Shri Vinod Pustak Mandir.
- Das, Dr. Phunu (Ed.) (2016). *Contemporary Issues of Indian Education*. Guwahati: Shanti Prakashan
- Krishnamacharyulu, V. (2005). *Environmental Education*. Hyderabad: Neelkamal Publications Pvt. Ltd.
- Mishra and Mohanty (2013). *Trends and Issues in Indian Education*. Meerut: R. Lall Book Depot.
- Taj, Haseen (2011). *Current Challenges in Education*. Hyderabad: Neelkamal Publications Pvt. Ltd.
- Tiwari, R.P. *Problems of Education in N.E. India*. Ludhiana: Tandon Publications.

EDU-HG-4016
HISTORY OF EDUCATION IN INDIA
Marks: 100 (External: 80 Internal: 20)
CREDIT: 6

Course Objectives:

After completion of this course the learner will be able to:

- Analyse the education system during British Period
- Understand the Educational situation during the time of Independence
- Explain the recommendations and educational importance of different Education Commission and Committees in post Independent India
- Analyse the National Policy on Education in different tomes
- Accustom with the recent Educational Development in India.

Course contents

Units	Content
Unit-1	<p>Education in British India</p> <ul style="list-style-type: none"> • The Beginning <ul style="list-style-type: none"> - The Charter Act of 1813 - The Anglicists-Orientalists Controversy - Macaulay's Minute, 1835 - Downward Filtration Theory • Wood Despatch of 1854 <ul style="list-style-type: none"> - Background of the Despatch - Recommendations - Implementation of the Despatch • Indian Education Commission-1882 <ul style="list-style-type: none"> - Appointment of Indian Education Commission - Background for appointing the Commission - Major Recommendations - Criticism of the Commission
Unit-2	<p>Raise of Nationalism and its impact on Education</p> <ul style="list-style-type: none"> • Initiative of Gopalkrishna Gokhle, Gokhale's Bill for Compulsory Primary Education- 1910-1912 • All India Educational Conference, Wardha, 1937 • Gandhijis Basic Education –Concept , Philosophy and Salient Features, Criticism of the Basic Education
Unit-3	<p>Development of Indian Education: Post Independence I</p> <ul style="list-style-type: none"> • University Education Commission-1948 <ul style="list-style-type: none"> - Appointment of University Education Commission - Aims of University Education - Recommendations of the Commission - Evaluation of the Recommendations • Secondary Education Commission-1952-53 <ul style="list-style-type: none"> - Appointment of Secondary Education Commission - Aims and Objectives of Secondary Education - Defects of Secondary Education

	<ul style="list-style-type: none"> - Recommendations of the Commission - Evaluation of the Recommendations of the Commission
Unit-4	<p>Development of Indian Education: Post Independence- II</p> <ul style="list-style-type: none"> • Indian Education Commission-1964-66 <ul style="list-style-type: none"> - Major Recommendations and its effects on existing Indian education • National Policy of Education-1986 <ul style="list-style-type: none"> - Background - Major Recommendations - Impact on Indian Education
Unit -5	<p>Recent Developments in Indian Education</p> <ul style="list-style-type: none"> • The National Knowledge Commission's Report <ul style="list-style-type: none"> - Major recommendation and its implementation • National Curriculum Framework, 2005 • Government Programmes of Education: SSA, RMSA and RUSA • The Right to Education Act, 2009 and its implementation.

Recommended Readings:

- Chaube, S. P. and Chaube, A. (2005). Education in Ancient and Medieval India. New Delhi: Vikas Publishing House Pvt. Ltd.
- Dash, B.N. (2014). History of Education in India. New Delhi: Dominant Publishers and Distributors Pvt. Ltd.
- Ghosh, Suresh C. (2007). History of Education in India. New Delhi: Rawat Publications.
- Aggarwal, J.C. (2004). Landmarks in the History of the Modern Indian Education. New Delhi: Vikas Publishing House Pvt. Ltd.
- Thakur, A.S. and Thakur, A. (2015). Development of Education System in India: Problems and Prospects. Agra: Agarwal Publications.

EDU-SE-4014
WRITING BIODATA AND FACING AN INTERVIEW
Credit- 4

Course Outcome:

After completing this course, students will be able to write a biodata scientifically and will develop confidence to face different types of interview.

In-semester assessment:

Students shall write a biodata to face interview. No sessional examination is required for this paper.

Guidelines:

- The teachers will have to guide the students in writing their Biodata, if necessary outside experts may also be invited to train the students in writing the Biodata.
- Teachers will guide the students to differentiate amongst Biodata, Resume and Curriculum Vitae (CV).
- Teachers will explain the style and skill of appearing a formal interview.
- Students will practice mock interview within the classroom.
- Evaluation (Submission of Prepared Biodata+Facing an Interview) will be done by an External Examiner.

5th SEMESTER (HONOURS)

EDU-HC-5016

MEASUREMENT AND EVALUATION IN EDUCATION & PRACTICAL

Total Marks: 100 (External: 80 and Internal: 20)

Credit-6

Course Objectives:

After completion of this course the learner will be able to:

- Enable the students to understand the concept of measurement and evaluation in education.
- Acquaint the students with the general procedure of test construction and characteristics of a good test.
- Develop an understanding of different types of educational tests and their uses.
- Acquaint the students about personality test, and aptitude tests.

Course contents

Units.	Contents
Unit-1	Measurement and Evaluation in Education <ul style="list-style-type: none">• Meaning and concept of measurement, Functions of measurement, Types of measurement, Scales of measurement• Evaluation -Its meaning, basic principles• Relationship and difference between Measurement and Evaluation• Examination and Evaluation• Formative and Summative evaluation• Role of evaluation in education,
Unit-2	Test Construction <ul style="list-style-type: none">• General procedure of Test Construction and Standardization• Item Analysis• Characteristics of a good test
Unit-3	Educational Achievement Test <ul style="list-style-type: none">• Meaning and objectives of Achievement Test• Difference between Achievement test and Intelligence• Types of Achievement Test• Different types of Educational Achievement Test - Essay Vs. New type tests
Unit-4	Personality Test <ul style="list-style-type: none">• Personality Test- Its meaning• Questionnaire technique- Minnesota Personality Scale• Rating Scales• Projective Techniques- Free Word Association test, Rorschach Ink-Blot-Test, Thematic Apperception Test (TAT)

Unit-5	Laboratory Practical <ul style="list-style-type: none">• Ink Blot Test• Free Association, Control Association• Teacher Made Test
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Recommended Readings:

- Asthana, Bipin--- Measurement and Evaluation in Psychology and Education, Agra, Vinod Pustak Mandir
- Freeman, F.S. – Theory and Practice of Psychological Measurement.
- Goswami, Marami – Measurement and Evaluation in Psychology and Education, Hyderabad, Neel Kamal Publications.

EDU-HC-5026
GUIDANCE AND COUNSELLING
Total Marks: 100 (External: 80 and Internal: 20)
Credit-6

Course Objectives:

After completion of this course the learner will be able to:

- Help the students to understand the concept, need and importance of Guidance and Counselling
- Enable the students to know the different types and approaches to Guidance and Counselling
- Acquaint the students with the organization of guidance service and school guidance clinic
- Enable the learners to understand the challenges faced by the teacher as guidance worker.

Course contents

Units	Contents
Unit-1	Introduction to Guidance <ul style="list-style-type: none"> • Meaning, objectives and scope of guidance • Need and principles of guidance • Types of guidance and their importance : Educational guidance, Vocational guidance, Personal guidance, Social guidance, Health guidance
Unit-2	Introduction to Counselling <ul style="list-style-type: none"> • Meaning, objectives and scope of counselling • Need and principles of counselling • Types of counselling : Directive, Non-directive and Eclectic counselling • Relation between Guidance and Counselling
Unit-3	Organization of guidance service <ul style="list-style-type: none"> • Meaning of guidance service • Need and principles of organizing guidance service • Components of guidance service: counselling service, techniques of counselling service • Qualities of a good counsellor
Unit-4	Guidance needs of students <ul style="list-style-type: none"> • Guidance needs of students in relation to home-centred and school-centred problems • Group guidance and Group counselling • Guidance for CWSN • School Guidance Clinic
Unit-5	School guidance programme <ul style="list-style-type: none"> • Importance of guidance and counselling cells in educational institutions

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| | <ul style="list-style-type: none">• Follow-up Services• Role of the Head of the institution and parents in guidance and counselling• Challenges and functions of the teacher as guidance provider/ counsellor |
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Recommended Readings:

- Agarwal, Rashmi (2010): Educational, Vocational guidance and Counselling, Principles, Techniques and programmes. Shipra Publication.
- Aggarwal J.C. (1989): Educational and Vocational Guidance and Counselling, Doaba House, New Delhi.
- Bhatia, K. K. (2009): Principles of Guidance and Counselling, Kalyani Publishers.
- Goswami, M. (2015): Nirdexona aru Paramorxodan, Ashok book stall, Panbazar. Guwahati
- Kalita, Utpal (2017): Nirdexona aru Poramorxodan, Shanti Publication, Panbazar, Guwahati.
- Kochhar, S. K. (2010): Educational and vocational guidance in secondary schools, Starling Publishers, New Delhi.

EDU-DSE-5016
CONTINUING EDUCATION
Total Marks: 100 (External: 80 and Internal: 20)
Credit-6

Course Objectives:

After completion of this course the learner will be able to:

- Know the concept, objectives, scope and significance of continuing education in the context of present scenario.
- Understand about different aspects and agencies of continuing education.
- Realize different methods and techniques as well as issues of continuing education.
- Know the meaning of open education and realise the importance of open school and open universities in continuing education.
- Understand the development of adult education in India, kinds of adult education and different problems of adult education.

Course Contents

Units	Contents
Unit-1	Continuing Education <ul style="list-style-type: none"> • Continuing Education: Meaning, Nature and objectives • Functions and Scope of Continuing education • Significance of continuing education • Meaning and nature of different Aspects Continuing education: Fundamental education, Adult education, Social education & Extension education • Agencies of continuing education
Unit-2	Methodologies and Issues of Continuing Education <ul style="list-style-type: none"> • Different methods of Continuing education • Strategies and devices of continuing education • Role of Mass-media in continuing education • Issues of continuing education in India
Unit-3	Open Education <ul style="list-style-type: none"> • Open Education: Meaning, Characteristics, Objectives and Types • Open School: Meaning and role of NIOS • Open University: Meaning, Characteristics, Objectives and development • Role of Open university in Continuing education
Unit-4	Adult Education

	<ul style="list-style-type: none"> • Meaning and Development of Adult education in India • Different kinds of adult education in India • Methods of Teaching adults • Planning adult education programmes in Assam for empowerment of rural women • Problems and Solution of Adult Education in India
Unit-5	Recent Literacy programmes in India <ul style="list-style-type: none"> • Changing concept of Literacy • National Literacy Mission 1988 • Total Literacy Campaign and Post Literacy programme • Shakshar Bharat Mission

Recommended Readings:

- Aggarwal, J. C. (2008). *Adult Education*. Delhi: Doaba House.
- Chandra, Dr. Soti Shivendra (2005). *Adult and Non-Formal Education*. Delhi: Surajeet Publications.
- Das, Dr. Lakshahira (1999). *Adult Continuing Education*. Guwahati: Amrita Prakashan.
- Goswami, Dulumoni (2009). *Literacy and Development*. Guwahati: DVS Publishers.
- Kalita, Utpal (2015). *Abirata Siksha Aaru Durattwa Siksha*. Guwahati: Shanti Prakashan.
- Kaur & Sood (2009). *Adult and Non-Formal Education*. Ludhiana: Tandon Publishers.
- Mohanty, S. (2012). *Lifelong and Adult Education*. New Delhi: APH Publishing House.
- Talukdar, B. K. (1993). *Adult Education: Concepts & Methods*. Guwahati: Bina Library.

EDU-DSE-5026
DEVELOPMENTAL PSYCHOLOGY
Total Marks: 100 (External: 80 and Internal: 20)
Credit-6

Course Objectives:

After completion of this course the learner will be able to:

- Enable the students to understand the basic concepts relating to development
- Acquaint the students about heredity and environmental factors affecting pre-natal development
- Enable the students to understand the development aspects during infancy and childhood
- Enable the students to understand the development aspects of adolescence, importance of adolescence period and problems associated with this stage.

Course contents

Units	Topics
Unit-1	Introduction to Developmental Psychology <ul style="list-style-type: none"> • Meaning, definition, nature and scope of developmental psychology • Different methods of studying developmental psychology • Hereditary and other factors that affect pre-natal development • Periods of pre-natal development • Characteristics of pre-natal development • Precautionary measures to be taken in pre-natal development
Unit-2	Infancy <ul style="list-style-type: none"> • Characteristics of infancy • Different developmental aspects during infancy <ul style="list-style-type: none"> - Physical development - Cognitive development - Motor development - Language development - Emotional development • Conditions that affect parental attitude towards the infant • Role of family in the development of infants
Unit-3	Childhood <ul style="list-style-type: none"> • Characteristics of childhood • Developmental tasks of childhood <ul style="list-style-type: none"> - Physical development of early and late childhood - Emotional development of early and late childhood

	<ul style="list-style-type: none"> • Influence of family and school in social and personality development in childhood
Unit-4	Adolescence <ul style="list-style-type: none"> • Meaning and definition of adolescence • Need and importance of studying adolescence • Characteristics of adolescence • Developmental tasks of adolescent period • Adolescence – age of transition • Physical changes during adolescence • Intellectual development during adolescence
Unit-5	Social, Emotional and Personality Development of Adolescence <ul style="list-style-type: none"> • Social development during adolescence • Role of family, school and peers in the development of adolescence • Emotionality during adolescence • Personality development during adolescence • Adjustment problems and juvenile delinquency

Recommended Readings:

- Bee, H. and Denise Boyd: The Developing Child, Pearson Education Inc. India edition
- Chaube. S.P.: Developmental Psychology, New Delhi, Neelkamal Publicattions Ltd.
- Cole, L.: Psychology of Adolescence, New York, Rinchart and Winsten
- Goswami, G. (2008): Child Development and Child Care, Guwahati, Arun Prakashan
- Hurllock, E.B.: Developmental Psychology-A Life span approach, Tata McGraw Hill Publishing Com. Ltd.
- Thompson, G.G.: Child Psychology, Bombay, The Times of India Press (Indian reprint)
- Hurlock, E.B.: Child Development, Tata McGraw Hill Publishing Com. Ltd

EDU-DSE-5036
HUMAN RIGHTS EDUCATION
Total Marks: 100 (External: 80 and Internal: 20)
Credit-6

Course Objectives:

After completion of this course the learner will be able to:

- Explain the basic concept, nature and scope of human rights
- Describe the meaning, nature, principles, curriculum and teaching methods of human rights education at different levels of Education.
- Know the role of United Nations on human rights
- Understand enforcement mechanism in India
- Know the role of advocacy groups

Course Contents

Units	Contents
Unit-1	<p>Basic Concept of Human Rights</p> <ul style="list-style-type: none"> • Concept and Nature of Human Rights • Scope of Human Rights • Concept, objectives, principles of Human Rights Education • Needs and Significance of Human Rights Education in India. • Human Rights Education at Different levels: <ul style="list-style-type: none"> - Elementary level - Secondary level - Higher level. • Methods and Activities of Teaching Human Rights • Curriculum of Human Rights Education
Unit-2	<p>United Nations and Human rights</p> <ul style="list-style-type: none"> • Universal Declaration of Human Rights (1948) by UN • UN and Promotion and Protection of Human Rights • Human Rights and Indian Constitution • Fundamental Rights similar to the UN Human Rights in Constitution of India
Unit-3	<p>Human Rights – Enforcement Mechanism in India</p> <ul style="list-style-type: none"> • Human Rights Act – 1993 • Human Rights Commission – role and objectives • Judicial organs – Role of Supreme Court and High court in India • Commission of Women and Children in India
Unit-4	<p>Role of Advocacy Groups for Promotion of Human Rights</p> <ul style="list-style-type: none"> • Role of Global Agencies: UN, UNESCO, Vienna Declaration • Role of Government and Non-Governmental Organizations; • Role of educational institutions

	<ul style="list-style-type: none"> • Role of press and mass media
Unit-5	Human Rights and Marginalised Sections <ul style="list-style-type: none"> • Human Rights related to Racial Discrimination • Human Rights related to Religions and Religious Minorities • Human Rights related to Linguistic Minorities • Human Rights related to Communal Minorities • Human Rights related to Refugees • Human Rights related to Aged • Human Rights related Women and Children • Human Rights related to Differently Abled • Human Rights related to Transgender

Recommended Readings:

- Naseema, C. (2008): Human Rights Education Theory and Practice, Shipra Publications, Shakarpur.
- Chand, Jagdish (2007): Education for Human Rights, Anashah Publishing House, New Delhi.
- Rao, Digumarti Bhaskara (2004): Human Rights Education. Discovery Publication House, New Delhi.
- Mohanty, J. (2006): Human Rights Education. Deep & Deep Publications, New Delhi.
- J.C Aggarwal (2008): Education in the Emerging Indian Society, Shipra Publication, New Delhi.
- Deka, Neelotpal (2008): Human Rights Perspectives and Challenges, Assam Book Depot.
- Reddy & Others (2015): Human Rights Education, Neelkamal Publications Pvt. Ltd., Hyderabad.

EDU-DSE-5046
TEACHER EDUCATION IN INDIA
Total Marks: 100 (External: 80 and Internal: 20)
Credit-6

Course Objectives:

After completion of this course the learner will be able to:

- Explain the Concept, Scope, Aims & Objectives and Significance of teacher education
- Acquaint with the development of Teacher Education in India
- Acquaint with the different organising bodies of teacher education in India and their functions in preparation of teachers for different levels of education
- Acquaint with the innovative trends and recent issues in teacher education, and be able to critically analyse the status of teacher education in India
- Understand and conceive the qualities, responsibilities and professional ethics of teachers

Course Contents

Units	Contents
Unit-1	<p>Conceptual Framework and Historical Perspectives of Teacher Education in India</p> <ul style="list-style-type: none"> • Teacher Education-Concept, scope and aims and objectives • Need and Significance of Teacher Education in 21st Century • Types of Teacher Education-Pre-service and In-service • Development of Teacher Education in India • Shifting focus from Teacher Training to Teacher Education
Unit-2	<p>Teacher Education For Different Levels of Education</p> <ul style="list-style-type: none"> • Preparation of Teachers for Pre-Primary Level • Preparation of Teachers for Primary Level • Preparation of Teachers for Secondary Level • Preparation of Teachers for Higher Level
Unit-3	<p>Structure and Organisations of Teacher Education in India</p> <ul style="list-style-type: none"> • Preparation of Teachers for Pre-primary, Primary and Secondary level • Basic Training Centre (BTC) • District Institute for Education and Training (DIET) • State Council for Educational Research and Training (SCERT) • National Council for Educational Research and Training (NCERT) • National Council for Teacher Education (NCTE) • National University of Educational Training and Administration

	(NUEPA) <ul style="list-style-type: none"> • Regional Colleges of Education
Unit-4	Status of Teacher Education in India: Trends, Issues and Challenges <ul style="list-style-type: none"> • Skill and Competency based Teacher Education, Flanders Interaction Analysis, Micro Teaching and Simulated Social Skill Teaching (SSST) • National Curriculum Framework for Teacher Education (NCFTE), 2009 • NCTE Regulations, 2014 • Present problems of Teacher Education in India and their solution • Quality Assurance in Teacher Education and its challenges
Unit-5	Quality, Responsibility and Professional Ethics of Teachers <ul style="list-style-type: none"> • Qualities and responsibilities of a teacher • Teacher as a Facilitator, Counsellor and Practitioner-Researcher • Role expectations of Teachers in twenty first century • Professional ethics and accountability of teachers

Recommended Readings:

- Bhargava, M. And Saikia, L.Rasul- Teacher in 21st Century-Challenges, Responsibilities, Creditability, Agra, Rakhi Prakashan.
- Fhanders, Ned, A.—Analysing Teacher Behaviour, London, Wesly Publishing Company.
- Gurry, P. -- Education and the Training of Teachers, London Longmans, Green and Company.
- J.C. Aggarwal—Teacher and Education in a Developing Society, Vikas Publishing House Pvt. Ltd, New Delhi
- J.S. Rajput and K. Walia-- Teacher Education in India, Sterling Publishers Pvt. Ltd., New Delhi.
- Mukherjee, S.N.—Education of Teachers in India, Vol.-I and II, New Delhi , S. Chand and Company.
- Sharma, Sashi Prabha—Teacher Education-Principles, Theories and Practices, New Delhi, Kanishka Publishers.

6th SEMESTER (HONOURS)

EDU-HC-6016

EDUCATION AND DEVELOPMENT

Total Marks: 100 (External: 80 and Internal: 20)

Credit-6

Course Objectives:

After completion of this course the learner will be able to:

- Relation between education and development
- Educational development in the post globalization era
- Role of education in community development
- Education for human resource development
- Economic and political awareness through education

Course Contents:

Units	Contents
Unit-1	Basic Concepts of Education and Development <ul style="list-style-type: none">• Indicators of educational development• Role of education in national development• Growth and development of education in India in the post globalization era• Concept of modernization- Role of education in modernization
Unit-2	Education and Community Development <ul style="list-style-type: none">• Community: Meaning, Definition, Nature.• Relationship between School and Community.• Role of Teachers in Community Development.• Participation of Community people in Educational Institutions.• Role of Education in Community Development.• Problems of Educational Institutions in Community Development.
Unit-3	Education and Human Resource Development <ul style="list-style-type: none">• Human Resource Development: Meaning, Definition and Characteristics.• Objectives and Need of Human Resource Development.• Factors of Human Resource Development.• Role of education in Human Resource Development.• Organisations of Human Resource Development: MHRD, UGC, NCERT, CBSE.
Unit-4	Education and Economic Development <ul style="list-style-type: none">• Meaning of Economic Development and National Development.• Relationship between education and Economics.• Impact of Economics on Education.• Role of Education in Economic Development.

	<ul style="list-style-type: none"> • Education as an Investment.
Unit-5	Education and Developing Political Awareness <ul style="list-style-type: none"> • Education and democracy • Role of education in creating political awareness • Politics among the students • Importance of students unions

Recommended Readings:

- Sharma, R. A. (2007). Economics of Education. Meerut: R. Lall Book Depot.
- Taj, Dr. Haseen (2011). Current Challenges in Education. Hyderabad: Neelkamal Publications Pvt. Ltd.
- Tiwari, R. P. Problems of Education in N.E. India. Ludhiana: Tandon Publications.
- Ravi, S. Samuel (2015). Education in emerging India. Delhi: PHI Learning Private Limited.
- Krishnamacharyulu, V. (2013). School Management and systems of education. Hyderabad: Neelkamal Publications Pvt. Ltd.
- Latchanna & Hussein (2007). Economics of Education. New Delhi: Discovery Publishing House.

**EDU-HC-6026
PROJECT**

**Total Marks: 100 (External: 80 and Internal: 20)
Credit-6**

Course Objectives:

After completion of this course the learner will be able to:

- Explain the process of conducting a Project.
- Prepare a Project Report.

Guideline:

Each student is required to complete anyone project related to any area of the syllabus to be evaluated by Internal and External Examiners jointly through viva-voce test. The project work will be completed according to following heads:

- Title of the Project
- Introduction
- Importance of the Study
- Objectives of the Study
- Review of related literature (if any)
- Methods and Procedure
- Data Analysis and Discussion
- Conclusion

Internal Assessment (20 Marks):

Home Assignment/Group Discussion related to Project: 10 Marks

Library Works: 6 Marks

Attendance: 4 Marks

External Assessment (80 Marks):

Project Report: 60 Marks

Viva Voce: 20 Marks

EDU-DSC-6016
MENTAL HEALTH AND HYGIENE
Total Marks: 100 (External: 80 and Internal: 20)
Credit-6

Course Objectives:

After completion of this course the learner will be able to:

- Acquaint with the fundamentals and development of mental health and the characteristics of a mentally healthy person.
- Understand the concept and importance of mental hygiene and its relationship with mental health.
- Acquire knowledge about the principles, factors promoting mental health and the role of home, school, and society in maintaining proper mental health.
- Learn the meaning and problem of adjustment and also the different adjustment mechanisms.
- Familiarise with the concept and issues of positive psychology, mental health of women, role of WHO and stress management.

Course Contents

Units	Content
Unit-1	Fundamentals of Mental Health <ul style="list-style-type: none"> • Mental Health – Meaning and Definitions • Scope of Mental Health • Dimensions of Mental Health • Characteristics of a mentally healthy person • History of development of Mental Health
Unit-2	Fundamentals of Mental Hygiene <ul style="list-style-type: none"> • Mental Hygiene – Meaning and Nature • Goals of Mental Hygiene • Functions of Mental Hygiene • Need and importance of Mental Health and hygiene • Relationship between Mental health and hygiene
Unit-3	Education and Mental Health <ul style="list-style-type: none"> • Principles of sound Mental Health • Factors affecting Mental Health • Mental Health Hazards • Mental Health of Students <ul style="list-style-type: none"> -Role of Home -Role of School -Role of Society • Mental Health of Teachers
Unit-4	Preservation of Mental Health and Hygiene

	<ul style="list-style-type: none"> • Positive Psychology – Meaning and Nature • Importance of Positive Psychology • Contribution of WHO on Mental Health • Stress management • Mental Health Care Act, 2017
Unit-5	Mental Health and Yoga <ul style="list-style-type: none"> • Concept of Yoga • Importance of Yoga for Physical and Mental Health • Role of Yoga for Personality Development • Role of Yoga for Management of Stress • Principles of Yoga for Healthy Living • Pranayama and Meditation for Promoting Mental Health

Recommended Readings:

- Baumgardner, S. And Crother, M. ‘*Positive Psychology*’ published by Pearson India Education Services Pvt. Ltd.
- Chauhan, S.S. (2007) ‘*Advanced Educational Psychology*’ published by New Delhi: Vikas Publishing House Pvt. Ltd.
- Crow, L.D. and Crow, A. (1951) ‘*Mental Hygiene*’ published by New York: McGraw Hill
- Gururani, G.D. (2006) ‘*Textbook on Mental Health and Hygiene*’ published by New Delhi: Akansha Publishing House
- Mangal, S.K. ‘*Abnormal Psychology*’ published by New Delhi: Sterling Publication
- Mangal, S.K. ‘*Essentials of Educational Psychology*’ published by New Delhi: PHI Learning Pvt. Ltd.
- Safaya, R.N. Shukla, C.S. and Bhatia, B.D. (2002) ‘*Modern Educational Psychology*’ published by Dhanpat Rai Publishing Company

EDU-DSC-6026
SPECIAL EDUCATION

Total Marks: 100 (External: 80 and Internal: 20)

Credit-6

Course Objectives:

After completion of this course the learner will be able to

- Understand the meaning and importance of special education
- Acquaint with the different policies and legislations of special education
- Familiarise the students with the different types of special children with their characteristics
- Enable the students to know about different issues, educational provisions and support services of special education

Course Content:

Units	Content
Unit-1	<p>Special Education-</p> <ul style="list-style-type: none"> • Meaning, Objectives, Scope and Importance of Special Education • Development of Special Education in India with special reference to Assam • Integration of Special Education in Regular Classroom • Issues relating to integration and innovation • Challenges in Special Education
Unit-2	<p>Physically Challenged Children</p> <ul style="list-style-type: none"> • Children with Visual Impairment (Meaning and Definition, Classifications, Identification, Problems, Educational Programmes) • Children with Hearing Impairment (Meaning and Definition, Classifications, Identification, Problems, Educational Programmes) • Children with Orthopedically Handicapped (Meaning and Definition, Classifications, Identification, Problems, Educational Programmes)
Unit-3	<p>Children with Intellectual Disability (Mental Retardation) and Gifted</p> <ul style="list-style-type: none"> • Gifted Children <ul style="list-style-type: none"> - Meaning and Definition - Characteristics - Educational Programme • Children with Intellectual Disability <ul style="list-style-type: none"> - Meaning and definition - Characteristics - Levels - Causes - Educational Programme
Unit-4	<p>Children with Learning Disability</p> <ul style="list-style-type: none"> • Meaning and Definition

	<ul style="list-style-type: none"> • Characteristics • Types • Causes • Prevention • Educational Programme
Unit-5	<p>Policies ,Legislation and Services</p> <ul style="list-style-type: none"> • National Policy on Education-1986 • Central Scheme of Integrated Education for Disabled Children (IEDC) • Rehabilitation Council of India Act-1992 • The Persons with Disabilities (PWD) Act-1995 • National Policy for Persons with Disability, 2006 • Community Based Rehabilitation <ul style="list-style-type: none"> - Definition - Need - Implementation Process

Recommended Readings:

- Ali, S. (2016). Special Education: For Differently Able Children. Guwahati: Kalyani Publishers.
- Kalita, U. and Saikia, I. (2018). Bisesh Siksha. Guwahati: Shanti Prakashan.
- Manivannan, M. (2013). Perspective in Special Education. New Delhi: Neelkamal Publications Pvt. Ltd.
- Mangal, S.K. (2008). Educating Exceptional Children: An Introduction to Special Education. New Delhi: PHI Pvt. Ltd.

EDU-DSC-6036
EDUCATIONAL MANAGEMENT
Total Marks: 100 (External: 80 and Internal: 20)
Credit-6

Course Objectives:

After completion of this course the learner will be able to

- Develop an understanding of the basic concept of educational management.
- Enable the students to know about the various resources in education
- Enable the students to understand the concept and importance of educational planning.
- Enable the students to know about the financial resources and financial management in education.

Course Contents

Units	Contents
Unit-1	Introduction to Educational Management <ul style="list-style-type: none"> • Meaning, nature and scope of Educational Management • Objectives/Purpose of Educational Management • Principles of Educational Management • Types of Educational Management • Functions of Educational Management- Planning, Organizing, Directing, Supervising and controlling • Classroom Management- Principles, Strategies and Techniques.
Unit-2	Resources in Education <ul style="list-style-type: none"> • Meaning of resources • Types of resources- Human resource, Material resource and Financial resource • Management of Human, Material and Financial resources • Optimum Utilization of resources in educational institutions
Unit-3	Educational Planning <ul style="list-style-type: none"> • Meaning, Nature and Importance of educational planning • Types of educational planning • Principles of educational Planning • Central State Relationship in Educational Planning, Central and State Educational Advisory Bodies- MHRD, UGC, NCERT, SCERT
Unit-4	Institutional Planning <ul style="list-style-type: none"> • Concept, Nature, and Scope of Institutional Planning • Institutional Planning for Infrastructural Development and Personnel Development • Procedure of Institutional Planning • Organisation of Time Table and Co-curricular Activities

Unit-5	Financing of Education and Recent Trends in Management <ul style="list-style-type: none"> • Concept of Educational Finance • Sources of Educational Finance • Principles of Educational Finance • Budget: Concept and Components, Process of Preparing Institutional Budget • Recent Trends in Educational Management <ul style="list-style-type: none"> - Total Quality Management - SWOT Analysis
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Recommended Readings:

- Bhatnagar and Gupta (2006). *Educational Management*. Meerut: R. Lall Book Depot.
- Bhattacharya, Shantanu (2012). *Educational Management-Theory and Practice*. Guwahati: EBH Publishers.
- Krishnamacharyulu, V. (2008). *School Management and System of Education*. Hyderabad: Neelkamal Publications Pvt. Ltd.
- Mathur and Mathur (2010). *School Organisation and Management*. Agra: Agrawal Publication.
- Sharma, R. N. (2010). *Educational Administration, Management and Organisation*. Delhi: Surjeet Publications.
- Sidhu, I. S. (2012). *Educational Administration and Management*. Delhi: Pearson India Publishers
- Taj Haseen and Bhatnagar, Piyush (2012). *Modern Perspectives of Organizational Behaviour*, Agra: Harprasad Institute of Behavioural Studies.

EDU-DSC-6046
WOMEN AND SOCIETY

Total Marks: 100 (External: 80 and Internal: 20)

Credit-6

Course Objectives:

After completion of this course the learner will be able to

- Know the changing role of women in India
- Understand gender discrimination in Indian society
- Make the students understand the constitutional provisions for women and their rights.
- Make the students understand women empowerment
- Develop an awareness and sensitivity towards women

Units	Contents
Unit-1	Status and role of women <ul style="list-style-type: none"> • Women in ancient and medieval India • Changing role of Women in India • Women's health and related issues • Role of women in family , school and society • Women's role in social and environmental movement
Unit-2	Constitutional provisions and Rights of women <ul style="list-style-type: none"> • Constitutional Provision for equality of Women (Educational and Legal Provisions) • National Policy on Education (1986) on women education • National Council for Women Education • Property Right • National Policy for Empowerment of Women, 2001
Unit-3	Gender inequalities in School and society <ul style="list-style-type: none"> • Family attitude • Gender bias in Textbook • Curricular Choices • Teachers' attitude • Classroom Interaction • Peer Culture • Gender inequality in workplace
Unit-4	Women Empowerment <ul style="list-style-type: none"> • Concept of women empowerment, importance • Types of women empowerment- Economic, political, Educational , legal • Women entrepreneurship • Barriers of women empowerment • Role of education in women empowerment
Unit-5	The new roles of men and women and its Implications <ul style="list-style-type: none"> • Changes in family patterns • Gender roles in transition

	<ul style="list-style-type: none"> • New gender roles • Factor influencing gender role • Women as peace builder • Gender sensitivity- new gender roles and its implications for family and society

Recommended Readings:

- Aeker,S. (1994) Feminist theory and the study of gender and education;
- Bhatia , R. L. & Ahuja , B. N. (2006) Modern Indian Education and it's Problems , Surjeet Publication , Delhi, India
- Reddy, V. Govinda (2017): Gender Perspectives in Peace Education. Manglam Publishers and Distributors. Delhi,India.
- Agarwal, N. (1993) Women Education & Population in India. Chugh Publications, Allahabad
- Kaur I.(1983) Status of Hindu Women in India, Chugh Publications, Allahabad
- Aggarwal J.C.(1976) Indian Women: Education and Status, Arya Book Depot, New Delhi
- Bhatt B.D. & Sharma S.R. (1992) Women's Education and Social Development , Kanishka Publishing House, Delhi
