

## PROGRAMS OFFERED UNDER GRADUATION AND POST GRADUATION

**UG COURSES: 8**

**PG COURSES: 6**

### UG COURSES

#### PROGRAM NAME

#### PROGRAM CODE

B.Com General	401
B.Com Honours	407
B.Com Computer Application	405
B.Com Business Analytics	538
B.B.A	684
B.Sc. MPCs	468
B.Sc. MSCs	467
B.Sc. BtMbC	487

### PG COURSES

#### PROGRAM NAME

#### PROGRAM CODE

M.Com	408
M.Sc. Mathematics	505
M.Sc. Organic Chemistry	503
M.Sc. Analytical Chemistry	585
M.Sc. Statistics	507
M.Sc. Applied Statistics	508

# **B.Com GENERAL**

## **Course Outcomes (COs)**

### **SEMESTER-I**

#### **COURSE TITLE: ENVIRONMENTAL SCIENCE COURSE CODE: AECC1**

- It provides the basic knowledge of environment & science used to save our environment.

#### **COURSE TITLE: FINANCIAL ACCOUNTING -I COURSE CODE: DSC 101**

- To enable the students to apply the conceptual principles and to develop an expertise in handling the accounts of specialized institutions and the consolidation of accounts through appropriate accounting techniques and policies.
- To enable the students to know about the different books maintained by the business organization to give the knowledge of different books maintained by the banks and rectify the difference
- Familiarize the students with the steps involved in locating errors and make them understand the relationship between Profit & Loss Account and Balance sheet

#### **COURSE TITLE: BUSINESS ORGANISATION AND MANAGEMENT COURSE CODE: DSC 102**

- Identify the basic principles and functions of management in functional areas of business
- To provide students with an understanding of the basic principles and functions of management in functional areas of business
- Understanding the different levels, skills& principles of management
- Define and describe the elements & process of co-ordination and control function that contributes to the achievement of organizational objectives.

#### **COURSE TITLE: FOREIGN TRADE COURSE CODE: DSC 103**

- To study the diversification of India's export Zones
- To provide students with a sound foundation on export registration policies.
- To identify sources of information on export documentation"

### **SEMESTER-II**

#### **COURSE TITLE: BASIC COMPUTER SKILLS COURSE CODE: AECCII**

- To give the knowledge of basic skills of computers

#### **COURSE TITLE: FINANCIAL ACCOUNTING II -COURSE CODE: DSC 201**

- To enable the students to gain the knowledge of Bills of Exchange

- To know the process of exchange of goods with Consignment
- Understanding how the different books of accounts are maintained in Joint Venture
- Knowing how the Non-profit organization maintains the different books to know the profit made

**COURSE TITLE: BUSINESS LAW -COURSE CODE: DSC 202**

- To provide students with an understanding of general principles of law of contract and special contracts
- To state the law relating to Indian Contract Act and define the concept of contract
- To understand the different elements of contract, performance of contract and different modes of discharge of contract
- To know the management of companies & directors rights, duties, qualification & disqualification knowing the process of winding of company & different modes of winding up

**COURSE TITLE: BANKING & FINANCIAL SERVICES -COURSE CODE: DSC 203**

- Understand and explain the conceptual framework of banking
- Aims to help students to appreciate and understand how financial services are done
- Knowing the relationship of a customer & a banker
- understanding the Different Financial services like leasing, factoring& forfeiting

**SEMESTER-III**

**COURSE TITLE: PRINCIPLES OF INSURANCE -COURSE CODE:SEC1**

- It gives the basic knowledge of principles of insurance.
- Provides knowledge of different insurance contract terms & plans.

**COURSE TITLE: PRACTICE OF LIFE INSURANCE COURSE CODE: SEC2**

- To familiarize the students with principals & practice of Life Insurance to settle the claims.

**COURSE TITLE: ADVANCEDACCOUNTING -COURSE CODE: DSC 301**

- Define & examine the accounting principles, underlying financial statements and their implementation in partnership firms.
- Interpret the financial result after admission, retirement and death of a partner and explain different accounting policies
- Discuss the case Garner Vs Murray and solve problems relating to insolvency of partners.
- Understanding the preparation of final accounts of companies by applying the company's act 2013
- Understanding the different methods of valuation of goodwill & shares

**COURSE TITLE: BUSINESS STATISTICS -I COURSE COD: DSC 302**

- To inculcate analytical and computational ability among the students
- To give the knowledge of the different diagrams & the Graphs used to represent data
- Understanding the Measures of central tendency with mean, median, mode, quartile, docile, percentile
- Understanding the Measures of Dispersion, Skewness
- Understanding the relationship between two variables with the help of Correlation.

**COURSE TITLE: FINANCIAL INSTITUTIONS & MARKETS COURSE CODE: DSC 303**

- Illustrate the Indian financial system and markets
- Imparting the knowledge of different financial institutions
- To give the knowledge of Money markets, its Instruments & its organization
- Explaining the Debt market & its instruments, Players.
- Giving the knowledge of Primary & Secondary markets.

**SEMESTER-IV**

**COURSE TITLE: PRACTICE OF GENERAL INSURANCE COURSE CODE: SEC3**

- Students know the prospects of Indian & International general Insurance Market
- Understanding the role of underwriters & actuaries in fixing the premiums by Risk & Management techniques
- students also learn about fraud prevention& different types of reserves of Insurance companies

**COURSE TITLE: REGULATION OF INSURANCE BUSINESS COURSE CODE: SEC4**

- Explains Insurance Operating including functions of Insurance & Insurance Market in India
- Evaluate the registration of Indian Insurance Legislation & Insurance Act
- Develop valuable insight into the Principles & Practices that regulate Insurance Business

**CCOURSE TITLE: INCOME TAX -COURSE CODE: DSC 401**

- Examine the basic concepts of schedule of rates of tax, tax liability
- To lay down a foundation for computing gross total income, rebate and the total tax liability of an individual.
- Explain the total taxable income of an assesses
- Apply and practice the computation of total income

- To know the total income from House property, profits & gains of the Business

**COURSE TITLE: BUSINESS STATISTICS -II COURSE CODE: DSC 402**

- To inculcate analytical and computational ability among the students
- Regression helps to predict the value of dependent variable
- Understanding the different test of consistency with the help of Index numbers
- Predicting the future value of the variable with Time series
- Understanding the occurrence of an event with Probability

**COURSE TITLE: CORPORATE ACCOUNTING -COURSE CODE: DSC 403**

- To Gain Knowledge in the provisions relating to liquidation of a company
- Acquaint with the legal formats and special items and adjustments pertaining to Banking companies and Insurance companies
- To give the knowledge of Amalgamation, Reconstruction & preparation of final statements

**SEMESTER-V**

**COURSE TITLE: BUSINESS ECONOMICS -COURSE CODE: GE**

- To make the students expertise in various methods and tool in economic analysis
- To analyze the factors of production and their specialization in the business.

**COURSE TITLE: COST ACCOUNTING COURSE CODE: DSE 501**

- Understand and explain the conceptual framework of Cost Accounting
- Familiarize concept and role of cost accounting in the business management of manufacturing and non-manufacturing companies
- Provide an in-depth knowledge on cost ascertainment. And to identify the areas of application of costing techniques.

**COURSE TITLE: COMPUTERIZED ACCOUNTING COURSE CODE: DSE 502**

- To introduce the students to basic of Accounts & the usage of Tally for Accounting purpose
- To help the students with Accounting software i.e. Tally
- Students learn to create Company, enter Accounting vouchers & generate Invoices with required information

**COURSE TITLE: AUDITING COURSE CODE: DSE 503**

- Students will be well versed with the Fundamental concepts of Auditing
- Gives knowledge of qualifications of an Auditor
- Preparation of Audit report

**SEMESTER-VI**

**COURSE TITLE - RESEARCH Methodology & PROJECT REPORT -COURSE CODE: PR**

- It provides a detailed plan which helps to keep researchers on track, making the process smooth, effective and manageable.
- A researcher's methodology allows understanding the approach and methods used to reach conclusions.

**COURSE TITLE: COST CONTROL & MANAGEMENT ACCOUNTING - COURSE CODE: DSE 601**

- Understand and explain the conceptual framework of Cost Accounting
- Providing the knowledge of cost control techniques
- Giving the knowledge of Management accounting decision making techniques & Reporting methods

**COURSE TITLE: THEORY & PRACTICE OF GST -COURSE CODE: DSE 602**

- It gives the knowledge of Registration process of GST& its Transactions.
- Minimum cascading of taxes, Improves competition in Indian manufacturing system

**COURSE TITLE: ACCOUNTING STANDARDS-COURSE CODE: DSE 603**

- Provides measurement of financial transaction.
- It gives knowledge on providing presentation of financial statement in fair manner.
- It gives the knowledge & application of Indian accounting stand

**B.Com HONOURS**  
**Course Outcomes (COs)**

**YEAR-I**

Code	Course Title	Course Type	HP W	Credits
DSC101	FINANCIAL ACCOUNTING –I	DSC-101	5	5

**SEMESTER-I**

**Upon successful completion of this course, the student will be able to:**

- Acquire conceptual knowledge of basics of accounting.
- Identify events that need to be recorded in the accounting records
- Develop the skill of recording financial transactions and preparation of reports in accordance with GAAP.

- Describe the role of accounting information and its limitations
- Equip with the knowledge of accounting process and preparation of final accounts of sole trader
- Identify and analyze the reasons for the difference between cash book and pass book balances.
- Recognize circumstances providing for increased exposure to errors and frauds
- Determine the useful life and value of the depreciable asset.

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Code	Course Title	Course Type	HPW	Credits
DSC102	BUSINESS ORGANISATION	DSC-102	5	5

**Upon successful completion of this course, the student will be able to:**

- Understand the scope of Business, and its importance.
- Describe the Social Responsibility of Business towards the society
- Explain business ethics as an integral part of every business organization
- Identify different forms of business organizations viz; Sole Proprietorship, Partnership, Joint Hindu Family Business & Co-operative Organizations.
- Understand a Joint Stock Company and various formalities to promote a Company
- Identify the various vital documents of a company
- Learn various sources Industrial Financial resources and the means to raise them
- Understand about the functioning of Stock Exchanges & Mutual funds.

Code	Course Title	Course Type	HPW	Credits
DSC-103	FOREIGN TRADE	DSC-103	5	5

**Upon successful completion of this course, the student will be able to:**

- Understand the concept of Foreign Trade and its significance.
- Learn about the different types of documents used in foreign trade
- Learn the components of Balance of payment and Balance of trade in international trade
- Know the remedies of correcting Balance of payment,
- Understand the trade and types of blocs in international trade.
- Understand the objectives and functions of international economic institutions.
- Know about the Indian trade policy.
- Learn about the international economic institutions and their objectives, functions and features.

Code	Course Title	Course Type	HPW	Credits
BC104	BUSINESS ECONOMICS	DSC-104	5	5

**Upon successful completion of this course, the student will be able to:**

- Learn economics in terms of business.
- Describe the nature of economics in dealing with the issue of scarcity
- Perform supply and demand analysis to analyze the impact of economic events on Markets.
- Analyze the behavior of consumers in terms of the demand for products
- Evaluate the factors affecting firm behavior, such as production and costs
- Analyze the performance of firms under different market structures,

- Recognize market failure and the role of government in dealing with those failures
- Understand the dynamics of how the markets work
- Use economic analysis to evaluate controversial issues and policies.

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### **I-YEAR SEMESTER-II**

<b>Code</b>	<b>Course Title</b>	<b>Course Type</b>	<b>HPW</b>	<b>Credits</b>
<b>DSC-201</b>	<b>FINANCIAL ACCOUNTING – II</b>	<b>DSC-201</b>	<b>5</b>	<b>5</b>

**At the end of this course, student should be able to:**

- Appreciate the need for negotiable instruments and procedure of accounting for bills honored and dishonored
- Differentiate Trade bills from Accommodation Bills
- Understand the concept of Consignment and learn the accounting treatment of the various aspects of consignment
- Distinguish Joint Venture and Partnership and to learn the methods of maintaining records under Joint Venture
- Distinguish between Single Entry and Double Entry
- Know the ascertainment of profit under Single Entry system.
- Understand the meaning and features of Non-Profit Organizations'
- Learn to prepare Receipts & Payment Account, Income & Expenditure Account and Balance Sheet for Non-Profit Organizations.

<b>Code</b>	<b>Course Title</b>	<b>Course Type</b>	<b>HPW</b>	<b>Credits</b>
<b>DsC-202</b>	<b>BUSINESS LAWS</b>	<b>DSC-202</b>	<b>5</b>	<b>5</b>

**Upon successful completion of this course, a student will be able to:**

- The ability to understand the essentials of contract including offer, acceptance and agreements leading to valid business propositions. Recognize and distinguish modes of discharge of contract with proper application in different forms of business.
- Instructing on the legal rights and obligations under the Sale of Goods Act, along with consumer protection legislation and consumer redressal forums
- Imparting importance of intellectual property rights including acquiring the rights.
- Ability to grasp the required statutory documents prepared for a company and legal procedure for winding up.

<b>Code</b>	<b>Course Title</b>	<b>Course Type</b>	<b>HPW</b>	<b>Credits</b>
<b>DSC-203</b>	<b>BANKING AND FINANCIAL SERVICES</b>	<b>DSC-203</b>	<b>5</b>	<b>5</b>

**Upon successful completion of this course, a student will be able to:**

- Knowledge about Indian Banking system, Apex Institutions, Redressal mechanism are gained.
- Empathizing the banker customer relationship
- Concepts regarding Negotiable Instruments, title of Goods, Advances of Loans are gained.
- The fund based and Non fund based financial services are introduced. Knowledge on Merchant banking, venture capital, Leasing, Factoring, Forfeiting is accrued.



Code	Course Title	Course Type	HPW	Credits
DSC-204	FINANCIAL MANGAEMENT	DSC-204	5	5

**Upon successful completion of this course, a student will be able to:**

- Introduced to profit and Wealth Maximisation, practiced time value for money with present cash flow techniques.
- Calculated of Long-term investments through capital Budgeting techniques.
- Practiced Investment Decision, Financing Decision, Dividend policies.

## II -YEAR SEMESTER-III

Code	Course Title	Course type	HPW	Credits
DSC-301	ADVANCED ACCOUNTING	DSC-301	5	5

**Upon successful completion of this course, a student will be able to:**

- Prepare financial accounts for partnership firms in different situations of admission, retirement, death and insolvency of the partners.
- Prepare financial statements for partnership firm on dissolution of the firm.
- Employ critical thinking skills to understand the difference between the dissolution of the firm and dissolution of partnership.
- Understand the various types of capital structure of the company and their representation in the balance sheet.
- Evaluate the different situations of capital issue to public like issue at premium, issue at discount, forfeiture of shares etc.
- Demonstrate an understanding about the profits of the company and their division.
- Preparation of financial accounts with profits before incorporation.
- Understand the valuation of shares and goodwill and prepare financial statements accordingly.

Code	Course Title	Course Title	HPW	Credits
DSC-302	BUSINESS STATISTICS-I	DSC-302	5	5

**Upon successful completion of this course, a student will be able to:**

- Understand basic statistical concepts such as statistical collection, statistical series, tabular and graphical representation of data
- Calculate measures of central tendency, dispersion and asymmetry, correlation and regression analysis
- Apply knowledge to solve simple tasks using computer
- Independently calculate basic statistical parameters viz- mean, measures of dispersion, correlation coefficient, indexes)
- Based on the acquired knowledge to interpret the meaning of the calculated statistical indicators
  - Choose a statistical method for solving practical problems
- Highlight statistical relationships between variables in data sets
- Predict values of strategic variables using regression and correlation analysis.

Code	Course Title	Course Type	HPW	Credits
DSC-303	FINANCIAL INSTITUTIONS AND MARKETS	DSC-303	5	5

**Upon successful completion of this course, a student will be able to:**

- Learner can understand Indian Financial system and happenings of recent developments.
- More clarity is given on types of commercial banking, functions, Merchant Banking, Venture Capital, Hire purchase, Leasing and Non-Banking Financing companies.
- Introduced to functions of money market, dealers in Money Market, Liquidity Adjustment Facility), MSF (Marginal Standing Facility) Repo, Reverse Repo, Monetary policy Committee, Structure and Functions. Government Securities and Monetary policy etc.
- That will have clarity on debt markets in India, Instruments and players.
- Knowledge about Equity market, methods of IPO, Primary and Secondary market, SEBI in India, Recent developments, objectives and functions is acquired.

Code	Course Title	Course Type	HPW	Credits
DSC-304	INVESTMENT MANAGEMENT	DSC-304	5	5

**Upon successful completion of this course, a student will be able to:**

- Introduced to the concepts of Investment Management
- Gained knowledge and practiced problems on its risk and returns.
- Awareness and computation of market indices is accrued
- Hands on experience on Concepts and techniques related to time value of money
- The emphasis is on rationale of diversification and measurement of expected risk and return using statistical tools.

Code	Course Title	Course Title	HPW	Credits
SEC-2 DEPT SEPCIFIED COURSE	PRINCIPLES OF INSURANCE	SEC-2	2	2

**On successful completion of this course, student should be able to:**

- Students are exposed to the Insurance Industry, its functioning and the principles regulating. Enlightened with types of insurances, Operating intermediaries and risk management.
- Made aware with the requirements of an insurer as expected by the society (Professionalism, Ethics, Roles and Responsibilities).

## II -YEAR SEMESTER-IV

Code	Course Title	Course type	HPW	Credits
DSC-401	INCOME TAX	DSC-401	5	5

**Upon successful completion of this course, a student will be able to:**

- The conceptual knowledge of Indian Tax Structure, History and Basic concepts are imparted.
- It enables to assess incidence of tax, residential status and computation of tax liability through total Income.
- The applicability of various provisions to compute taxable income under the Head salaries.

- Ability of computing taxable income under the heads Income from House property, Business or Profession, capital gains and Income from other sources.

Code	Course Title	Course type	HPW	Credits
DSC-402	BUSINESS STATISTICS II	DSC-402	5	5

**Upon successful completion of this course, a student will be able to:**

- Knowledge about Linear and Non-Linear Regression Correlation Vs. Regression
- Regression of Y on X - Line of Regression of X on Y
- Uses - Types - Problems in the Construction of Index Numbers - Methods of Constructing Index Numbers - Simple and Weighted Index Number
- Components – Methods-Semi Averages - Moving Averages – Least Square methods.
- Probability – Meaning – Experiment, Event - Mutually Exclusive Events
- Theorems of Probability: Addition – Multiplication - Bayes' Theorem.
- Knowledge about distributions -binomial, Poisson, nominal.

Code	Course Title	Course type	HPW	Credits
DSC-403	CORPORATE ACCOUNTING	DSC-1D	5	5

**Upon successful completion of this course, a student will be able to:**

- Understand the regulatory environment in which the companies are formed and operate
- Have a solid foundation in accounting and reporting requirements
- of the Companies Act and relevant Indian Accounting Standards
- Have a comprehensive understanding of the advanced issues in accounting for assets, liabilities and owner's equity
- Understand the treatment regarding issue of bonus shares and treatment of prior period profits
- Account for mergers and amalgamations
- Value goodwill and shares under various methods
- Draft Final Accounts for Manufacturing concerns, Banks and Insurance Companies
- Perform computerized accounting using Tally package.

DSE-404	HUMAN RESOURCES MANAGEMENT	DSC-404	5	5
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**By the end of the programme, students will be able to:**

- Critically assess existing theory and practice in the field of HRM
- Develop an ability to undertake qualitative and quantitative research
- Apply knowledge about qualitative and quantitative research to an independently constructed piece of work
- Respond positively to problems in unfamiliar contexts
- Identify and apply new ideas, methods and ways of thinking.
- Demonstrate competence in communicating and exchanging ideas in a group context
- Be able to advance well-reasoned and factually supported arguments in both written work and oral presentations
- Work effectively with colleagues with diverse skills, experience levels and way of thinking
- Be able to evaluate HRM related social, cultural, ethical and environmental responsibilities and issues in a global context.

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Code	Course Title	Course Title	HPW	Credits
SEC-4 DEPT SEPCIFIED COURSE	PRACTISE OF LIFE & GENERAL INSURANCE	SEC-2	2	2

**On successful completion of this course, student should be able to:**

- They can get knowledge about Insurance, Understanding various types of insurance policies, insurers and concept of Underwriting.
  - Provide students with the knowledge of calculating premiums along required policy documents. Giving knowledge about settlement of claims risk & underwritings and financial planning including tax planning
  - Different types of reserves of insurance companies—reserving process followed by insurance companies—Insurance accounting.
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**III -YEAR SEMESTER-V**

Code	Course Title	Course Type	HPW	Credits
DSE-501	COST ACCOUNTING	DSE-501	5	5

**On successful completion of this course, student should be able to:**

- Recognize and apply appropriate theories, principles and concepts relevant to cost accounting.
- Exercise appropriate judgment in selecting and presenting information using various methods relevant to cost accounting.
- Plan, design and execute practical activities using techniques and procedures appropriate to cost accounting.
- Respond to change within the external and internal business environments and its effect on cost accounting.
- Develop appropriate effective written and oral communication skills relevant to cost accounting.
- Use organization skills (including task and time management) relevant to cost accounting systems both individually and in a group situation.
- Solve problems relevant to cost accounting systems using ideas and techniques some of which are at the forefront of the discipline.

Code	Course Title	Course Type	HPW	Credits
DSE-502	COMPUTERISED ACCOUNTING	DSE-502	3T+4P	5

**On successful completion of this course, student should be able to:**

- Need of the hour to learn office automation techniques imparted through concepts of computerized accounting
- Practical training on maintaining books of accounts, inventory management, including preparation of financial statements is given.
- maintenance of Accounts payable and Receivable management is trained using ERP
- Significance of Management Information System and generating customized reports used by stakeholders are trained.

Code	Course Title	Course Type	HPW	Credits
DSE-503	AUDITING	DSE-503	5	5

**On successful completion of this course, student should be able to:**

- Meaning, importance, objectives, types of audits are elucidated
- Knowledge on procedure for appointment, process of auditing is acquired.
- Significance and process of internal check and internal control are accrued.
- Training imparted on vouching, valuation of assets and understanding audit reports.

Code	Course Title	Course Type	HPW	Credits
DSE-504	MARKETING MANAGEMENT	DSC-4504	5	5

**On completion of this course, the students will be able to**

- Students will be able to identify the scope and significance of Marketing In Domain Industry
- Students will be able to examine marketing concepts and phenomenon to current business events in the industry.
- Students will be able to coordinate the various marketing environment variables and interpret them for designing marketing strategy for business firms
- Students will be able to illustrate market research skills for designing innovative marketing strategies for business firms
- Students will be able to practice marketing communication skills relevant to the corporate world.

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### **III -YEAR SEMESTER-VI**

Code	Course Title	Course Type	HPW	Credits
DSE-601	COST CONTROL AND MANAGEMENT ACCOUNTING	DSE-601	5	5

**On successful completion of this course, student should be able to:**

- \* Knowledge on concepts of managerial accounting, marginal costing, and approaches for managerial decision-making process
- \* Learnt to forecast budgets, compare budgeted and actual, and practiced budgetary control through variances.
- \* Practiced techniques and applied ratios to determine the financial performance of the business.
- \* The importance of working capital management, flow of cash through various sources and applications are imparted and practiced.
- \* Practice of financial statement analysis Recognize and apply appropriate theories, principles and concepts relevant to cost accounting
- \* Solve problems relevant to cost accounting systems using ideas and techniques some of which are at the forefront of the discipline.

Code	Course Title	Course Type	HPW	Credits
DSE-602	THEORY AND PRACTISE OF GST	DSE-602	3T+4P	5

**On successful completion of this course, student should be able to:**

- Understand the origin of goods and services tax (GST), the constitutional change to implement GST in India, the composition, and functions of the GST council along with Registration and Revocation process.
- Comprehend the concept of supply under GST law, types of invoices, distinguish between intrastate and inter-state supply, embraced with elements of supply.
- Familiarized with the concepts of input tax credit, reverse charge mechanism and compensating GST liability.
- The significance of generating E-way Bill and Practiced Tax liability transactions through accounting software.
- Imparted knowledge about service tax, negative list, subsumed terms of GST, skill enhanced through practice on ERP.
- Through training on computerized acquired knowledge of generating and uploading various returns to the GST portal:

Code	Course Title	Course Type	HPW	Credits
DSE-603	ACCOUNTING STANDARDS	DSE-603	5	5

**On successful completion of this course, student should be able to:**

- Deeper incense of accounting theory in imparted
- Knowledge on specific Accounting Standards is accrued.
- Guidance on certain financial statement items is given and practiced.
- Accustomed to the standards relating to business acquisitions and consolidations.
- Acquired knowledge in concepts of financial Reporting through GAAP of various countries, along with recent trends in corporate reporting.

Code	Course Title	Course Type	HPW	Credits
DSE-604	INTERNATIONAL FINANCE	DSE-604	5	5

**On completion of this course, the students will be able to**

- Made understood with the concepts of international Finance and Financial environment.
- Introduced to International Exchange rates, International Liquidity, IMF Solution for Financial Crisis.
- Practiced application of foreign exchange rates through various options.
- Exposed to methods of compilation of Balance of Payments

Code	Course Title	Course Type	HPW	Credits
PR	RESEARCH METHODOLOGY AND PROJECT REPORT	PR	2T+4R	4

**On completion of this course, the students will be able to**

- Students will learn the importance of research and research methodology, as well as to analyze the issues that arise during social science research.
- Learn to identify research problem and plan a research design.
- Knowledge of determining sample size, data sources based on the research problem
- Imparted framing hypothesis and relevant statistical tools to be applied for authentication of the study.

- Skills for writing project report are acquired.

## **B.Com (COMPUTER APPLICATIONS)**

### **Course Outcomes(COs)**

#### **I-YEAR SEMESTER-I**

Code	Course Title	Course Type	HPW	Credits
BC104	FINANCIAL ACCOUNTING –I	DSC-1A	5	5

**Upon successful completion of this course, the student will be able to:**

- Acquire conceptual knowledge of basics of accounting.
- Identify events that need to be recorded in the accounting records
- Develop the skill of recording financial transactions and preparation of reports in accordance with GAAP.
- Describe the role of accounting information and its limitations
- Equip with the knowledge of accounting process and preparation of final accounts of sole trader.
- Identify and analyze the reasons for the difference between cash book and pass book balances.
- Recognize circumstances providing for increased exposure to errors and frauds
- Determine the useful life and value of the depreciable asset.

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Code	Course Title	Course Type	HPW	Credits
BC105	BUSINESS ECONOMICS	DSC-2A	5	5

**Upon successful completion of this course, the student will be able to:**

- Learn economics in terms of business.
- Describe the nature of economics in dealing with the issue of scarcity
- Perform supply and demand analysis to analyze the impact of economic events on Markets.
- Analyze the behavior of consumers in terms of the demand for products
- Evaluate the factors affecting firm behavior, such as production and costs
- Analyze the performance of firms under different market structures,
- Recognize market failure and the role of government in dealing with those failures
- Understand the dynamics of how the markets work
- Use economic analysis to evaluate controversial issues and policies.

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Code	Course Title	Course Type	HPW	Credits
BC106	BUSINESS ORGANISATION	DSC-3A	4	4

**Upon successful completion of this course, the student will be able to:**

- Understand the scope of Business, and its importance.
- Describe the Social Responsibility of Business towards the society
- Explain business ethics as an integral part of every business organization
- Identify different forms of business organizations viz; Sole Proprietorship, Partnership, Joint Hindu Family Business & Co-operative Organizations.
- Understand a Joint Stock Company and various formalities to promote a Company
- Identify the various vital documents of a company
- Learn various sources Industrial Financial resources and the means to raise them
- Understand about the functioning of Stock Exchanges & Mutual funds.

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Code	Course Title	Course Type	HPW	Credits
BC107	INFORMATION TECHNOLOGY	DSC-4A	3T-2P	4

**Upon successful completion of this course, the student will be able to:**

**To understand how organizations identify customers and their wants/needs.**

- Aware of the role of information technology in business.
- Capable of developing web pages for business
- Acquaint with internet as a knowledge management tool
- Capable of developing web pages for business

### **I-YEAR SEMESTER-II**

Code	Course Title	Course Type	HPW	Credits
BC-204	FINANCIAL ACCOUNTING - II	DSC-1B	5	5

**At the end of this course, student should be able to:**

**Appreciate the need for negotiable instruments and procedure of accounting for bills honored and dishonored**

- Differentiate Trade bills from Accommodation Bills
- Understand the concept of Consignment and learn the accounting treatment
- of the various aspects of consignment



- Distinguish Joint Venture and Partnership and to learn the methods of maintaining records under Joint Venture
- Distinguish between Single Entry and Double Entry
- Know the ascertainment of profit under Single Entry system.
- Understand the meaning and features of Non-Profit Organizations
- Learn to prepare Receipts & Payment Account, Income & Expenditure Account and Balance Sheet for Non-Profit Organizations.

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Code	Course Title	Course Type	HPW	Credits
BC-205	MANAGERIAL – ECONOMICS	DSC-2B	5	5

**At the end of this course, student should be able to:**

**In today's dynamic economic environment, effective managerial decision-making requires**

- Timely and efficient use of information.
- The purpose of this course is to provide students with a basic understanding of the Economic theory and analytical tools that can be used in decision-making problems.
- The course will sharpen the analytical skills of the students through integrating their knowledge of the economic theory with decision-making techniques.
- Students will learn to use economic models to isolate the relevant elements of a managerial problem, identify their relationships, and formulate them into a managerial model to which decision-making tools can be applied.
- Use of Graphs is encouraged.

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Code	Course Title	Course Type	HPW	Credits
BC-206	PRINCIPLES OF MANAGEMENT	DSC-3B	4	4

**Upon successful completion of this course, the student will be able to:**

- Understand the importance of Administration & Management.
- Understand the Principles of Management in traditional & modern scientific way.
- Understand the details about Planning and MBO
- Learn about Principles of Organization & various types of Organizations.
- Explain Span of Management.
- Describe Delegation and Decentralization types of delegation.

- Learn about Co-ordination and Control, Principles and techniques
- View management techniques to be adopted to run the Organization
- Effectively by using Principles of Management.

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Code	Course Title	Course Type	HPW	Credits
BC-207	Relational Data Base Management Systems	DSC-4B	3T+2P	4

**Upon successful completion of this course, the student will be able to:**

- Each relation has a unique name by which it is identified in the database.
- Relation does not contain duplicate tuples.
- The tuples of a relation have no specific order.
- All attributes in a relation are atomic, i.e., each cell of a relation contains exactly one value.

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## **II - YEAR SEMESTER-III**

Code	Course Title	Course type	HPW	Credits
BC-304	ADVANCED ACCOUNTING	DSC-1C	5	5

**Upon successful completion of this course, a student will be able to:**

- Prepare financial accounts for partnership firms in different situations of admission, retirement, death and insolvency of the partners.
- Prepare financial statements for partnership firm on dissolution of the firm.
- Employ critical thinking skills to understand the difference between the dissolution of the firm and dissolution of partnership.
- Understand the various types of capital structure of the company and their representation in the balance sheet.
- Evaluate the different situations of capital issue to public like issue at premium, issue at discount, forfeiture of shares etc.
- Demonstrate an understanding about the profits of the company and their division.
- Preparation of financial accounts with profits before incorporation.
- Understand the valuation of shares and goodwill and prepare financial statements accordingly.

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Code	Course Title	Course type	HPW	Credits
BC-305	INCOME TAX-I	DSC-2C	5	5

**Upon successful completion of this course, a student will be able to:**

- Acquire the complete knowledge of basic concepts of income tax
- Understand the concept of exempted incomes.
- Understand the provisions of agricultural income
- Calculate Residential status of a person.
- Identify and comply with the relevant provisions of the Income Tax Act as it relates to the income tax of individuals
- Compute the income under the head “Income from Salary”
- Compute income under the head “Income from House Property”
- Compute income under the head “Income from Business or Profession”

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Code	Course Title	Course Title	HPW	Credits
BC-305	BUSINESS STATISTICS-I	DSC-3C	4	4

**On successful completion of this course, student should be able to:**

- Understand basic statistical concepts such as statistical collection, statistical series, tabular and graphical representation of data
- Calculate measures of central tendency, dispersion and asymmetry, correlation and regression analysis
- Apply knowledge to solve simple tasks using computer
- Independently calculate basic statistical parameters viz- mean, measures of dispersion, correlation coefficient, indexes)
- Based on the acquired knowledge to interpret the meaning of the calculated statistical indicators
  - Choose a statistical method for solving practical problems
  - Highlight statistical relationships between variables in data sets
  - Predict values of strategic variables using regression and correlation analysis.

\*\*\*\*\*

Code	Course Title	Course Type	HPW	Credits
BCC307	PROGRAMMING WITH C	DSC-4C	3T+2P	4

- On completion of this course, the students will be able to
- Procedural Language - Instructions in a C program are executed step by step
- Portable - You can move C programs from one platform to another, and run it without any or minimal changes.
- Speed - C programming is faster than most programming languages like Java, Python, etc.

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## II -YEAR SEMESTER-IV

Code	Course Title	Course type	HPW	Credits
BC-404	CORPORATE ACCOUNTING	DSC-1D	5	5

**Upon successful completion of this course, a student will be able to:**

- Understand the regulatory environment in which the companies are formed and operate
  - Have a solid foundation in accounting and reporting requirements of the Companies Act and relevant Indian Accounting Standards
  - Have a comprehensive understanding of the advanced issues in accounting for assets, liabilities and owner's equity
  - Understand the treatment regarding issue of bonus shares and treatment of prior period profits
  - Account for mergers and amalgamations
  - Value goodwill and shares under various methods
  - Draft Final Accounts for Manufacturing concerns, Banks and Insurance Companies
  - Perform computerized accounting using Tally package.
- .....

Code	Course Title	Course type	HPW	Credits
BC-405	INCOME TAX-II	DSC-2D	5	5

**Upon successful completion of this course, a student will be able to:**

1. Acquire the complete knowledge of the tax evasion, tax avoidance and tax planning.
2. Grasp amendments made from time to time in Finance Act.
3. Compute total income and define tax complications and structure.
4. Prepare and File IT returns of individual at his own.

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Code	Course Title	Course type	HPW	Credits
BC-405	BUSINESS STATISTICS-II	DSC-3D	4	4

**Upon successful completion of this course, a student will be able to:**

- Compute the correlation between two variables and its interpretation.
- Construction of simple linear regression model. Interpretation of regression coefficient and coefficient of determination.

- Fitting of regression line and different types of curves using the method of least squares.
- Identifying various components of time series.
- Different methods for identifying and eliminating these components.
- Concept and construction of index numbers Different types of standard continuous probability distributions and their properties.

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Code	Course Title	Course type	HPW	Credits
BCC407	Objective Oriented Programming with C++	DSC-4D	3T+2P	4

**Upon successful completion of this course, a student will be able to:**

- Comprehend the role of auditor in avoiding the corporate frauds
- Determine the appropriate audit report for a given audit situation
- Apply auditing practices to different types of business entities
- Plan an audit by considering concepts of evidence, risk and material

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### III -YEAR SEMESTER-V

Code	Course Title	Course Type	HPW	Credits
BC-503	COST ACCOUNTING	DSC	4	4

- Enable the students to understand the basic concepts of costs and fundamentals of cost accounting.
- Students are equipped with the preparation of cost sheet Recognize and apply appropriate theories, principles and concepts relevant to cost accounting.
- Exercise appropriate judgment in selecting and presenting information using various methods relevant to cost accounting.

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Code	Course Title	Course Type	HPW	Credits
BC-504	BUSINESS LAW	DSC	4	4

**Upon successful completion of this course, a student will be able to:**

- Understand the legal environment of business and laws of business.
- Highlight the security aspects in the present cyber-crime scenario.
- Apply basic legal knowledge to business transactions.
- Understand the various provisions of Company Law

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Code	Course Title	Course Type	HPW	Credits
BC-505	Banking Theory & Practice	DSC	4	4

**Upon successful completion of this course, a student will be able to:**

- Discuss the impact of Government policy and regulations on the banking industry
- Evaluate the performance of the banking industry
- Discuss bank lending policies and procedures
- Describe how to manage and price bank deposit service

Code	Course Title	Course Type	HPW	Credits
BCC506	Excel Foundation	DSC	4T+2P	4

**Upon successful completion of this course, a student will be able to:**

- Students will be able to apply the application of Mathematics in Telecommunication Engineering
- Solve higher order linear differential equation using appropriate techniques for modelling and analysing electrical circuits.
- Perform vector differentiation and integration, analyze the vector fields and apply to Electro-Magnetic fields.
- Use Vector differentiation and integration required in Electro-Magnetics and Wave theory

Code	Course Title	Course Type	HPW	Credits
BCC506	Computerised Accounting	DSE	4T+2P	5

**Upon successful completion of this course, a student will be able to:**

- Enter entry-level training positions in companies where accounting departments may be specialized or all inclusive;
- Apply select computerized accounting software to analyze and record transactions including general accounting transactions;
- Demonstrate the ability to process accounts payable, accounts receivable, inventory control, and/or payroll;
- Demonstrate an understanding of the federal tax structure as its applies to both individuals and corporations;

- Communicate effectively in a professional accounting workplace environment;
- Demonstrate ethical behavior and confidentiality with financial data;
- Display positive interpersonal skills as a member of a business work team.

Code	Course Title	Course Type	HPW	Credits
BC-505	Web Technology	DSE	4T+2P	5

**Upon successful completion of this course, a student will be able to:**

- Design static web pages using HTML and CSS.
- Develop dynamic web pages using JavaScript.
- Build JDBC programs and server-side scripts using servlets.
- Develop server-side scripts using JSP.
- Apply jQuery methods and events

### **III<sup>rd</sup> Year Semester-VI**

Code	Course Title	Course Type	HPW	Credits
BC-603	Theory and Practice of GST	DSE	3T+2P	4

**Upon successful completion of this course, a student will be able to:**

- Following Central Taxes should be, to begin with, subsumed under the Goods and Services Tax
- Central Excise Duty (CENVAT)· Additional Excise Duties· The Excise Duty levied under the Medicinal and Toiletries Preparations (Excise Duties) Basic Customs Duty: These are protective duties levied at the time of Import of goods into India.
- ·Exports Duty: This duty is imposed at the time of export of certain goods which are not available in India in abundance.
- Road & Passenger Tax: These are in the nature of fees and not in the nature of taxes on goods and services

Code	Course Title	Course Type	HPW	Credits
BC-604	Company Law	DSC	4	4

**Upon successful completion of this course, a student will be able to:**

**Part A:**

Describe in general terms what a business is demonstrate an appreciation of the concept of capital.

## **Part B:**

Identify the main types of business medium demonstrate an understanding of the key characteristics of businesses run as sole traders determine what are the assets and liabilities of a business using numeracy skills.

<b>Code</b>	<b>Course Title</b>	<b>Course Type</b>	<b>HPW</b>	<b>Credits</b>
<b>BC-605</b>	<b>Managerial Accounting</b>	<b>DSC</b>	<b>4</b>	<b>4</b>

**Upon successful completion of this course, a student will be able to:**

- Provides data: It serves as a vital source of data for planning
- The historical data captured by managerial accounting shows the growth of the business, which is useful in forecasting.
- Analyzes data: The accounting data is presented in a meaningful way by calculating ratios and projecting trends.
- Helps in achieving goals: It helps convert organizational strategies and objectives into feasible business goals.
- Uses qualitative information: Management accounting does not restrict itself to quantitative information for decision-making. It takes into account qualitative information which cannot be measured in terms of money.

<b>Code</b>	<b>Course Title</b>	<b>Course Type</b>	<b>HPW</b>	<b>Credits</b>
<b>BC-606</b>	<b>Commerce Lab</b>	<b>DSC</b>	<b>4T+2P</b>	<b>5</b>

**Upon successful completion of this course, a student will be able to:**

### **COMMERCE LAB ACTIVITIES:**

1. Practical orientation to students on matters relating to Banking, Insurance, Taxation, Foreign Trade, Corporate affairs, Stock exchange etc. by the faculty and resource persons
2. Online entry of forms / IT Returns through power point presentation



## **ROLE AND FUNCTIONS OF COMMERCE LAB**

- To provide practical exposure of the process, Procedure and practices followed by the organization in conducting commercial practices/businesses and expose the students with all forms/formats/ formalities.
- To provide practical orientation to students while teaching the subjects according to the syllabus by linking it with the Lab practical.
- List of items used in the day-to-day banking (Forms, Formats, Challans, Vouchers and RBI guidelines)

<b>Code</b>	<b>Course Title</b>	<b>Course Type</b>	<b>HPW</b>	<b>Credits</b>
<b>BCC607</b>	<b>E-Commerce</b>	<b>DSE</b>	<b>4T+2P</b>	<b>5</b>

### **Upon successful completion of this course, a student will be able to:**

- Impart the students with higher level knowledge and understanding of contemporary trends in e-commerce and business finance.
- To provide adequate knowledge and understanding about E-Com practices to the students.
- Learners will be able to recognize features and roles of businessmen, entrepreneur, managers, consultant, which will help learners to possess knowledge and other soft skills and to react aptly when confronted with critical decision making.

<b>Code</b>	<b>Course Title</b>	<b>Course Type</b>	<b>HPW</b>	<b>Credits</b>
<b>BCC608</b>	<b>Management Information systems</b>	<b>DSE</b>	<b>4T+2P</b>	<b>5</b>

### **Upon successful completion of this course, a student will be able to:**

- Students get familiar with office management activities using Information Technology
- Gets proper awareness regarding data base management systems
- To know the practical applications of office packages
- To know the basics of office presentations tool

## **B.Com (BUSINESS ANALYTICS)**

### **Course Outcomes(COs)**

#### **I-YEAR SEMESTER-I**

<b>Code</b>	<b>Course Title</b>	<b>Course Type</b>	<b>HP W</b>	<b>Credits</b>
<b>DSC-101</b>	<b>FINANCIAL ACCOUNTING -I</b>	<b>DSC-101</b>	<b>5</b>	<b>5</b>

**Upon successful completion of this course, the student will be able to:**

- Acquire conceptual knowledge of basics of accounting.
- Identify events that need to be recorded in the accounting records
- Develop the skill of recording financial transactions and preparation of reports in accordance with GAAP.
- Describe the role of accounting information and its limitations
- Equip with the knowledge of accounting process and preparation of final accounts of sole trader
- Identify and analyze the reasons for the difference between cash book and pass book balances.
- Recognize circumstances providing for increased exposure to errors and frauds
- Determine the useful life and value of the depreciable asset.

<b>Code</b>	<b>Course Title</b>	<b>Course Type</b>	<b>HPW</b>	<b>Credits</b>
<b>DSC102</b>	<b>BUSINESS ORGANISATION</b>	<b>DSC-102</b>	<b>5</b>	<b>5</b>

**Upon successful completion of this course, the student will be able to:**

- Understand the scope of Business, and its importance.
- Describe the Social Responsibility of Business towards the society
- Explain business ethics as an integral part of every business organization
- Identify different forms of business organizations viz; Sole Proprietorship, Partnership, Joint Hindu Family Business & Co-operative Organizations.
- Understand a Joint Stock Company and various formalities to promote a Company
- Identify the various vital documents of a company
- Learn various sources Industrial Financial resources and the means to raise them
- Understand about the functioning of Stock Exchanges & Mutual funds.

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<b>Code</b>	<b>Course Title</b>	<b>Course Type</b>	<b>HPW</b>	<b>Credits</b>
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<b>DSC103</b>	<b>DATA-DRIVEN DECISION MAKING</b>	<b>DSC-102</b>	<b>3T+4P</b>	<b>5</b>
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**Upon successful completion of this course, the student will be able to:**

- Identify hurdles to becoming data-driven organization.
- Distinguish how to be proactive data practitioner
- Identify six steps of the data-driven decision-making model.
- Relational data bases -purpose of SQL language
- Statistical tools: learning, and data visualization.
- Identify the stages in the data life cycle.
- Distinguished between the ways data is consumed 3v's of data.
- Distinguished between the stages of the customer journey map.

### **I-YEAR SEMESTER-II**

<b>Code</b>	<b>Course Title</b>	<b>Course Type</b>	<b>HPW</b>	<b>Credits</b>
<b>DSC-201</b>	<b>FINANCIAL ACCOUNTING - II</b>	<b>DSC-201</b>	<b>5</b>	<b>5</b>

**At the end of this course, student should be able to:**

- Appreciate the need for negotiable instruments and procedure of accounting for bills honoured and dishonoured
- Differentiate Trade bills from Accommodation Bills
- Understand the concept of Consignment and learn the accounting treatment of the various aspects of consignment
- Distinguish Joint Venture and Partnership and to learn the methods of maintaining records under Joint Venture
- Distinguish between Single Entry and Double Entry
- Know the ascertainment of profit under Single Entry system.
- Understand the meaning and features of Non-Profit Organizations
- Learn to prepare Receipts & Payment Account, Income & Expenditure Account and balance Sheet for Non-Profit Organizations

<b>Code</b>	<b>Course Title</b>	<b>Course Type</b>	<b>HPW</b>	<b>Credits</b>
<b>DSC-202</b>	<b>BUSINESS LAWS</b>	<b>DSC-202</b>	<b>5</b>	<b>5</b>

**Upon successful completion of this course, a student will be able to:**

- The ability to understand the essentials of contract including offer, acceptance and agreements leading to valid business propositions. Recognize and distinguish modes of discharge of contract with proper application in different forms of business.

- Instructing on the legal rights and obligations under the Sale of Goods Act, along with consumer protection legislation and consumer redressal forums
- Imparting importance of intellectual property rights including acquiring the rights.
- Ability to grasp the required statutory documents prepared for a company and legal procedure for winding up.

Code	Course Title	Course Type	HPW	Credits
DSC-203	DATA ANALYTICS ESSENTIALS	DSC-203	3T+4P	5

**Upon successful completion of this course, a student will be able to:**

- Determine the nature of variables in data analysis.
- Distinguish between nominal and ordinary variables
- Distinguish between continuous and discrete variables.
- Identify the components of central tendency
- Calculation of mean, median, mode
- Basic probabilities: independent and dependent variables.
- Calculate Bayes theorem
- Identify distributions: binomial, Poisson, normal.
- Statistics in R case study
- Use data frames in R
- Use Bayes' theorem in R.

## II -YEAR SEMESTER-III

Code	Course Title	Course type	HPW	Credits
DSC-301	ADVANCED ACCOUNTING	DSC-301	5	5

**Upon successful completion of this course, a student will be able to:**

- Prepare financial accounts for partnership firms in different situations of admission, retirement, death and insolvency of the partners.
- Prepare financial statements for partnership firm on dissolution of the firm.
- Employ critical thinking skills to understand the difference between the dissolution of the firm and dissolution of partnership.
- Understand the various types of capital structure of the company and their representation in the balance sheet.
- Evaluate the different situations of capital issue to public like issue at premium, issue at discount, forfeiture of shares etc.
- Demonstrate an understanding about the profits of the company and their division.
- Preparation of financial accounts with profits before incorporation.
- Understand the valuation of shares and goodwill and prepare financial statements accordingly.

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Code	Course Title	Course Title	HPW	Credits
DSC-302	BUSINESS STATISTICS-I	DSC-302	5	5

On successful completion of this course, student should be able to:

- Understand basic statistical concepts such as statistical collection, statistical series, tabular and graphical representation of data
- Calculate measures of central tendency, dispersion and asymmetry, correlation and regression analysis
- Apply knowledge to solve simple tasks using computer
- Independently calculate basic statistical parameters viz- mean, measures of dispersion, correlation coefficient, indexes)
- Based on the acquired knowledge to interpret the meaning of the calculated statistical indicators
- Choose a statistical method for solving practical problems
- Highlight statistical relationships between variables in data sets • Predict values of strategic variables using regression and correlation analysis.

Code	Course Title	Course Title	HPW	Credits
DSC-303	DATA ANALYTICS MODELLING	DSC-303	3T+4P	5

On successful completion of this course, student should be able to:

- Identify business value- Determine how business and corporate drivers impact the strategic direction of the business - Analyze different project processes used in working with data - Compare different types of data.
- Identify core data profiling tasks, Use tools for data profiling
- Identify core data cleansing tasks - Use tools for cleansing.
- Identify role of data quality in organization
- Use tools for data quality and MDM - ETL Tools: Distinguish between ETL Use Talend Data Integration - Use MSSQL SSIS.
- Identify purpose of data warehousing
- Data Warehousing Tools
- Compare techniques for data integration with regards to warehousing, Use warehousing tools - Use integration tools for warehousing

Code	Course Title	Course Title	HPW	Credits
SEC-2 DEPT SEPCIFIED COURSE	PRINCIPLES OF INSURANCE	SEC-2	2	2

On successful completion of this course, student should be able to:

- Students are exposed to the Insurance Industry, its functioning and the principles regulating. Enlightened with types of insurances, Operating intermediaries and risk management.

- Made aware with the requirements of an insurer as expected by the society (Professionalism, Ethics, Roles and Responsibilities).

## II -YEAR SEMESTER-IV

Code	Course Title	Course type	HPW	Credits
DSC-401	INCOME TAX	DSC-401	5	5

**Upon successful completion of this course, a student will be able to:**

- The conceptual knowledge of Indian Tax Structure, History and Basic concepts are imparted.
- It enables to assess incidence of tax, residential status and computation of tax liability through total Income.
- The applicability of various provisions to compute taxable income under the Head salaries.
- Ability of computing taxable income under the heads Income from House property, Business or Profession, capital gains and Income from other sources.

Code	Course Title	Course type	HPW	Credits
DSC-402	BUSINESS STATISTICS II	DSC-402	5	5

**Upon successful completion of this course, a student will be able to:**

- Knowledge about Linear and Non-Linear Regression Correlation Vs. Regression
- Regression of Y on X - Line of Regression of X on Y
- Uses - Types - Problems in the Construction of Index Numbers - Methods of Constructing Index Numbers - Simple and Weighted Index Number
- Components – Methods-Semi Averages - Moving Averages – Least Square methods.
- Probability – Meaning – Experiment, Event - Mutually Exclusive Events
- Theorems of Probability: Addition – Multiplication - Bayes' Theorem.
- Knowledge about distributions -binomial, Poisson, nominal.

Code	Course Title	Course type	HPW	Credits
DSC-403	FORECASTING AND PREDICTIVE ANALYSIS	DSC-403	3T+4P	5

**Upon successful completion of this course, a student will be able to:**

- Identify linear regression models and their application in data analysis
- Differentiate seasonal variations from trends in order to improve prediction of future values from a model - Calculate seasonal indices so that seasonal variations can be qualified in the model
- Calculate KNN algorithm with fixed or variable number of k and assess the quality of the results - Classification Naïve Bayes: Identify Naïve Bayes classification

- Apply the steps to create a basic decision tree.
- Apply various clustering algorithms to data sets in order to solve common, applicable business problems.
- Identify the goals and constraints of a linear optimization - Calculate a linear optimization in order to solve a business problem. Use data analysis performed on historical data and any applicable theory to construct a model - Use a Monte Carlo analysis with the model in order to generate and assess the likelihood of predictions from the model

Code	Course Title	Course Title	HPW	Credits
SEC-4 DEPT SEPCIFIED COURSE	PRACTISE OF LIFE & GENERAL INSURANCE	SEC-2	2	2

**On successful completion of this course, student should be able to:**

- They can get knowledge about Insurance, Understanding various types of insurance policies, insurers and concept of Underwriting.
- Provide students with the knowledge of calculating premiums along required policy documents. Giving knowledge about settlement of claims risk & underwritings and financial planning including tax planning.
- Different types of reserves of insurance companies—reserving process followed by insurance companies—Insurance accounting.

## **B.B.A. BACHELOR OF BUSINESS ADMINISTRATION**

### **Courses Outcomes (COs)**

#### **SEMESTER- 1**

Course Name	Course Outcome
<b>ENVIRONMENTAL STUDIES</b>	1. Understand the transactional character of the environmental problems and ways of addressing them, including the interaction across local and global scales. 2. Appreciate the ethical, cross-cultural, and historical context of environmental issues and the links between human and natural systems. 3. Understand the importance of sustainable development and modern approaches that enable humans to protect the environment.
<b>PRINCIPLES OF MANAGEMENT</b>	1. Students will be able to have clear understanding of managerial functions. 2. Understand planning process in the organization 3. Learn the principles of Organizing 4. Understand the concept and process of Staffing

	5. Demonstrate the ability to directing, leadership and communicate effectively
<b>BASICS OF MARKETING</b>	<ol style="list-style-type: none"> <li>1. An awareness about the Marketing Concepts and Marketing Environment</li> <li>2. An understanding of the Bases for Market Segmentation</li> <li>3. An ability to formulate Strategies for Developing new Products, Concepts, goods and Services that respond to evolving Market needs.</li> <li>4. A capacity to develop Strategies for the efficient and effective placement distribution of Products, Concepts, goods, and Services that respond to evolving Markets.</li> <li>5. A competence to evaluate the impact of using different Marketing Strategies for a Product, Concept, good and/or service on the (i) Finances, (ii) Return on Investment (ROI), and (iii) the Business goals of an organization.</li> </ol>
<b>BUSINESS ECONOMICS</b>	<ol style="list-style-type: none"> <li>1. Upon the Completion of the course, students will be able to have clear understanding of the concept of the various constituents of environment and their impact on businesses.</li> <li>2. Understand the concept Elasticity of demand.</li> <li>3. To draw ISO quant and ISO cost curves.</li> <li>4. Understand the concept of Budgeting in economics and economies of scale</li> <li>5. Understand Perfect and Imperfect competitions in the market.</li> </ol>



## SEMESTER- 2

<b>Course Name</b>	<b>Course Outcome</b>
<b>BASIC COMPUTER SKILLS</b>	Upon the Completion of the course, students will be able to: 1. Identify basic terms, concepts, and functions of computer system components. 2. Select and use the appropriate software application to complete a particular task such as Word, Processing skills to create, save, modify business documents 3. Identify basic concepts and procedures for creating, viewing, and managing files, and folders for different operating systems. 4. Identify basic concepts of organization and procedures for creating and viewing will software presentation such as PowerPoint.
<b>ORGANISATIONAL BEHAVIOUR</b>	1. Upon the Completion of the course, students will be able to demonstrate the applicability of the concept of organizational behaviour to understand the behaviour of people in the organization. 2. Demonstrate the applicability of analysing the complexities associated with management of individual behaviour in the organization. 3. Analyse the complexities associated with management of the group behaviour in the organization. 4. Demonstrate how the organizational behaviour can integrate in understanding the motivation (why) behind behaviour of people in the organization.
<b>BUSINESS STATISTICS</b>	On completion of this course, the students will be able to: 1. Describe and discuss the key terminology, concepts tools and techniques used in business statistical analysis 2. Critically evaluate the underlying assumptions of analysis tools 3. Understand and critically discuss the issues surrounding sampling and significance 4. Solve a range of problems using the techniques covered 5. Conduct basic statistical analysis of data
<b>FINANCIAL ACCOUNTING</b>	1. Understand the Accounting Process 2. Preparation of Journal, Ledger, Trial Balance and Final Accounts 3. Analyse performance of companies using ratio Analysis 4. Understand the need and importance of Accounting Standards

### SEMESTER- 3

Course Name	Course Outcome
<b>PROFESSIONAL SKILLS</b>	<ol style="list-style-type: none"> <li>1. Develop a planned approach towards career and life</li> <li>2. Gain ability to match skills and interests with a chosen career path</li> <li>3. Develop interview skills and professional etiquette</li> </ol>
<b>BASIC QUALITY MANAGEMENT</b>	<ol style="list-style-type: none"> <li>1. Students get to know about the evolution and importance of quality management.</li> <li>2. Helps the students get aware of various tools used for quality management in the organizations.</li> <li>3. Students will be able to know about the quantitative and qualitative techniques used to measure the effectiveness of quality management tools.</li> <li>4. Students will be able to use the six sigma applications for quality check.</li> <li>5. Students can understand the use of total quality management in various service organizations.</li> </ol>
<b>BUSINESS POLICY AND STRATEGY</b>	<ol style="list-style-type: none"> <li>1. Critically analyze the internal and external environments in which businesses operate and assess their significance for strategic planning.</li> <li>2. Apply understanding for the theories, concepts and tools that support strategic management in organizations.</li> <li>3. Build understanding of the nature and dynamics of strategy formulation and implementation processes at corporate and business level. Enhanced ability to identify strategic issues and design appropriate courses of action.</li> </ol>
<b>HUMAN RESOURCE MANAGEMENT</b>	<ol style="list-style-type: none"> <li>1. Understand theories and practices in the field of Human Resources Management</li> <li>2. Identify different methods of developing Human Resources</li> <li>3. Develop knowledge of industrial laws</li> <li>4. Demonstrate understanding of different appraisal methods,</li> <li>5. Understand organizational culture and climate and its implications for HRM</li> </ol>
<b>INFORMATION TECHNOLOGY FOR BUSINESS</b>	<ol style="list-style-type: none"> <li>1. Demonstrate that they can use a personal computer or mobile device for accessing the internet and use basic computer applications such as e-mail, PowerPoint, Excel and common webpage creation tools.</li> <li>2. Demonstrate that they can apply a variety of information technologies to their own work, demonstrating their competence in researching, creating, and presenting projects using a variety of digital information tools.</li> <li>3. Demonstrate that they can use digital technology in research, analysis, and critical inquiry.</li> <li>4. Demonstrate that they can evaluate and explain the on-going</li> </ol>

	changes in digital technology and their impacts on society.
<b>INFORMATION TECHNOLOGY – LAB</b>	This course gives management students practical experience on working in typical office software like MS-OFFICE.
<b>FINANCIAL MANAGEMENT</b>	<ol style="list-style-type: none"> <li>1. To apply project appraisal methods to cash flows.</li> <li>2. To understand the determinants of capital structure</li> <li>3. To learn about dividend practices of companies</li> <li>4. To calculate working capital requirements of firms</li> </ol>

#### SEMESTER-4

<b>Course Name</b>	<b>Course Outcome</b>
<b>UNIVERSAL HUMAN VALUES</b>	<ol style="list-style-type: none"> <li>1. Student will understand and appreciate human values</li> <li>2. Student will be able to do self- exploration, Self-evaluation and achieve self development</li> <li>3. Apply professional ethics in their future profession &amp; contribute for making a value-based society.</li> </ol>
<b>STARTUP MANAGEMENT</b>	<ol style="list-style-type: none"> <li>1. To identify opportunities for starting business</li> <li>2. To be able to write a business plan</li> <li>3. To take decision regarding form of business ownership</li> <li>4. To conduct feasibility study</li> </ol>
<b>BUSINESS LAW &amp; ETHICS</b>	<ol style="list-style-type: none"> <li>1. Identify the fundamental legal principles behind contractual agreements</li> <li>2. Understand companies act and its implications for employers and employees</li> <li>3. Understand legal obligations of businesses towards customers</li> <li>4. Demonstrate knowledge of negotiable instruments.</li> <li>5. Understand consumer protection laws and their implications</li> </ol>
<b>MARKETING RESEARCH</b>	<ol style="list-style-type: none"> <li>1. Apply a range of Quantitative and/or Qualitative Research Techniques to business and Management problems / issues</li> <li>2. Necessary critical thinking skills in order to evaluate different Research Approaches utilized in the service industries</li> <li>3. Identify the overall Process of designing a Research study from its inception to its Report.</li> <li>4. Define the Meaning of a variable, and to be able to identify independent, dependent, and mediating variables.</li> <li>5. Acquire familiarization with good practices in conducting a Qualitative Interview and observation</li> </ol>
<b>MANAGEMENT</b>	<ol style="list-style-type: none"> <li>1. Helps in formulating real life situations in organizations in Quantitative form.</li> </ol>

<b>SCIENCE</b>	<p>2. Helps in formulating strategies for optimal use of various resources within the organizations.</p> <p>3. Enables the students to understand the managerial applications of transportation problems.</p> <p>4. Students get understanding on the concepts of network fundamentals and resource analysis and allocations.</p>
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### SEMESTER-5

<b>Course Name</b>	<b>Course Outcome</b>
<b>MOBILE COMMERCE</b>	<p>1. Learn the fundamental principles of e-business and e-commerce.</p> <p>2. Understand the impact of information and communication technologies on business.</p> <p>3. Develop an understanding of the tools and services used by virtual e-commerce sites.</p> <p>4. Awareness of the developments in M-Commerce Applications and technology</p>
<b>FINANCIAL MARKETS AND SERVICES (F)</b>	<p>1. Understand what a financial system is and does, and the distinct functions of each component.</p> <p>2. Understand some important financial instruments and the economic principles underlying their use.</p> <p>3. Understand the classification of Leasing.</p> <p>4. Learn about the categories of Merchant Banking and their functions.</p> <p>5. Understand the process of IPO</p>
<b>BRAND MANAGEMENT (M)</b>	<p>1. Demonstrate knowledge of the nature and processes of branding which can attract customers</p> <p>2. Evaluate the scope of brand management activity to deal to customers.</p> <p>3. Appraise the key issues in managing a brand portfolio and making strategic brand decisions for effective marketing mix.</p> <p>4. Formulate and justify brand development decisions for a right</p>

	<p>brand image.</p> <p>5. Analyse contemporary brand related problems and develop appropriate strategies and initiatives to increase the brand equity</p>
<b>ORGANIZATIONAL DEVELOPMENT (HR)</b>	<p>1. The students would gain the conceptual clarity of OD and its process</p> <p>2. The students would learn the concept of planned change in organizations.</p> <p>3. Students gets familiarized on various techniques and interventions of OD</p> <p>4. Learn about the OD consultation process</p> <p>5. Students will be able to use various applications of OD.</p>

<b>Course Name</b>	<b>Course Outcome</b>
<b>ANALYSIS OF INVESTMENT IN FINANCIAL ASSETS (F)</b>	<p>1. To make calculations for Risk Return of Individual Stocks</p> <p>2. To determine the Intrinsic Value of Bonds and also finding the YTM</p> <p>3. To determine the Intrinsic Value of Equity by applying different methods</p> <p>4. To apply the concept of diversification for portfolio valuation</p>
<b>RETAIL MANAGEMENT (M)</b>	<p>1. The student understands the strategies of retailers</p> <p>2. The student is made aware of the practices of merchandise management and store layout of retailers</p> <p>3. Learn the Role and functions of Channels of Distribution are also clearly understood</p> <p>4. To understand the retail management practices in real world</p>
<b>PERFORMANCE APPRAISAL AND COUNSELLING (HR)</b>	<p>1. The students would gain the process of employee performance through HRD</p> <p>2. The students would be familiarized with the dimensions of</p>

	<p>performance appraisal and its effectiveness.</p> <p>3. Students gets familiarized on various techniques performance measurement</p> <p>4. Learn about the performance measurement methods and improvement strategies</p> <p>5. Students will be able know the about the various counselling methods for improving the mental health of employees.</p>
<p><b>INSURANCE SERVICES (F)</b></p>	<p>1.Understand the role and importance of insurance, its types</p> <p>2.Understand the role of IRDA</p> <p>3.Learn about the types of life insurance and general insurance</p> <p>4.Learn about the terms in Policy documents</p> <p>5.Understand the concepts of Assignment and Nomination</p>
<p><b>CUSTOMER RELATIONSHIP MANAGEMENT (M)</b></p>	<p>After studying this Course, the students:</p> <p>1.can work with CRM tools to make positive contribution to the organization.</p> <p>2.can take professional responsibilities and make informed judgments in the organizations</p> <p>towards their target market</p> <p>3. can streamline work processes and improve CRM within the organization.</p> <p>4. will learn skills on the functionalities of campaign management customer support services</p> <p>5. will acquire the skills on effective implementation of CRM practices</p>

Course Name	Course Outcome
<b>COMPENSATION MANAGEMENT (HR)</b>	<ol style="list-style-type: none"> <li>1. Students will be able to explore on compensation system and its dimensions.</li> <li>2. To establish and align pay plans by linking the compensation strategy with HR and Business Strategy</li> <li>3. To use techniques for arriving at optimal compensation system</li> <li>4. To acquire knowledge on administration of employee benefits and services programs.</li> <li>5. To gain insights on Executive Compensation process</li> </ol>

### SEMESTER-6

<b>BUSINESS ANALYTICS</b>	<ol style="list-style-type: none"> <li>1. To understand the Business Analytics in practice</li> <li>2. To understand concepts of Descriptive Analytics</li> <li>3. To learn about Data mining for business</li> <li>4. To understand concepts of Prescriptive Analytics</li> <li>5. To learn about the R environment</li> </ol>
<b>BANKING (F)</b>	<ol style="list-style-type: none"> <li>1. Learn about the sources and uses of Bank funds</li> <li>2. Understand the role and importance of Banking, its types</li> <li>3. Understand the latest innovations in banking system</li> <li>4. Develop an understanding about Banking Regulation</li> <li>5. Understand the process of CRM in Banks</li> </ol>
<b>BUYER BEHAVIOUR (M)</b>	<ol style="list-style-type: none"> <li>1. Identify and explain factors which influence consumer</li> </ol>

	<p>behaviour.</p> <p>2.Demonstrate how knowledge of consumer behaviour can be applied to marketing.</p> <p>3.Display critical thinking and problem-solving skills</p> <p>4.Gain, evaluate and synthesize information and existing knowledge from a number of sources and experiences.</p> <p>5. Be able to identify the dynamics of human behaviour and the basic factors that influence the consumers decision process</p>
<p><b>LEADERSHIP AND CHANGE MANAGEMENT (HR)</b></p>	<p>1. Students will develop critical thinking skills.</p> <p>2. Enhances Leadership and Management skills</p> <p>3. Students will develop an understanding of change processes</p> <p>4. Able to think critically about obstacles to change</p> <p>5. Able to Understand different methods and models in the process for decision making.</p>
<p><b>RISK ANALYSIS AND MANAGEMENT (F)</b></p>	<p>After studying this course, the students will be able to</p> <p>1. Make calculations to find out CaR and Var</p> <p>2. Differentiate between forwards and futures</p> <p>3. Understand the valuation of swaps and hedging mechanism</p>
<p><b>ADVERTISING AND SALES PROMOTION (M)</b></p>	<p>After reading this course student should be able to</p> <p>1. Understand the role of advertising in marketing</p> <p>2. Explore the various elements relating to an effective advertising strategy</p> <p>3. Understand the importance of advertising in the marketing mix</p> <p>4. Establish the importance of creativity in an ad campaign</p> <p>5. Student will be able to understand the importance of Sales Management, Sales</p> <p>6. Planning and Budgeting and need for distribution channels and managing them</p>



<b>TALENT AND KNOWLEDGE MANAGEMENT (HR)</b>	Students will be able to understand <ol style="list-style-type: none"> <li>1. Talent Management Process</li> <li>2. Succession and career planning approaches</li> <li>3. Knowledge management aspects</li> <li>4. Knowledge management assessment and solutions</li> </ol>
<b>INTERNATIONAL FINANCE (F)</b>	Students will be able to understand <ol style="list-style-type: none"> <li>1. International Financial Management</li> <li>2. Balance of Payments</li> <li>3. Foreign Exchange Markets</li> <li>4. Asset and liability Management.</li> </ol>
<b>RURAL MARKETING (M)</b>	Students will be able to understand: <ol style="list-style-type: none"> <li>1. Rural Marketing opportunities</li> <li>2. Rural Economy and Environment</li> <li>3. Social and cultural aspects in rural India</li> <li>4. innovations in rural marketing.</li> </ol>
<b>EMPLOYEE RELATIONS (HR)</b>	Students will be able to understand <ol style="list-style-type: none"> <li>a) Importance of Industrial Relations</li> <li>b) Collective Bargaining Mechanism</li> <li>c) Parties and role in Industrial Relations</li> <li>d) Labour Legislation aspects.</li> </ol>
<b>PROJECT REPORT &amp; Viva-Voce</b>	Student should choose a topic based on his elective chosen in the final year and make a study and prepare a report, which will be evaluated through a viva-voce.

**Mathematics Subject**  
**Course outcomes(COs)**  
**For the Courses B.Sc. (MSCs/MPCs)**

**SEMESTER I**

(I) Course Outcomes for **Differential and integral Calculus**

Upon completion of the course, the student will be able to:

1. Interpret a function from an algebraic, numerical, graphical and verbal perspective and extract information relevant to the phenomenon modelled by the function.
2. Verify the value of the limit of a function at a point using the definition of the limit
3. Calculate the limit of a function at a point numerically and algebraically using appropriate techniques including L Hospital's rule.
4. Find points of discontinuity for functions and classify them.
5. Understand the consequences of the intermediate value theorem for continuous functions
6. Interpret the derivative of a function at a point as the slope of the tangent line and estimate its value from the graph of a function
7. Compute the value of the derivative at a point algebraically using the (limit) definition
8. Be able to show whether a function is differentiable at a point.
9. Compute the expression for the derivative of a composite function using the chain rule of differentiation
10. Differentiate exponential, logarithmic, and trigonometric and inverse trigonometric functions.
11. Obtain expressions for higher order derivatives of a function using the rules of differentiation
12. Compute the critical points of a function on an interval.
13. Identify the extremes of a function on an interval and classify them as minima, maxima or saddles using the first derivative test.
14. Understand the consequences of Rolle's Theorem and the Mean Value theorem for differentiable functions
15. Partial differentiation, functions of two variables, Homogeneous functions, theorems of Total Differentials, Maxima and Minima of functions of two variables.
16. Radius of curvature, Length and derivative of arc, chord of curvature.
17. Properties of Evolutes, Envelopes.
18. Length of Plane Curves, Volumes and Surfaces of revolution.

**SEMESTER II**

(II) Course outcome of **Differential equations**: -

After completion of the course, students will be able to: -

1. Explain the concept of differential equation.
  - 1.1. Classifies the differential equations with respect to their order and linearity.
  - 1.2. Explains the meaning of solution of a differential equation.
  - 1.3. Expresses the existence-uniqueness theorem of differential equations.
2. Will be able to solve first-order ordinary differential equations.
  - 2.1. Solves exact differential equations.

- 2.2. Converts separable and homogeneous equations to exact differential equations by integrating factors.
- 2.3. Solves Bernoulli's differential equations.
3. Will be able to find solution of higher-order linear differential equations.
  - 3.1. Expresses the basic existence theorem for higher-order linear differential equations.
  - 3.2. Solves the homogeneous linear differential equations with constant coefficients.
  - 3.3. Applies the method of undetermined coefficients to solve the non-homogeneous linear differential equations with constant coefficients.
  - 3.4. Uses the method "variations of parameters" to find to solution of higher-order linear differential equations with variable coefficients.
  - 3.5. Solves the Cauchy-Euler equations.
4. Will be able to solve systems of linear differential equations.
  - 4.1. Determines the type of a linear differential equation system.
  - 4.2. Uses the operator method to solve linear systems with constant coefficients
  - 4.3. Solves the linear systems in normal form.
  - 4.4. Solves the homogeneous linear systems with constant coefficients.
5. Will be able to use the Laplace transform in finding the solution of linear differential equations.
  - 5.1. Explains basic properties of Laplace transform.
  - 5.2. Expresses the inverse Laplace transform.
  - 5.3. Finds Laplace transforms solution of linear differential equation with constant coefficients.

### **SEMESTER III**

(III) Course outcome of **Real analysis**: -

**On successful completion of this course, students will be able to**

1. Describe fundamental properties of the real numbers that lead to the formal development of real analysis;
2. Comprehend rigorous arguments developing the theory underpinning real analysis;
3. Demonstrate an understanding of limits and how they are used in sequences, series, differentiation and integration;
4. Construct rigorous mathematical proofs of basic results in real analysis;
5. Appreciate the applications of L'Hospital Rule, Taylors Theorem and The Riemann Integrals.
6. Appreciate how abstract ideas and rigorous methods in mathematical analysis can be applied to important practical problems.

Course out comes of **Logic and Sets (SEC)**

**On completion of this course, the student will be able to**

1. Know basic connectives and truth tables, Logical equivalences, The Use of Quantifiers.
2. Knows about Laws of set Theory, Counting and Venn diagrams, The axioms of probability

#### **SEMESTER IV**

(IV) Course outcome of **Algebra: -**

After successful completion of the course

1. Students will have a working knowledge of important mathematical concepts in abstract algebra such as definition of a group, order of a finite group and order of an element.
2. Recall and use the definitions and properties of dihedral, symmetric and alternating groups
3. Students will be knowledgeable of different types of subgroups such as normal subgroups, cyclic subgroups and understand the structure and characteristics of these subgroups.
4. Students will be introduced to and have knowledge of many mathematical concepts studied in abstract mathematics such as permutation groups, factor groups and Abelian groups.
5. Students will see and understand the connection and transition between previously studied mathematics and more advanced mathematics.
6. The students will actively participate in the transition of important concepts such homomorphisms and isomorphisms from discrete mathematics to advanced abstract mathematics.
7. Students will gain experience and confidence in proving theorems.
8. A blended teaching method will be used requiring the students to prove theorems give the student the experience, knowledge, and confidence to move forward in the study of mathematics.

Course outcome of **vector calculus (SEC)**

On completion of this course, the student will be able to:

1. Understand the basic of surfaces in space.
2. Able to apply the basic concepts of partial derivatives.
3. Understand and able to apply the concepts of vector function, vector field, scalar field, gradient, conservative fields and potentials, divergence and curl.
4. Able to apply the concepts of line integrals, Surface integrals and Volume integral in daily Life.
5. Understand basic concepts of differentiation and integration of complex derivatives.

#### **SEMESTER V**

(V A) Course outcome of **Linear Algebra:** -

Upon successful completion of this course, students will be able to:

1. Use computational techniques and algebraic skills essential for the study of systems of linear equations, matrix algebra, vector spaces, eigenvalues and eigenvectors, orthogonality and diagonalization.
2. Use visualization, spatial reasoning, as well as geometric properties and strategies to model, solve problems, and view solutions, especially in  $R^2$  and  $R^3$ , as well as conceptually extend these results to higher dimensions.
3. Critically analyze and construct mathematical arguments that relate to the study of introductory linear algebra.
4. Use technology, where appropriate, to enhance and facilitate mathematical understanding, as well as an aid in solving problems and presenting solutions.
5. Communicate and understand mathematical statements, ideas and results, both verbally and in writing, with the correct use of mathematical definitions, terminology and symbolism.
6. Work collaboratively with peers and instructors to acquire mathematical understanding and to formulate and solve problems and present solutions.

**SEMESTER VI**

(VI) Course outcome of **Numerical analysis:** -

On completion of this course, the student will be able to:

1. Numerically solve a scalar nonlinear equation
2. Understand basics of finite precision arithmetic, conditioning of problems and stability of numerical algorithms.
3. Solve dense systems of linear equations and least squares problems and have a working knowledge of LU and QR factorizations for these problems.
4. Use condition number and norms to assess accuracy of solutions to linear equations and least squares problems
5. Numerically approximate functions with polynomials
6. Understand and apply appropriate techniques for numerical differentiation and integration
7. Solve initial value problem ordinary differential equations with explicit or implicit methods as appropriate.
8. Derive numerical methods for various mathematical operations and tasks, such as interpolation, differentiation, integration, the solution of linear and nonlinear equations, and the solution of differential equations.
9. Analyze and evaluate the accuracy of common numerical methods.

Course Out Comes of **Mathematical Modelling.**

On completion of this course, the student will be able to

1. Learn how to use the mathematical techniques in solving differential equations.
2. This course is focus on those mathematical techniques that are applicable to models involving differential equations and which describe rate of change.
3. Student realizes some beautiful problems can be modeled by using differential equations.

# STATISTICS SUBJECT OF B.SC (MSCs)

## Course Outcomes(COs)

### SEMESTER-I

**PAPER-I TITLE:** Descriptive Statistics and Probability:

**Upon completion of the course, the student will be able to:**

- Organize, manage and present data.
- Analyze statistical data using measures of central tendency, dispersion and location.
- Analyze statistical data graphically using frequency distributions and cumulative frequency distributions.
- Calculate probabilities, and derive the marginal and conditional distributions of bivariate random variables.
- Derive the probability density function of transformation of random variables.
- Use the basic probability rules, including additive and multiplicative laws, using the terms, independent and mutually exclusive events.
- Translate real-world problems into probability models.
- Analyze Statistical data using MS-Excel for Diagrammatic & Graphical Representation.

### SEMESTER-II

**PAPER- II TITLE:** Probability Distributions:

Upon completion of the course, the student will be able to:

- Use the normal probability distribution including standard normal curve calculations of appropriate areas.
- Use discrete and continuous probability distributions, including requirements, mean and variance, and making decisions.
- Use different distributions to solve simple practical problems.

- Use Poisson, exponential distributions to solve statistical problems.
- Identify the type of statistical situation to which different distributions can be applied.
- Identify the characteristics of different discrete and continuous distributions.
- Analyze statistical data using MS Excel for Discrete & continuous distributions.

### **SEMESTER-III**

#### **PAPER-III TITLE: Statistical Methods:**

Upon completion of the course, the student will be able to:

- Calculate and interpret the correlation between two variables.
- Calculate the simple linear regression equation for a set of data.
- Know the construction of point and interval estimators.
- Know the association between the attributes.
- Evaluate the properties of estimators.
- Employ the principles of linear regression and correlation, including least square method, predicting a particular value of Y for a given value of X and significance of the correlation coefficient.
- Demonstrate understanding of the theory of maximum likelihood estimation.
- Analyze Statistical data using MS-Excel for Correlation's & Regression's.

### **SEMESTER-IV**

#### **PAPER-IV TITLE: Inference**

Upon completion of the course, the student will be able to:

- Describe the concept of estimation of parameters
- Solve the problems related to Testing of Hypotheses, (Large Sample Tests small sample test)
- Explain the concepts of Testing of Hypotheses, (Large Sample Tests small sample test)

- Calculate the problems related to point estimation and interval estimation
- Hypothesize various advanced statistical techniques for modelling and exploring practical situations.
- Analyze Statistical data using MS-Excel for large & small sample tests.

## **SEMESTER-V**

**PAPER-V TITLE:** APPLIED STATISTICS-I:(Design of sample surveys, Time series and Statistical Quality Control)

Upon successful completion of the course, Students will be able to:

- understand the principles underlying sampling as a means of making inferences about a population.
- Will able to analyze data from multi-stage surveys.
- Have an appreciation of the practical issues arising in sampling studies.
- Appreciate the important features that describe a time series, and perform simple analyses and computations on series.
- Informally define and explain terminology used to describe timeseries, including trend, seasonal effects, and cyclical effects.
- Recognize when curve—fitting may be an appropriate method for modelling a series, identifying linear, quadratic, Gompertz and Logistic models where appropriate.
- Describe models for seasonal variation, including additive and multiplicative models.
- Analyze Statistical data using MS-Excel for time series, SQC
- Introduce the principles and techniques of Statistical Quality Control (X bar, SD chart, Range chart) and with respect to attributes (p, np, c charts) and their practical uses in product and/or process design and monitoring.
- Demonstrate the approaches and techniques to assess and improve process and/or product quality
- Use control charts to analyze for improving the process quality.
- Analyze Statistical data using MS-Excel for X bar, SD, Range chart, p, np, c charts.
- Explain critical R programming concepts
- To learn how to install and configure R studio.
- Analyze various statistical techniques like basic descriptive statistics, correlation and regression, control charts
- Generate reports based on the data.

## **SEMESTER-V**

**PAPER-VI TITLE:** Basic Statistics (GE)

- Organize, manage and present data.



- Analyse statistical data graphically using frequency distributions and cumulative frequency distributions.
- Analyse statistical data using measures of central tendency, dispersion and location.
- Calculate and interpret the correlation between two variables.
- Calculate the simple linear regression equation for a set of data.
- Employ the principles of linear regression and correlation, including least square method, predicting a particular value of Y for a given value of X and significance of the correlation coefficient.
- Know the association between the attributes.

## **SEMESTER-VI**

**PAPER-VII TITLE:** Design of Experiments, Vital Statistics, Official Statistics and Index Numbers

**Upon completion of this course the student will be able to:**

- Understand the issues and principles of Design of Experiments (DOE).
- Understand experimentation is a process,
- List the guidelines for designing experiments, and Experiments like CRD, RBD & LSD.
- Recognize the key historical figures in DOE.
- Analyze Statistical data using MS-Excel for CRD, RBD & LSD.
- To learn mortality and morbidity rates
- Concepts of life tables
- Concepts about CSO, NSSO and National Income
- ANOVA techniques using R
- Concepts of Parametric and Non-parametric tests using R

## **SEMESTER-VI**

**PAPER-VIII TITLE:** Operations Research

**Upon completion of this course the student will be able to:**

- **Knowledge and understanding**

- Be able to understand the characteristics of different types of decision-making environments and the appropriate decision-making approaches and tools to be used in each type.

- **Cognitive skills (thinking and analysis)**

- Be able to build and solve Simplex models, Dual simplex, two phase, Big M models.

- Be able to build and solve Transportation Models and Assignment Models.

- **Communication skills (personal and academic).**

- Be able to design new simple models, like: CPM, MSPT to improve decision –making and develop critical thinking and objective analysis of decision problems.

## Computer Science Subject Course Outcomes(COs)

### **Bachelor of Commerce (B.Com) (Year Wise)**

**Course Title: Fundamentals of Information Technology**

**Year: I Year**

**Paper Code: 104(CA, Comp & G), 105(H)**

**Course Code: 401,402,405,407**

**On successful completion of this course students should be able to-**

- Understand the basics of computers and improve their MS-Office skills and knowledge.
- get hands on experience in various aspects of information technology.
- get introduced to the generation of computers, components and classification of computers.
- Various input and output devices and its working principles are learnt. Basic functions like opening, saving and closing a file are being taught. Formatting of documents and mail merge concepts are learnt.
- Creating tables in word, inserting pictures from excel are learnt.
- Understanding the importance of file management, back up of files and folders, renaming of files and folders, basics of PowerPoint are covered. Operations on spreadsheet, creation, tabulation and formatting are learnt.
- learn Mathematical functions and chart creation. Students are introduced to basic networking topologies.
- Surfing of internet, bookmarking, how to create email account and printing web page are learnt.

**Course Title: Fundamentals of C**

**Year: I Year**

**Paper Code: 105(CA, Comp)**

**Course Code: 402,405**

**On successful completion of this course students should be able to-**

- understand the fundamentals of C programming language
- Structure of C programming, data types definition and declaration, operators in C and input and output functions are covered.
- Branching statements, looping statements, nested control structures are covered.
- Different type of functions and procedures and different type of storage classes are covered.
- Defining and declaring arrays, passing values to array, single dimensional and multi-dimensional array concepts are taught.
- To learn about opening and closing a file, writing data to file, declaring and usage of pointer operations are being covered.
- to develop logics which will help them to create programs and applications in C.

**Course Title: Relational Database Management Systems**

**Year: II Year**

**Paper Code: 205(CA, Comp),207(H)**

**Course Code: 402,405,407**

**On successful completion of this course students should be able to-**

- describe data models and schemas in DBMS
- understand the features of database management systems and relational database
- use SQL – the standard language of relational databases and learn the commands of SQL
- understand the functional dependencies and design of a database
- understand the concept of Transaction and Query Processing, database security and recovery

**Course Title: E-Commerce**

**Year: III Year**

**Paper Code: 302(CA, Comp), 307(H)**

**Course Code:402,405,407**

**On successful completion of this course students should be able to-**

- E-Commerce, E-Market, EDI, Business Strategies etc.,
- understand the foundation and importance of ecommerce
- learn the impact of ecommerce on business models and strategies, types of ecommerce
- Understand the infrastructure of ecommerce, various electronic payment systems and mercantile process models.
- Articulate EDI, Applications and the legal and privacy issues in EDI
- Describing internet trading relationships and marketing and advertising techniques as part of market research.

**Course Title: Web Programming**

**Year: III Year**

**Code: 307(CA, Comp)**

**Course Code: 402,405**

**On successful completion of this course students should be able to-**

- learn syntax and semantics of HTML and use HTML tags
- use scripting languages and web services to transfer data and add interactive components to webpages
- design webpages using appropriate security principles, focusing on the vulnerabilities inherent in common web implementations
- Develop dynamic websites using JavaScript techniques, along with HTML and CSS. Window/browser of a particular web page.

**Bachelor of Commerce (B.Com) CBCS System (All Semesters)**

**Course Title: Information Technology**

**Year/Semester: I Year I Semester**

**Course Code: BC-107**

**Course Outcome Code:401, 402, 405 & 407**

**On successful completion of this course students should be able to-**

- Understand the basics of computers and improve their MS-Office skills and knowledge.
- get hands on experience in various aspects of information technology.

- get introduced to the generation of computers, components and classification of computers.
- Various input and output devices and its working principles are learnt. Basic functions like opening, saving and closing a file are being taught. Formatting of documents and mail merge concepts are learnt.
- Creating tables in word, inserting pictures from excel are learnt.
- Understanding the importance of file management, back up of files and folders, renaming of files and folders, basics of PowerPoint are covered. Operations on spreadsheet, creation, tabulation and formatting are learnt.
- Learn Mathematical functions and chart creation. Students are introduced to basic networking topologies.
- Surfing of internet, bookmarking, how to create email account and printing web page are learnt.

**Course Title: Management Information Systems    Year/Semester: I Year II Semester**

**Course Code: BCC-207, BCC-608, BCH-302    Course Outcome Code:402,405 & 407**

**On successful completion of this course students should be able to-**

- Learn the fundamentals of management –the functions and levels of management.
- To learn the management function of planning, its importance, forms and different types like policies, procedures, methods etc. Also, the function of decision making is learnt.
- Function of organizing is taught with focus on organization structure, both formal and informal.
- learn about the types of information systems and how information systems can solve business problems
- Articulate the fundamental principles of Information Systems Analysis and Design
- Better understand the updated business procedures like ERP, SCM, CRM etc.

**Course Title: Programming with C**

**Year/Semester: II Year III Semester**

**Course Code: BCC-307**

**Course Outcome Code:402, 405**

**On successful completion of this course students should be able to-**

- understand the fundamentals of C programming language
- Structure of C programming, data types definition and declaration, operators in C and input and output functions are covered.
- Branching statements, looping statements, nested control structures are covered.
- Different type of functions and procedures and different type of storage classes are covered.
- Defining and declaring arrays, passing values to array, single dimensional and multi-dimensional array concepts are taught.
- To learn about opening and closing a file, writing data to file, declaring and usage of pointer operations are being covered.

to develop logics which will help them to create programs and applications in C.

**Course Title: Programming in C++**

**Year/Semester: II Year IV Semester**

**Course Code: BCC-407**

**Course Outcome Code:402, 405**

**On successful completion of this course students should be able to-**

- Learn the syntax and semantics of C++ programming language

- Learn how C++ improves C with object-oriented features
- Learn to implement constructors and destructors
- Learn constructor overloading and overloading functions
- Learn to design and implement generic classes and templates
- Learn how to use Exception Handling
- Have an overview of basic data structures like Stacks, Queues and Linked Lists.

**Course Title: Excel Foundation**

**Year/Semester: III Year V Semester**

**Course Code: BCC-506**

**Course Outcome Code:402, 405**

**On successful completion of this course students should be able to-**

- Understand the interface, tabs, ribbon, page setup and layout.
- create and edit workbooks, format data and cells
- navigation on a worksheet, auto fill both formulas and lists
- validating a spread sheet and how to preview and print a worksheet.

**Course Title: Relational Database Management Systems (RDBMS)**

**Year/Semester: III Year VI Semester**

**Course Code: BCC-608(a), BCC-207, BCH-202 Course Outcome Code:402, 405 & 407**

**On successful completion of this course students should be able to-**

- describe data models and schemas in DBMS
- understand the features of database management systems and relational database
- use SQL – the standard language of relational databases and learn the commands of SQL
- understand the functional dependencies and design of a database
- understand the concept of Transaction and Query Processing, database security and recovery

**Course Title: E-Commerce**

**Year/Semester: III Year VI Semester**

**Course Code: BCC-607(a), BCC-607**

**Course Outcome Code:402, 405**

**On successful completion of this course students should be able to-**

- E-Commerce, E-Market, EDI, Business Strategies etc.,
- understand the foundation and importance of ecommerce
- learn the impact of ecommerce on business models and strategies, types of ecommerce
- Understand the infrastructure of ecommerce, various electronic payment systems and mercantile process models.
- Articulate EDI, Applications and the legal and privacy issues in EDI
- Describing internet trading relationships and marketing and advertising techniques as part of market research.

**Course Title: Web Technology**

**Year/Semester: III Year VI Semester**

**Course Code: BCC-508(a)**

**Course Outcome Code:402, 405**

**On successful completion of this course students should be able to-**

- learn syntax and semantics of HTML and use HTML tags
- use scripting languages and web services to transfer data and add interactive components to webpages
- design webpages using appropriate security principles, focusing on the vulnerabilities inherent in common web implementations
- Develop dynamic websites using JavaScript techniques, along with HTML and CSS. Window/browser of a particular web page.

**Course Title: E-Commerce and Digital Marketing**

**Year/Semester: II Year III Semester**

**Course Code: BCH-402**

**Course Outcome Code:407**

**On successful completion of this course students should be able to-**

- E-Commerce, E-Market, EDI, Business Strategies etc.,
- understand the foundation and importance of Ecommerce
- learn the impact of Ecommerce on business models and strategies, types of Ecommerce
- Understand the infrastructure of ecommerce, various electronic payment systems and mercantile process models.
- Articulate EDI, Applications and the legal and privacy issues in EDI
- Understand what is social media is, the various channels through which it operates and role in marketing strategy.
- develop social media content. Gain knowledge on marketing to develop effective approaches for propagating ideas, messages, products and behaviours across social networks
- Measure the impact of a social media campaign in terms of a specific marketing objective

## CHEMISTRY SUBJECT FOR COURSE B.Sc. BtMbC

### Course Outcomes (COs)

At the completion of B. Sc. in Chemistry the students can:

After completion of degree, students gained the theoretical as well as practical knowledge of handling chemicals. Also, they expand the knowledge available opportunities related to chemistry in the government services through public service commission particularly in the field of food safety, health inspector, pharmacist etc. Afford a broad foundation in chemistry that stresses scientific reasoning and analytical problem solving with a molecular perspective. Achieve the skills required to succeed in graduate school, professional school, and the chemical

industry like cement industries, agro product, Paint industries, Rubber industries, Petrochemical industries, Food processing industries, Fertilizer industries etc. Got exposures of a breadth of experimental techniques using modern instrumentation. Understand the importance of the elements in the periodic table including their physical and chemical nature and role in the daily life. Understand the concept of chemistry to interrelate and interact to the other subject like mathematics, physics, bio logical science etc. Learn the laboratory skills and safely to transfer and to interpret knowledge entirely in the working environment.

### **SEMESTER I:**

I) **INORGANIC CHEMISTRY** - Chemical bonding and p-block elements.

#### **Course outcomes:**

Upon successful completion students should be able to:

- 1) The above two books are prescribed texts for first two semesters.
- 2) The bonding fundamentals for both ionic and covalent compounds, including electro negativities, bond distances and bond energies using MO diagrams and thermodynamic data.
- 3) Predicting geometries of simple molecules.
- 4) The fundamentals of the chemistry of the main group elements. Students will gain knowledge on p-block elements of Boranes, Carbides, and Nitrides and their preparation, properties, and structures.

II) **ORGANIC CHEMISTRY**- Structural Theory of Organic chemistry, Acyclic Hydrocarbones and Aromatic hydrocabones.

#### **Course outcomes:**

After successful completion of course students able to-

- 1) Understanding of organic reagents and applying in mechanism of reactions.
- 2) Prediction of organic reactions, preparations and their properties of aliphatic and aromatic hydrocarbons.
- 3) Understanding the concept of mechanisms in nucleophilic and electrophilic reactions.

III) **PHYSICAL CHEMISTRY**

#### **Course outcomes:**

- 1) To apply gas laws in various real-life situations.
- 2) To explain the behavior of real and ideal gas.
- 3) To differentiate between gaseous state and vapour.
- 4) To explain the kinetic theory of gases. ∞ Explain the properties of liquids.
- 5) To describe condition required for liquefaction of gases.
- 6) To write the expressions for equilibrium constants.
- 7) To study the laws of equilibrium. To understand various types of colloids and its applications.

8) State and apply the laws of thermodynamics; perform calculations with ideal and real gases; design practical engines by using thermodynamic cycles; predict chemical equilibrium and spontaneity of reactions by using thermodynamic principles.

9) To learn depth knowledge about liquid states, Gaseous state and Liquid state.

#### IV) GENERAL CHEMISTRY - General Principles of Inorganic Qualitative Analysis, Isomerism and Solid-state Chemistry

##### Course outcomes:

After successful completion of course students should be able to-

- 1) Understand the concept of qualitative analysis of identification of radicals in a mixture by systematic method.
- 2) Understand the concept of common ion effect and solubility product.
- 3) Able to understand the concept of definition of isomerism, classification with examples.
- 4) Predict the structures of constitutional and conformational isomers.
- 5) Understand the symmetry of molecules and able to give the structures of solid crystals.

#### LABORATORY COURSE - Semi Micro Analysis of mixtures.

##### Course outcomes:

After completing the lab course-

- 1) Students can be able to get the practical knowledge on to identify the radicals (anions & cations) in the mixture by following systematic procedure.
- 2) Can be able to recognize the formation of gases, precipitations, reactions while doing analysis.

### **SEMESTER II**

I) INORGANIC CHEMISTRY: P-block elements, Chemistry of Zero group elements, Chemistry of d- block elements.

##### Course outcomes:

After completion of the course students can be able to---

- 1) Know the elements of p-block and discuss the oxides and oxyacids of C, O, N & S
- 2) Describe the preparation and properties of oxides & oxyacids and predict their structures.
- 3) Explain the inertness of Zero group elements and identify the structures of Xenon compounds,
- 4) Understand the various characteristic properties of d-block elements.
- 5) Discuss the traits of Titanium, Chromium and Copper.



II) ORGANIC CHEMISTRY: Halogen compounds, Hydroxy compounds and Ethers, Carbonyl compounds.

Course Outcomes:

After studying this, the students will be able to:

- 1) Discuss electrophilic and nucleophilic in aromatic compounds.
- 2) Difference between activating and deactivating groups.
- 3) Correlate the preparation of types of phenol. Explain the mechanism of phenol.
- 4) Understand the mechanisms of SN1 and SN2 reactions.
- 5) Get the knowledge on named reactions and their mechanisms.
- 6) Discuss the preparations and properties of aldehydes and ketones.
- 7) Knowledge on to identify aldehydes and ketones and their industrial applications.

III) PHYSICAL CHEMISTRY: ELECTROCHEMISTRY

Course Outcomes:

- 1) Explain chemical cell and concentration cell (with and without transfer). Derive the expression of liquid junction potential.
- 2) Write down the applications of EMF measurement. Define electrode polarization, decomposition potential and concentration over potential.
- 3) Write down Debye – Huckel theory of electrolytic solution and Bjerrum theory of ion association. Derive Debye – Huckel – Onsager equation.
- 4) Understand the concept of electro motive force of a cell and its measurement.
- 5) Define and determine the transport number.
- 6) Know the applications of EMF measurements. Describe potentiometric titrations.

IV) GENERAL CHEMISTRY: Theory of Quantitative Analysis, Stereoisomerism, Dilute Solutions and Colligative Properties.

Course Outcomes:

After completion of the course students will be able to

- 1) Discuss the methods of quantitative analysis.
- 2) Understand the concept of different types of titrations and theory of indicators.
- 3) Identify the symmetry elements and symmetry operations in molecules
- 4) Explain the criteria for chirality and discuss axial, planar and helical chirality.

- 5) Discuss the Racemization and Resolution. and
- 6) Determine the R, S Configuration for asymmetric and dissymmetric molecules.
- 7) Define Lowering of vapor pressure, Elevation in Boiling point, Depression in Freezing point and Osmotic pressure
- 8) Derive the equations for determination of molecular weight of solute and understand the methods to solve problems.

## LABORATORY COURSE---QUANTITATIVE ANALYSIS

### Course Outcomes:

This course aims to familiarize students with the principles of analytical chemistry and basic analytical techniques to analyze organic compounds including volumetric analysis.

- 1) Experimental practice of quantitative and qualitative analysis. The objective of the titration is the determination of the concentration or the mass of the minimum formula from the titrated chemical material composing a pure liquid or a solution.
- 2) The main objective of volumetric analysis is to determine the amount of a substance in a given sample. When dealing with volumetric analysis the concept of concentration cannot be avoided. Molarity i.e., moles per litre or decimeter is widely used unit of concentration.
- 3) Facilitate the learner to make solutions of various molar concentrations. This may include: The concept of the mole; Converting moles to grams; Converting grams to moles; Defining concentration; Dilution of Solutions; Making different molar concentrations.

## SEMESTER III

1) INORGANIC CHEMISTRY - Chemistry of f-block elements, coordination compounds-I, metal carbonyls and organo chemistry.

### Course Outcomes:

After completion of course, students will be able to:

- 1) Discuss the properties of f-block elements of lanthanides and actinoids.
- 2) Understand the concept of lanthanoid contraction.
- 3) Describe the separation of lanthanoids.
- 4) Understand the nomenclature of coordination compounds and predict their structures.
- 5) Discuss the theories of coordination compounds for octahedral, tetrahedral and square planar complexes.
- 6) Describe the geometrical and optical isomerism of complex compounds.
- 7) Understand the definition classification of organo metallic compounds and predict the structures of metal carbonyls.

II) ORGANIC CHEMISTRY- Carboxylic acids and derivatives, Nitrohydrocabons Amines, Cyanides and Isocyanides.

Course Outcomes:

- 1) Study about the chemistry of Aromatic aldehyde, aromatic ketones and acids.
- 2) Study about the chemistry of aromatic sulphonic acid and Nitro compounds, amines, cyanides and isocyanides.
- 3) Understand the industrial applications of benzene diazonium chloride.

III) PHYSICAL CHEMISTRY- Thermodynamics- I & II

Course Outcomes:

In this course the chemical thermodynamics, will be taught to the students.

- 1) In chemical thermodynamics, the students are expected to learn the thermodynamics terms - closed, open and isolated system, surrounding, energy, heat, internal etc.
- 2) They will also be able to know about the state functions and differentials, relation between  $C_p$  and  $C_v$  calculation of bond energy, thermochemical data etc.
- 3) The students will also learn about the entropy change during various processes, Gibb's free energy, Maxwell's thermodynamics relations, second law and third law of thermodynamics etc.

IV) GENERAL CHEMISTRY- Evaluation of analytical data, Carbanions-I and Phase rule.

Course Outcomes:

- 1) Understand the definitions of significant figures, accuracy, and precision.
- 2) Discuss the different types of errors.
- 3) Know the mechanisms of named reactions involved carbanion.
- 4) Discuss the terminology in phase rule and different types of one component and two component systems with examples.

LABORATORY COURSE: Organic Synthesis

Course Outcomes:

- 1) Students will be able to get the experience of preparing organic compounds using laboratory metods.

**SEMESTER IV**

I) INORGANIC CHEMISTRY:

Course Outcomes:

1. Understanding the postulates of crystal field theory.
2. Discuss the d- orbital splitting pattern in different geometrics like octahedral, tetrahedral and square planar complexes.
3. Calculate magnetic moment and crystal field stabilization energy of metal complexes.

4. Explain high spin and low spin complexes and formation metal complexes in solution
5. Discuss HSAB rule and its applications regarding the stability of metal complexes.
6. Determine stability constant of particular complex through PH metry, conductivity method etc
7. Understanding the concept of Job`S method to determine the composition of of complex.
8. Discuss the biological significance of Na,K,Ca,Fe,Cu &Zn and toxicity of Ar,Hg & Pb.

## II.ORGANIC CHEMISTRY

### Course Outcomes:

- 1) Explain the nomenclature, aromatic nature, synthesis, and reactivity of hetero cyclic compounds.
- 2) Explain the classification of carbohydrates.
- 3) Discuss the open chain structure of glucose and fructose.
- 4) Explain the classification of amino acids and give their structures.
- 5) Discuss the preparation and properties of Amino acids.
- 6) Describe the primary structure of proteins.

## III) PHYSICAL CHEMISTRY:

### Course Outcomes:

- 1) Understand the definitions of rate of the reactions, order, and molecularity.
- 2) Discuss the Factors influencing the rate of the reaction.
- 3) Give the derivation for the rate constant for zero, first and second order reactions.
- 4) Identify the differences between thermal and photochemical reactions.
- 5) Understand the Laws of Photochemistry.
- 6) Describe quantum yield and the method of its determination.
- 7) Explain abnormal quantum yield of formation of HCl and HBr.
- 8) Discuss the concepts of fluorescence and phosphorescence
- 9) Explain Zablonski diagram.

## IV) GENERAL CHEMISTRY-

### Course Outcomes:

- 1) Explain Theories of metallic bond like VBT, free electron theory and band theory.
- 2) Explanation of metallic properties.

- 3) Discuss the band theory of metals, insulators, and Semi-Conductors. Define n-type and p-type semi-conductors.
- 4) Understand the mechanism of acid hydrolysis and ketonic hydrolysis of active methylene compounds.
- 5) Discuss the classification of collides and their physical properties.
- 6) Explain the adsorption phenomenon and factors influencing adsorption.

#### LABORATORY COURSE- Qualitative analysis of organic compounds

##### Course Outcomes:

- 1) Students can be able to identify the functional group analysis, aromatic or aliphatic and determination of physical constants of different organic compounds.

#### SEMESTER V (Paper V) – Molecular spectroscopy and separation techniques:

##### Course Outcomes:

- 1) Explain the instrumentation, types of currents and applications of DC polarography in qualitative and quantitative analysis.
- 2) Give a brief account of (i) A.C. Polarography (ii) Square-wave polarography (iii) Pulse polarography (iv) differential pulse polarography and discuss their advantages over conventional D.C. Polarography.
- 3) Discuss the principle, instrumentation, types, and applications of amperometric titrations and Cyclic Voltammetry.
- 4) Give a brief account of the different types of thermo analytical methods.
- 5) Discuss the principles and applications of thermogravimetry, differential thermal analysis and Differential scanning calorimetry.
- 6) Discuss the principles, chemical shifts, coupling constants, and application of  $^1\text{H}$ ,  $^{19}\text{F}$ ,  $^{31}\text{P}$  and solid-state NMR spectroscopy.
- 7) Discuss the Principles and instrumentation of different types of mass spectrometer
- 8) Outline Salient features of fragmentation pattern of organic compounds
- 9) Discuss the Principle and Instrumentation of Photoelectron Spectroscopy, Interpretation of Vibrational spectral data for ionized ( $\text{M}^+$ ) species.
- 10) Discuss principle, instrumentation of Electron Spin Resonance spectroscopy and its applications.
- 11) Explain the principles of Rotational spectroscopy and calculate bond lengths and atomic mass from rotational spectra of diatomic molecules, Isotope effect on rotational spectra
- 12) Explain the principles of Vibrational spectroscopy, a harmonic nature of vibrations, Stereo chemical effects on the absorption pattern and Isotope effect on vibrational spectra
- 13) Explain the principles of Ultraviolet/Visible Spectroscopy

#### LABORATORY COURSE- Experiments in Physical Chemistry.

### Course Outcomes:

- 1) After completion of lab course students will be able to determine the molecular status and partition coefficient of immiscible liquids.
- 2) Can verify the Ostwald's dilution law, Beer's law by instrumentation methods.
- 3) Determine the cell constant of a conductivity cell and verification of Freundlich adsorption isotherm.
- 4) Understand the concept of surface tension and viscosity of liquids.

### **SEMESTER VI (paper VI)- Agriculture and Fuel Chemistry:**

#### Course Outcomes:

- 1) Understand basic concepts (including history of, resources needed, and the future of) production agriculture.
- 2) Describe important historical developments in production agriculture.
- 3) Understand factors influencing food security.
- 4) Describe the differences between macro and micro nutrients, calories, cholesterol, carbohydrates, proteins, vitamins, and minerals.
- 5) Students acquire the basic knowledge of inorganic, analytical, organic and biochemistry.
- 6) Student can understand the molecular mechanisms that regulate the activity of Agro ecosystem function
- 7) Accumulate skills for scientific research work and agricultural works in the future.
- 8) Demonstrate a comprehensive understanding of the fundamental principles and multidisciplinary concepts in the field of agriculture.
- 9) Demonstrate skills in laboratory techniques and field work relevant to agriculture as well as the use of the instrumentation for analysis.
- 10) Discuss the pesticides, bio pesticides, fertilizers, and bio fertilizers.
- 11) Describe the renewable and non-renewable energy sources.
- 12) Explain the petroleum and its products and lubricants.

### **LABORATORY COURSE- Experiments in physical chemistry**

#### Course Outcomes:

- 1) Students can determine the rate constant of first order reactions.
- 2) determine the redox potentials of  $\text{Fe}^{+2}/\text{Fe}^{+3}$  by potentiometric titrations.
- 3) Determine the strength of acid by PH metry and conductometry.

# **BIOTECHNOLOGY SUBJECT FOR COURSE B.Sc. BtMbC**

## **Course Outcomes (COs)**

### **SEMESTER – 1**

<b>PROGRAM</b>	<b>COURSE CODE</b>	<b>COURSE TITLE</b>	<b>HPW</b>	<b>CREDITS</b>	<b>COURSE TYPE</b>
B.Sc	BS104	Cell Biology and Genetics	4+3	5	DSC-1A

### **COURSE OUTCOME**

- The student will learn fundamental concepts on the structure of different types of cells, namely, bacteria, fungi, plant and animal cells, and their mechanisms of cell division, senescence, and death.
- Students will get a very good understanding of the principles of genetics, with several examples on genomic and cytoplasmic inheritances.
- The genomic inheritance includes Mendelian and non-Mendelian inheritances, the phenomenon of co-dominance, incomplete dominance, the existence of multiple alleles for a gene in a population, Hardy-Weinberg equilibrium, non-allelic interactions, pleiotropism, and phenocopy. Further, Students will learn the concepts of Linkage, recombination, and gene mapping.
- The cytoplasmic inheritance includes mitochondrial inheritance, chloroplast inheritance, and on the importance of cytoplasmic proteins in developmental fates.

## SEMESTER – II

PROGRAM	COURSE CODE	COURSE TITLE	HPW	CREDITS	COURSE TYPE
B.Sc	BS204	Biological Chemistry and Microbiology	4+3	5	DSc-1B

### COURSE OUTCOME

With this course, students will get the following deliverables.

- Fundamental knowledge on the different kinds of biomolecules (Carbohydrates, Proteins, Lipids, and Nucleic acids), the existence of different isoforms of each kind, their structures and their importance in living cells. Practical knowledge of tests and estimations of sugars, lipids, amino acids, and proteins, chromatographic technique for separation of small molecules.
- Importance of Enzymes, their classification, nomenclature. Concepts of enzyme kinetics, enzyme inhibition and role of co-factors in enzyme activity.
- Pathways of metabolism: Glycolysis, TCA cycle, electron transport, and oxidative phosphorylation, Gluconeogenesis, Glyoxylate cycle, amino-acid and fatty acid degradation pathways,
- Historical developments in microbiology, structure and characteristics of bacteria, virus, micro-algae, and fungi. Methods of sterilization, Bacterial nutrition, methods of cultures, and factors affecting bacterial growth. Practical knowledge on preparations of various kinds of solutions and buffers, microbial media, methods of growing and isolating bacteria, fungi, and micro-algae.
- Fundamental knowledge on Microscopy: Bright field microscopy, Dark field microscopy, Phase contrast microscopy, Fluorescent microscopy, Scanning and Transmission electron microscopy



### SEMESTER – III

PROGRAM	COURSE CODE	COURSE TITLE	HPW	CREDITS	COURSE TYPE
B.Sc	BS305	Molecular Biology and Recombinant DNA Technology	4+3	5	DSC-1C

#### COURSE OUTCOME

With this course, students will get the following deliverables.

- Fundamental concepts on DNA as the genetic material with historical background, organization of the genomes of prokaryote, eukaryote, mitochondria, and chloroplast; mechanisms of DNA replication, and types of genetic mutations.
- Historical account on discovery of genetic code, properties, and wobble hypothesis. Structures of prokaryotic and eukaryotic genes, mechanisms of transcription and translation with the role of different components of transcription and translational machinery. Mechanisms in post-transcriptional and post-translational mechanism.
- Fundamental concepts on recombinant DNA technology, which includes: various enzymes and their uses; various kinds of cloning vectors, and their uses specifically vectors for library preparations, gene transfer techniques, and applications of recombinant DNA technology.
- Practical exposure on molecular biology techniques like genomic DNA isolation, plasmid DNA isolation, quality and quantity determinations of DNA samples based on agarose gel electrophoresis and UV spectrophotometry, bacterial transformation, restriction digestion of DNA, and PCR.

## SEMESTER – IV

PROGRAM	COURSE CODE	COURSE TITLE	HPW	CREDITS	COURSE TYPE
B.Sc	BS405	Bioinformatics and Biostatistics	4+3	5	DSC-1D

### COURSE OUTCOME

This course aims to introduce to students, the basics of Bioinformatics and Biostatistics. With this course, students will get the following deliverables.

- Historical account on Bioinformatics, introduction to and exploration of bioinformatics web portals NCBI, EBI, ExPasy; and introduction to and exploration of primary (Genbank), secondary (PIR), and composite databases (KEGG).
- Comparison of DNA and protein sequences by pairwise and multiple alignment methods; sequence similarity searches based on BLAST and FASTA; Introduction to the concepts of phylogeny with emphasis on distance based and character-based methods.
- Introduction to various kinds of data, and their graphical representation; sampling methods, sampling errors, measures of central tendency and dispersion, concepts of probability and probability distributions, hypothesis testing methods: t-test, Z-test, chi-square test, ANOVA, and tests of correlation.

## SEMESTER – V [PAPER – 5]

PROGRAM	COURSE CODE	COURSE TITLE	HPW	CREDITS	COURSE TYPE
B.Sc	BS504	Optional 1A – Plant Biotechnology	4+3	5	DSC-1E

## **COURSE OUTCOME**

- This course aims to introduce to students on fundamentals of plant tissue culture, applications of plant tissue culture, production of transgenics, and examples of transgenics developed to address various challenges. Students will get the following deliverables.
- Fundamentals of plant tissue culture that is the kind of plant tissue suitable for culture, nutritional requirements for development of a tissue into a plant with root and shoot system, with emphasis on macronutrient and micronutrients, growth factors, substrate, environment required, and sterilization methods.
- Plant biotechnology applications like, production of synthetic seeds, development of somatic hybrids and cybrids, production of haploid plants, and on cryopreservation methods.
- Concepts on Methods of production of transgenics like micro-injection, gene gun, electroporation, chemical methods, Ti plasmid, viral vectors, latest techniques like CRISPR-CAS9, and on the identification of transgenics based on reporter and selection marker genes.
- Transgenics developed for insect resistance, herbicide resistance, resistant to pathogenic forms of bacteria fungi, virus; resistance to drought, heat, salinity; transgenics with enhanced nutritional value that is having a higher content of vitamins, specific oils, and amino acids; and transgenics producing anti-bodies, and vaccines.
- Practical exposure on preparation of media, sterilization and inoculation, establishment of callus culture, meristem culture, cell suspension culture, protoplast isolation and culture, agrobacterium mediated transformation, and production of synthetic seeds,

## SEMESTER – V [PAPER -6]

PROGRAM	COURSE CODE	COURSE TITLE	HPW	CREDITS	COURSE TYPE
B.Sc	BS604	Optional II-B : Environmental Biotechnology	4+3	5	DSE-1F

### COURSE OUTCOME

- This course aims to introduce to students the environment, the cascades and consequences of the exploitation of the environmental resources, development of technology for restoration of the environment and for the sustenance of life. Students will get the following deliverables.
- Unit one discusses on the kinds of pollution, sources of pollution, types of pollutants that is their molecular nature, and the varied consequences of pollution.
- Unit two discusses biomass and biofuels that is the conventional sources of fuel, and the emerging technologies for sustainable fuel sources.
- Unit three discusses the kinds of chemical fertilizers, and pesticides, their impact on environment; the concept of bio fertilizers, and bio pesticides, types and their uses.
- Unit four discusses on agricultural, sweage, and industrial pollutants, the concepts of bioremediation, with detail on insitu, exsitu methods, use of various kinds of microbes and plants in bioremediation for removal / treatment of toxic accumulations and recycling of the organic wastes by methods like organic composting.
- Practical training on estimation of BOD, COD, Coliform test, production of biogas, production of biofertilizer, isolation, identification and characterization of microbes for biodegradation.

## SEMESTER – VI [PAPER – 7]

PROGRAM	COURSE CODE	COURSE TITLE	HPW	CREDITS	COURSE TYPE
B.Sc	BS601	Optional 1: IPR, Biosafety, and Entrepreneurship	4	4	Opt-P

### COURSE OUTCOME

- This course is designed to introduce to the students, on the intellectual property rights, Laboratory management and safety, and on Entrepreneurship. Students will get the following deliverables
- Unit one defines intellectual property, significance and need for the protection of intellectual property; different kinds of intellectual properties and their protection by copy right, trade mark, patent, etc.
- Unit two details on the concept of patent, historical overview on patent law, kinds of patents, procedures for obtaining patent in India and other countries, patentability of life forms and their products.
- Unit three details on laboratory administration, laboratory design and laboratory information management system; good laboratory practices; handling procedures, storage and disposal of hazardous compounds; principles of quality control and quality assurance.
- Unit Four details on concept, structure and theories, and types of entrepreneurships; Entrepreneurial development, and leadership; search for business idea, product planning and development, the concept of project, project identification and management; Bio-entrepreneurship.

# MICROBIOLOGY SUBJECT OF B.Sc. BtMbC

## COURSE OUTCOMES (COs)

<b>SEMESTER I:MBP 101 BASIC MICROBIOLOGY (THEORY)</b>	<ul style="list-style-type: none"><li>➤ To learn scope and applications of Microbiology in various fields.</li><li>➤ To learn theory in microscopy and their handling techniques</li><li>➤ To learn the principle of various specialized microscopes like Dark field microscope, Phase contrast microscope, Fluorescent microscope, Electron microscope etc.</li><li>➤ To study Photomicrography.</li><li>➤ To learn staining procedures like Grams staining, Endospore staining, Cell wall staining etc</li><li>➤ Know various physical and chemical means of sterilization</li><li>➤ To study Antibiotics and chemotherapeutic agents.</li></ul>
<b>MBP 102 BASIC MICROBIOLOGY (PRACTICAL)</b>	<ul style="list-style-type: none"><li>➤ To understand safety measures in laboratory</li><li>➤ To get acquainted with the instruments used in microbiology laboratory</li><li>➤ Master aseptic techniques and be able to perform routine culture handling tasks safely and effectively</li><li>➤ Demonstrate practical skills in microscopy and their handling techniques and staining procedures like Grams staining, Endospore staining, Cell wall staining etc</li></ul>

<p><b>SEMESTER II: MBP 201 MICROBIAL TAXONOMY AND CULTURE TECHNIQUES (THEORY)</b></p>	<ul style="list-style-type: none"> <li>➤ Understand the basic microbial structure and function and study the comparative characteristics of prokaryotes and eukaryotes</li> <li>➤ Understand the structural similarities and differences among various physiological groups of bacteria/archaea</li> <li>➤ Know various Culture media and their applications</li> <li>➤ Know General bacteriology and microbial techniques for isolation of pure cultures of bacteria, and fungi</li> <li>➤ Understand the viral classification, structure, reproduction and significance of viruses</li> <li>➤ Know the methods used in studying viruses.</li> <li>➤ To study Properties, classification, reproduction and significance of major groups of fungi.</li> <li>➤ To learn the nutritional requirements, growth, multiplication and cultivation of bacteria.</li> </ul>
<p><b>MBP 202 MICROBIAL TAXONOMY AND CULTURE TECHNIQUES (PRACTICAL)</b></p>	<ul style="list-style-type: none"> <li>➤ To learn preparation of media and culture techniques.</li> <li>➤ To perform isolation and identification of Bacteria and Fungi from various sources like water and soil.</li> <li>➤ To learn dark field microscopy and observation of live bacterial motility by hanging drop method.</li> <li>➤ To learn Haemocytometry and Micrometry.</li> <li>➤ To study Fungal, protozoal and Cyanobacterial forms.</li> </ul>
<p><b>SEMESTER III: MBP 301 MICROBIAL PHYSIOLOGY AND MICROBIAL GENETICS (THEORY)</b></p>	<ul style="list-style-type: none"> <li>➤ Understanding the laws of thermodynamics, concepts of entropy, enthalpy and free energy changes and their application to biological systems.</li> <li>➤ Conceptual knowledge of aerobic and anaerobic respiration and various intermediary mechanisms involved oxidative phosphorylation.</li> <li>➤ Overview of major biomolecules –carbohydrates, lipids, proteins, amino acids, nucleic acids, classification, structure, function of the above-mentioned biomolecules</li> <li>➤ Discuss the biosynthesis and the degradation pathways involved.</li> <li>➤ Conceptual knowledge of properties, structure, function of enzymes, enzyme kinetics and their regulation.</li> <li>➤ Know the terms and terminologies related to molecular biology and microbial</li> <li>➤ Understand the properties, structure and function of genes in living organisms at the molecular level</li> <li>➤ Have a conceptual knowledge about DNA as a genetic material, enzymology, and replication strategies</li> <li>➤ Discuss the molecular mechanisms underlying mutations, detection of mutations and DNA damage</li> </ul>

	<p>and repair mechanisms</p> <ul style="list-style-type: none"> <li>➤ Explain the concept of recombination- Transformation, Transduction and Conjugation.</li> <li>➤ To understand the concept of transposition</li> </ul>
<p><b>SEMESTER III: MBP 302 MICROBIAL PHYSIOLOGY AND MICROBIAL GENETICS (PRACTICAL)</b></p>	<ul style="list-style-type: none"> <li>➤ To perform various biochemical tests for the identification and classification of microorganisms.</li> <li>➤ To learn the growth curve patterns both in fungal and bacterial category.</li> <li>➤ To perform the quantification of Sugar and Protein in unknown samples.</li> <li>➤ To learn the effect of pH and temperature on various bacterial forms.</li> <li>➤ To understand Genetic recombination in bacteria.</li> </ul>
<p><b>SEMESTER IV: MBP 401 MOLECULAR BIOLOGY AND RECOMBINANT DNA TECHNOLOGY (THEORY)</b></p>	<ul style="list-style-type: none"> <li>➤ Explain the significance of central dogma of gene action</li> <li>➤ Understand the molecular mechanisms involved in transcription and translation</li> <li>➤ Describe the importance of genetic code and wobble hypothesis</li> <li>➤ Handle and independently work on lab protocols involving molecular techniques</li> <li>➤ To study various tools, gene cloning vectors in rDNA technology</li> <li>➤ To know invitro construction of rDNA molecule and Transformation into target cells.</li> <li>➤ To understand application of genetic engineering In various fields</li> </ul>
<p><b>SEMESTER IV: MBP 402 MOLECULAR BIOLOGY AND RECOMBINANT DNA TECHNOLOGY (PRACTICAL)</b></p>	<ul style="list-style-type: none"> <li>➤ To learn preparation of Phosphate and Citrate buffers.</li> <li>➤ To learn estimation of DNA and RNA in unknown samples.</li> <li>➤ To learn antibiotic sensitivity and antibiotic resistance.</li> <li>➤ To learn basic techniques in genetic engineering and recombinant DNA technology like In vitro ligation, Restriction digestion and Plasmid isolation.</li> </ul>
<p><b>SEMESTER V: PAPER 5: MBP 501 AGRICULTURAL AND ENVIRONMENTAL MICROBIOLOGY (THEORY)</b></p>	<ul style="list-style-type: none"> <li>➤ Appreciate the diversity of microorganism and microbial communities inhabiting a multitude of habitats and occupying a wide range of ecological habitats.</li> <li>➤ Learn the occurrence, abundance and distribution of microorganism in the environment and their role in the environment and also learn different methods for their detection and characterization</li> <li>➤ Competently explain various aspects of environmental microbiology and microbial ecology and to become familiar with current research in environmental microbiology.</li> <li>➤ Understand various biogeochemical cycles – Carbon,</li> </ul>



	<p>Nitrogen, Phosphorus cycles etc. and microbes involved.</p> <ul style="list-style-type: none"> <li>➤ To understand mechanism of nitrogen fixation by both symbiotic and non symbiotic bacteria.</li> <li>➤ Understand various plant microbes interactions especially rhizosphere, phyllosphere and mycorrhizae and their applications especially the biofertilizers and their production techniques.</li> <li>➤ Understand the basic principles of environment microbiology and be able to apply these principles to understanding and solving environmental problems – waste water treatment and bioremediation</li> <li>➤ Know the Microorganisms responsible for water pollution especially Water-borne pathogenic microorganisms and their transmission.</li> <li>➤ Comprehend the various methods to determine the sanitary quality of water and sewage treatment methods employed in waste water treatment.</li> <li>➤ To study various techniques for trapping air borne microbes.</li> <li>➤ To learn about various important plant pathogens- Bacterial, Viral, Fungal and Mycoplasma diseases.</li> </ul>
<p><b>SEMESTER V: PAPER 5: MBP 502 AGRICULTURAL AND ENVIRONMENTAL MICROBIOLOGY (PRACTICAL)</b></p>	<ul style="list-style-type: none"> <li>➤ Isolation, identification and enumeration of Bacteria and Fungi from Rhizosphere soil.</li> <li>➤ Study of Rhizobium from nodules.</li> <li>➤ Isolation and identification of various forms of Actinomycetes.</li> <li>➤ Study of Antagonism and plant pathogens.</li> <li>➤ Study of air borne micro-organisms.</li> <li>➤ Determination of water quality by coliform test and BOD test.</li> <li>➤ Study of soil fungal forms.</li> </ul>
<p><b>SEMESTER V: PAPER 6: MBP 503 FOOD AND DAIRY MICROBIOLOGY (THEORY)</b></p>	<ul style="list-style-type: none"> <li>➤ Understand the beneficial role of microorganisms in fermented foods and in food processing and the microbiology of different types of fermented dairy products</li> <li>➤ Understand the significance and activities of microorganisms in food and role of intrinsic and extrinsic factors on growth and survival of microorganisms in foods.</li> <li>➤ Know the spoilage mechanisms in foods and thus identify methods to control deterioration and spoilage</li> <li>➤ Recognize and describe the characteristics of important pathogens and spoilage microorganisms in foods.</li> <li>➤ Learn various methods for their isolation, detection and identification of microorganisms in food and employ in industries</li> </ul>

	<ul style="list-style-type: none"> <li>➤ Identify ways to control microorganisms in foods and thus know the principles involving various methods of food preservation</li> <li>➤ Understand of the basis of food safety regulations</li> <li>➤ Study of microbes as Food- Single cell protein and Single cell oil.</li> <li>➤ To study various microflora in milk, sources of microbial contamination of milk.</li> <li>➤ Microbial analysis and preservation of milk and its products</li> </ul>
<p><b>SEMESTER V: PAPER 6: MBP 504 FOOD AND DAIRY MICROBIOLOGY (PRACTICAL)</b></p>	<ul style="list-style-type: none"> <li>➤ Isolation and identification of micro-organisms infected fruits, vegetables, curd, and idly batter.</li> <li>➤ Bacterial examination of milk by DMC, SPC and MBRT.</li> <li>➤ Estimation of fat and lactose from given milk samples.</li> <li>➤ Production and detection of Aflatoxins.</li> <li>➤ Study of plant pathogens.</li> <li>➤ Production of yoghurt.</li> </ul>
<p><b>SEMESTER VI: MBP 601 PAPER 7: IMMUNOLOGY AND MEDICAL MICROBIOLOGY (THEORY)</b></p>	<ul style="list-style-type: none"> <li>➤ This course provides learning opportunities in the basic principles of medical microbiology and infectious disease.</li> <li>➤ It covers the role of the human body's normal microflora.</li> <li>➤ The course provides the conceptual basis for understanding pathogenic microorganisms and the mechanisms by which they cause disease in the human body.</li> <li>➤ It also provides opportunities to develop informatics and diagnostic skills, including the use and interpretation of laboratory tests in the diagnosis of infectious diseases.</li> <li>➤ Explain the methods of microorganisms control, e.g. chemotherapy &amp; vaccines. Solve problems in the context of this understanding.</li> <li>➤ To understand types of immunity, cells and organs involved in immune system and various immune responses.</li> <li>➤ To have the basic knowledge of Antigens, Antibodies and Antigen antibody responses.</li> <li>➤ To study various Bacterial, Viral, Protozoan and Fungal diseases.</li> </ul>
<p><b>SEMESTER VI: MBP 602 PAPER 7: IMMUNOLOGY AND MEDICAL MICROBIOLOGY (PRACTICAL)</b></p>	<ul style="list-style-type: none"> <li>➤ To Isolate and identification of normal microflora using various culture media.</li> <li>➤ To learn Analysis of urine – Estimation of urine sugar and urine protein.</li> <li>➤ To understand Blood grouping and differential counting of WBC.</li> <li>➤ To learn Various diagnostic tests like ODD, RID,</li> </ul>

	<p>VDRL, WIDAL and Dot ELISA.</p> <ul style="list-style-type: none"> <li>➤ Study of pathogens</li> </ul>
<p><b>SEMESTER VI: PAPER 8: MBP 603 INDUSTRIAL MICROBIOLOGY AND MICROBIAL TECHNOLOGY (THEORY)</b></p>	<ul style="list-style-type: none"> <li>➤ Get equipped with a theoretical and practical understanding of industrial microbiology</li> <li>➤ Appreciate how microbiology is applied in manufacture of industrial products</li> <li>➤ Know how to isolate and improve the strains of microorganisms of industrial importance</li> <li>➤ Know about design of bioreactors, factors affecting growth and production, heat transfer, oxygen transfer</li> <li>➤ Understand the rationale in medium formulation &amp; design for microbial fermentation, sterilization of medium and air</li> <li>➤ Appreciate the different types of fermentation processes</li> <li>➤ Comprehend the techniques and the underlying principles in downstream processing</li> <li>➤ To study immobilization of enzymes and cells.</li> <li>➤ To understand the industrial production of various products.</li> <li>➤ To know mushroom cultivation</li> </ul>
<p><b>SEMESTER VI: PAPER 8: MBP 604 INDUSTRIAL MICROBIOLOGY AND MICROBIAL TECHNOLOGY (PRACTICAL)</b></p>	<ul style="list-style-type: none"> <li>➤ To learn production and estimation of various industrially important microbial products like alcohol, citric acid, amylase enzyme, lactic acid etc</li> <li>➤ To learn mushroom cultivation.</li> <li>➤ To learn about various fermenters.</li> </ul>

## LEARNING OUTCOME

<p><b>SEMESTER I:MBP 101 BASIC MICROBIOLOGY (THEORY)</b></p>	<ul style="list-style-type: none"> <li>➤ Understanding of basic history, scope and contributions of major scientists towards the field of microbiology</li> <li>➤ Acquaintances with the principle, construction and applications of various light and electron microscopes.</li> <li>➤ Learning of basics of various microbial staining techniques.</li> <li>➤ Understanding the principle and applications of various physical and chemical sterilization techniques relevant in microbiology laboratory.</li> </ul>
<p><b>MBP 102 BASIC MICROBIOLOGY (PRACTICAL)</b></p>	<ul style="list-style-type: none"> <li>➤ Familiarity in handling the instruments like microscope along with basic and analytical instruments in the laboratory.</li> <li>➤ Ability to identify bacteria with respect to morphology and staining.</li> </ul>

	<ul style="list-style-type: none"> <li>➤ Would know all aseptic techniques required in the laboratory</li> </ul>
<b>SEMESTER II: MBP 201 MICROBIAL TAXONOMY AND CULTURE TECHNIQUES (THEORY)</b>	<ul style="list-style-type: none"> <li>➤ Deep insight into Bacterial, Fungal and Viral properties, structure and classification with type studies.</li> <li>➤ Knowledge about various bacterial and fungal culture media, isolation and identification of microbes and maintenance of pure culture.</li> <li>➤ Knowledge about various nutritional requirements (both physical and chemical), along with microbial growth kinetics.</li> </ul>
<b>MBP 202 MICROBIAL TAXONOMY AND CULTURE TECHNIQUES (PRACTICAL)</b>	<ul style="list-style-type: none"> <li>➤ Ability to prepare fungal and bacterial media.</li> <li>➤ Ability to isolate and identify bacteria and fungal forms from water and soil by various isolation techniques.</li> <li>➤ To measure as well as count various microbial cells.</li> </ul>
<b>SEMESTER III: MBP 301 MICROBIAL PHYSIOLOGY AND MICROBIAL GENETICS (THEORY)</b>	<ul style="list-style-type: none"> <li>➤ Knowledge about classification, properties and significance of various biomolecules along with study of basic enzymology.</li> <li>➤ Total insight into various anabolic and catabolic processes which include aerobic and anaerobic respiration, fermentation, Photosynthesis and chemolithotrophy.</li> <li>➤ Overall knowledge of Structure, replication of DNA, Genetic recombination, mutation and transposition processes.</li> </ul>
<b>SEMESTER III: MBP 302 MICROBIAL PHYSIOLOGY AND MICROBIAL GENETICS (PRACTICAL)</b>	<ul style="list-style-type: none"> <li>➤ Ability to plot growth curve of bacteria and fungi.</li> <li>➤ To identify and classify the bacteria based on the biochemical characteristics.</li> <li>➤ To be able to quantify Glucose and protein concentration in any solution or extract.</li> </ul>
<b>SEMESTER IV: MBP 401 MOLECULAR BIOLOGY AND RECOMBINANT DNA TECHNOLOGY (THEORY)</b>	<ul style="list-style-type: none"> <li>➤ Complete understanding of Central dogma of molecular biology i.e. transcription and translation of prokaryotes.</li> <li>➤ Learning Operon concept as a regulatory mechanism in Bacteria.</li> <li>➤ Overall knowledge about genetic engineering and gene cloning experiment.</li> <li>➤ Learning molecular techniques and applications in genetic engineering.</li> </ul>
<b>SEMESTER IV: MBP 402 MOLECULAR BIOLOGY AND RECOMBINANT DNA TECHNOLOGY (PRACTICAL)</b>	<ul style="list-style-type: none"> <li>➤ Ability to prepare buffers for recombinant DNA technology experiments with accuracy in using pH meter.</li> <li>➤ Quantitative assessment of DNA and RNA from given unknown source.</li> <li>➤ Independent assessment of MIC of any antimicrobial</li> </ul>

	<p>agent.</p> <ul style="list-style-type: none"> <li>➤ Hands on experience of conducting basic rDNA technology experiments.</li> </ul>
<p><b>SEMESTER V: PAPER 5: MBP 501 AGRICULTURAL AND ENVIRONMENTAL MICROBIOLOGY (THEORY)</b></p>	<ul style="list-style-type: none"> <li>➤ Understanding various aspects of Soil organisms and their interactions.</li> <li>➤ Overall role of Microbes in Agriculture including usefulness (Nitrogen fixing, Biofertilizers and biopesticides) and Harmfulness (Plant pathogens)</li> <li>➤ Understanding the role of microbes in both air and water.</li> <li>➤ To be able to assess various methods of trapping air borne organisms and their spores.</li> <li>➤ To have an overall picture of pure drinking water and various municipal water treatment.</li> </ul>
<p><b>SEMESTER V: PAPER 5: MBP 502 AGRICULTURAL AND ENVIRONMENTAL MICROBIOLOGY (PRACTICAL)</b></p>	<ul style="list-style-type: none"> <li>➤ Ability to isolate, identify and quantify the Bacteria and fungi in soil and understand the antagonism and antibiotic production from various organisms.</li> <li>➤ To be able to perform tests to assess the quality of water from different sources.</li> <li>➤ To have the ability to isolate various bacteria and fungi from various indoor and outdoor environments.</li> </ul>
<p><b>SEMESTER V: PAPER 6: MBP 503 FOOD AND DAIRY MICROBIOLOGY (THEORY)</b></p>	<ul style="list-style-type: none"> <li>➤ To gain deep knowledge of relationship between microbes and food.</li> <li>➤ To understand the role of microbes in food contamination, spoilage and food borne pathogens and their assessment and food preservation.</li> <li>➤ To have an understanding of milk and microbial spoilage of milk.</li> <li>➤ Various milk organisms and their biochemical functions in milk.</li> <li>➤ Total understanding of various preservation techniques and fermentations in milk.</li> <li>➤ Deep insight about the production of various fermented milk products.</li> </ul>
<p><b>SEMESTER V: PAPER 6: MBP 504 FOOD AND DAIRY MICROBIOLOGY (PRACTICAL)</b></p>	<ul style="list-style-type: none"> <li>➤ To be able assess the quality of food sample and the microbial load.</li> <li>➤ Understanding composition and quality of milk.</li> <li>➤ To be able to perform all major milk assessment tests along with fat and lactose estimation.</li> </ul>
<p><b>SEMESTER VI: MBP 601 PAPER 7: IMMUNOLOGY AND MEDICAL MICROBIOLOGY (THEORY)</b></p>	<ul style="list-style-type: none"> <li>➤ Basic concepts of immunology like immunity, Antigen, Antibody, immune system, immune responses are well understood.</li> <li>➤ Overall view of Ag-Ab reactions, Hypersensitivity reactions, vaccines and compliment system is well understood.</li> <li>➤ Concepts of Medical microbiology are introduced.</li> <li>➤ Major Bacterial, viral, fungal and protozoan human</li> </ul>

	diseases are studied.
<b>SEMESTER VI: MBP 602 PAPER 7: IMMUNOLOGY AND MEDICAL MICROBIOLOGY (PRACTICAL)</b>	<ul style="list-style-type: none"> <li>➤ Isolation and identification of bacteria from various clinical samples is made familiar with.</li> <li>➤ Basic blood examinations like blood grouping and differential counting of WBC is taught.</li> <li>➤ Various laboratory diagnostic techniques including WIDAL, VDRL, ODD, RID AND ELISA are understood.</li> </ul>
<b>SEMESTER VI: PAPER 8: MBP 603 INDUSTRIAL MICROBIOLOGY AND MICROBIAL TECHNOLOGY (THEORY)</b>	<ul style="list-style-type: none"> <li>➤ Theoretical understanding of industrial upstream and down stream processing.</li> <li>➤ Understanding various aspects of Industrial fermentation processes.</li> <li>➤ To specifically study the production mechanisms of some important specific industrially important products.</li> <li>➤ To understand recombinant vaccine and hormone production.</li> </ul>
<b>SEMESTER VI: PAPER 8: MBP 604 INDUSTRIAL MICROBIOLOGY AND MICROBIAL TECHNOLOGY (PRACTICAL)</b>	<ul style="list-style-type: none"> <li>➤ To be able to produce and assess wine from grapes.</li> <li>➤ Specific production and activity assessment of enzyme from various organisms with various substrates.</li> <li>➤ Specific production and estimation of percentage of Citric acid from various sources and various organisms and their analysis.</li> <li>➤ To perform mushroom cultivation.</li> </ul>

## COURSE OBJECTIVE

<b>SEMESTER I:MBP 101 BASIC MICROBIOLOGY (THEORY)</b>	<ul style="list-style-type: none"> <li>➤ To give the fundamentals of microbiology along with scientist contributions to the field.</li> <li>➤ Principle, construction and applications of various microscopes are covered.</li> <li>➤ Total aseptic techniques along with chemotherapeutic agents are well studied.</li> </ul>
<b>MBP 102 BASIC MICROBIOLOGY (PRACTICAL)</b>	<ul style="list-style-type: none"> <li>➤ Handling of light microscope with basic microbial staining techniques are covered.</li> <li>➤ Aseptic methods are well understood along with usage of instruments.</li> </ul>
<b>SEMESTER II: MBP 201 MICROBIAL TAXONOMY AND CULTURE TECHNIQUES (THEORY)</b>	<ul style="list-style-type: none"> <li>➤ Is to teach Properties, classification and type studies of Viruses, Bacteria, Fungi, Cyanoabcteria and Protozoa.</li> <li>➤ Is to teach various preparation of culture media and culture techniques along with growth aspects.</li> </ul>
<b>MBP 202 MICROBIAL</b>	<ul style="list-style-type: none"> <li>➤ Isolation and identification of microbes by various</li> </ul>

<b>TAXONOMY AND CULTURE TECHNIQUES (PRACTICAL)</b>	<p>techniques and from various sources.</p> <ul style="list-style-type: none"> <li>➤ Counting and measuring of microbial cells and their spores.</li> </ul>
<b>SEMESTER III: MBP 301 MICROBIAL PHYSIOLOGY AND MICROBIAL GENETICS (THEORY)</b>	<ul style="list-style-type: none"> <li>➤ To teach Biomolecules, enzymology along with total microbial metabolic processes i.e. catabolic and anabolic processes.</li> <li>➤ To cover Microbial DNA replication, its structure and various recombination processes along with mutation and transposition.</li> </ul>
<b>SEMESTER III: MBP 302 MICROBIAL PHYSIOLOGY AND MICROBIAL GENETICS (PRACTICAL)</b>	<ul style="list-style-type: none"> <li>➤ Estimation of reducing sugar and protein in given solution.</li> <li>➤ To teach students to identify bacteria based on the biochemical characteristics</li> </ul>
<b>SEMESTER IV: MBP 401 MOLECULAR BIOLOGY AND RECOMBINANT DNA TECHNOLOGY (THEORY)</b>	<ul style="list-style-type: none"> <li>➤ Teaching of Microbial transcription and translation along with operon concept as a gene regulatory mechanism in prokaryotes.</li> <li>➤ To impart basic knowledge of genetic engineering experiment with molecular techniques and applications.</li> </ul>
<b>SEMESTER IV: MBP 402 MOLECULAR BIOLOGY AND RECOMBINANT DNA TECHNOLOGY (PRACTICAL)</b>	<ul style="list-style-type: none"> <li>➤ To teach DNA and RNA estimations.</li> <li>➤ To teach the usage of pH meter for the preparation of buffer of specific pH</li> <li>➤ To understand antimicrobial evaluation of an antibiotic</li> </ul>
<b>SEMESTER V: PAPER 5: MBP 501 AGRICULTURAL AND ENVIRONMENTAL MICROBIOLOGY (THEORY)</b>	<ul style="list-style-type: none"> <li>➤ Various aspects of role of microorganisms in the field of Soil, Water and Air.</li> <li>➤ Impact of microbes on Agriculture.</li> </ul>
<b>SEMESTER V: PAPER 5: MBP 502 AGRICULTURAL AND ENVIRONMENTAL MICROBIOLOGY (PRACTICAL)</b>	<ul style="list-style-type: none"> <li>➤ To teach isolation and identification of microbes from soil, water and air.</li> <li>➤ To assess the quality of air and water by various methods.</li> </ul>
<b>SEMESTER V: PAPER 6: MBP 503 FOOD AND DAIRY MICROBIOLOGY (THEORY)</b>	<ul style="list-style-type: none"> <li>➤ To teach the role of microbes in food spoilage and causing food borne illness and food preservation techniques also microbes as food.</li> <li>➤ To teach various organisms in milk and their role in fermentation, spoilage and preparation of fermented products along with preservation of milk and milk products</li> </ul>
<b>SEMESTER V: PAPER 6: MBP 504 FOOD AND DAIRY MICROBIOLOGY</b>	<ul style="list-style-type: none"> <li>➤ To teach assessment of many types of food by finding the presence various microbes and mycotoxins.</li> </ul>

<b>(PRACTICAL)</b>	<ul style="list-style-type: none"> <li>➤ To teach examination of fat and lactose percentage of milk along with milk quality checking by various methods.</li> </ul>
<b>SEMESTER VI: MBP 601 PAPER 7: IMMUNOLOGY AND MEDICAL MICROBIOLOGY (THEORY)</b>	<ul style="list-style-type: none"> <li>➤ To teach basic immune system and its functioning which includes the understanding of immunity, Antigen, antibody, antigen antibody reactions, immune cells, immune organs, immune response, compliment system, vaccines and hypersensitivity reactions.</li> <li>➤ To teach various bacterial, fungal, viral and protozoan diseases which covers pathogen, identification and cultivation of pathogen, antigenic properties, disease, symptoms, pathogenicity, pathogenesis, diagnosis, treatment and prevention of diseases.</li> </ul>
<b>SEMESTER VI: MBP 602 PAPER 7: IMMUNOLOGY AND MEDICAL MICROBIOLOGY (PRACTICAL)</b>	<ul style="list-style-type: none"> <li>➤ To teach isolation and identification of bacteria from various samples.</li> <li>➤ To understand urine sugar, protein and cfu analysis.</li> <li>➤ To learn blood grouping along with many diagnostic techniques including ODD, RID, ELISA, WIDAL, VDRL etc..</li> </ul>
<b>SEMESTER VI: PAPER 8: MBP 603 INDUSTRIAL MICROBIOLOGY AND MICROBIAL TECHNOLOGY (THEORY)</b>	<ul style="list-style-type: none"> <li>➤ To teach the industrially important microbes and their cultivation.</li> <li>➤ To teach about various types of fermenters and upstream and downstream processes.</li> <li>➤ To teach various microbial productions specifically like alcohol, organic acid, antibiotic, hormone, vitamin and enzyme productions.</li> <li>➤ To teach cell and enzyme immobilizations and mushroom cultivation.</li> </ul>
<b>SEMESTER VI: PAPER 8: MBP 604 INDUSTRIAL MICROBIOLOGY AND MICROBIAL TECHNOLOGY (PRACTICAL)</b>	<ul style="list-style-type: none"> <li>➤ To teach the cultivation and estimation of citric acid, lactic acid and amylase with various strains of microbes.</li> <li>➤ To teach white oyster mushroom cultivation.</li> <li>➤ To teach wine production and biogas production.</li> </ul>



# PHYSICS SUBJECT OF B.Sc. MPCs

## Course Outcomes(COs)

### SEMESTER – 1

PROGRAM	COURSE CODE	COURSE TITLE	HPW	CREDITS	COURSE TYPE
B.Sc	Not Applicable	Mechanics and Oscillations	4+1	5	DSc-Compulsory

#### Course outcome

- The students would learn about the behavior of physical bodies it provides the basic concepts related to the motion of all the objects around us in our daily life.
- The course builds a foundation of various applied field in science and technology; especially in the field of mechanical engineering. The course comprises of the study vectors, laws of motion, momentum, energy, rotational motion, gravitation, fluids, elasticity and special relativity.
- Students would perform basic experiments related to mechanics and also get familiar with various measuring instruments would learn the importance of accuracy of measurements.

### SEMESTER – II

PROGRAM	COURSE CODE	COURSE TITLE	HPW	CREDITS	COURSE TYPE
B.Sc	Not Applicable	Thermal Physics	4+3	5	DSc-Compulsory

#### COURSE OUTCOME

- The course makes the students able to understand the basic physics of heat and temperature and their relation with energy, work, radiation and matter.
- The students also learn how laws of thermodynamics are used in a heat engine to transform heat into work.

- The course contains the study of laws of thermodynamics, thermodynamic description of systems, thermodynamic potentials, kinetic theory of gases, theory of radiation and statistical mechanics.
- Students would gain practical knowledge about heat and radiation, thermodynamics, thermo emf , RTD etc. and perform various experiments.

### SEMESTER – III

PROGRAM	COURSE CODE	COURSE TITLE	HPW	CREDITS	COURSE TYPE
B.Sc	Not Applicable	Electromagnetic Theory	4+3	5	DSc-Compulsory

### COURSE OUTCOME

- Knowledge of, physical interpretation, and ability to apply Maxwell's equations to determine field waves, potential waves, energy and charge conservation conditions.
- Experimental measurement of voltages induced by time varying magnetic flux. Flux determination.

### SEMESTER – IV

PROGRAM	COURSE CODE	COURSE TITLE	HPW	CREDITS	COURSE TYPE
B.Sc	Not Applicable	Waves and Optics	4+3	5	DSc-Compulsory

### COURSE OUTCOME

- The course comprises of the study of superposition of harmonic oscillations, waves motion (general), oscillators, sound, wave optics, interference, diffraction, polarization.
- The course is important for the students to make their career in various branches of science and engineering, especially in the field of photonic engineering.
- The practical knowledge of wave motion doing experiments: Tuning fork, electric vibrations.
- They would also learn optical phenomena such as interference, diffraction and dispersion and do experiments related to optical devices: Prism, grating, spectrometers

### SEMESTER – V

PROGRAM	COURSE CODE	COURSE TITLE	HPW	CREDITS	COURSE TYPE
B.Sc	Not Applicable	Modern Physics	4+3	5	DSc-Compulsory

### COURSE OUTCOME

- In this course students would be able to understand Basic experiments of modern physics such as: Determination of Plank's and Boltzmann's constants, Determination of ionization potential, Wavelength of H-spectrum, Single and double slit diffraction, Photo electric effect and determination of  $e/m$

### SEMESTER – VI

PROGRAM	COURSE CODE	COURSE TITLE	HPW	CREDITS	COURSE TYPE
B.Sc	Not Applicable	Electronics	4+3	5	DSc-Compulsory

### COURSE OUTCOME

- It gives an opportunity for the students to learn about one of the fundamental interactions of electricity and magnetism, both as separate phenomena and as a singular electromagnetic force. The course contains vector analysis, electrostatics, magnetism, electromagnetic induction and Maxwell's equations. The course is very useful for the students in almost every branch of science and engineering.
- Students would gain practical knowledge about electricity and magnetism and measurements such as: Resistance, Voltage, current etc.

# SANSKRIT LANGUAGE

## Course Outcome (COs)

### B.Com,B.Sc – I year 1<sup>st</sup> semester

(Poetry, Play, Grammar)

1. It imparts the poetic knowledge.
2. It conveys the message that a nation develops with the development of its people.
3. That is possible with a leader with high qualities.
4. There cannot be development without good character, which is not possible without the study of our culture.
5. Excellent nature description has been projected.
6. Imparting the knowledge of rich Sanskrit vocabulary and its usage.

### B.Com,B.Sc – I year 2<sup>nd</sup> semester

(Poetry, Prose, Grammar)

1. A study of Itihas Granthas.
2. Character building, personality development and nationalism through it.
3. Teaches good behaviour, orator skills and good character.
4. Importance and need for research in the field of Sanskrit.
5. Speaking and writing simple Sanskrit sentences through Sanskrit verbs.

### B.Com,B.Sc – II year 3<sup>rd</sup> semester

(Play, Prose, Grammar)

1. Description of the nature, teaches to be environment friendly.
2. Poets are nothing but ambassadors of the state.
3. The king is supposed to be citizen friendly. He should win the heart of his citizens through his statecraft.
4. The history of our region and devotion towards the God is conveyed.
5. The vocabulary and its vibhaktis are taught so that they can be used in framing own sentences.

### B.Com,B.Sc – II year 4<sup>th</sup> semester

(Play, Prose, Grammar)

1. The duty of a statesman and a good ruler is to sacrifice anything for the cause of people.
2. The importance of Indian culture. One should not get disturbed even in crises and should have faith in Guru.
3. The olden Sanskrit literature was so rich that there were fictional novels too in that period.
4. One can achieve success with willpower and success.

5. For the better understanding of the language, the participle forms of verbs, by adding suffixes, are taught.

B.Com,B.Sc – III year 5<sup>th</sup> semester

(Poetry, Vedic Literature, Poetics, History of Sanskrit literature)

1. The qualities of a king have been explained with precautions of evils. The student has to become a leader with these qualities.
2. Learning about the Kavya Shastras with special reference to Alamkaras.
3. Giving a brief note of the Upanishads which are the fourth part, imparting Gyan, in the Vedic Literature.
4. The education system which ends with convocation has been explained very effectively.
5. The great authors have been explained showcasing the rich history of our literature.

B.Com,B.Sc – III year 6<sup>th</sup> semester

(Poetry, Vedic Literature, Poetics, History of Sanskrit literature)

1. The greatness of our nation has to be re-generated so as to attain the Jagat-Guru sthan.
2. Learning about the Kavya Shastras with special reference to Alamkaras.
3. Upanishads are not only philosophy but they are the scriptures expressing the mode of life.
4. The divine education system has been explained.
5. The great authors have been explained showcasing the rich history of our literature.

**LEARNING OUTCOME OF SANSKRIT**

The importance of Sanskrit has increased manifold in recent years. But the question arises- why should we learn a language which is no longer in practical use? We can answer this question through various angles.

Communication Skills: It is well known fact that if you master any one language, you can learn other languages with ease. And moreover, it is easy to master one's mother tongue than other languages. But let us not forget that Sanskrit is the mother of all languages. Thus, learning Sanskrit helps you learn other language and develop communication skills.

Cultural Development and Character Building: Sanskrit literature is full of inspiring and motivating stories such as Panchatantra which helps in personality development and character building. Also, our epics such as Ramayana and Mahabharata inculcate cultural values in the youth.

Scope of Research: The ancient India was an ocean of knowledge. We had the scriptures right from medicine to metallurgy. There was no field left untouched by Indians. All these scriptures are in Sanskrit. Thus, research of these scriptures will provide new insights into various fields of knowledge.

Sanskrit as a Career: According to a research journal A1 published by NASA, Sanskrit is the most compatible language for computers. It gains this merit due to its unique grammatical structure. Hence, in future, Artificial Intelligence and many other related fields would inevitably require the knowledge of Sanskrit. Thus, software engineers with the knowledge of Sanskrit will have an edge over others.

## HINDI LANGUAGE Course Outcomes(COs)

हिन्दी विभाग

बी ए, बी. काम, बी.एस्सी ( प्रथम वर्ष -- वर्षार्ध 1 )

( गद्य -- निबंध, कहानी )

1. विद्यार्थियों को हिन्दी भाषा की संरचना और साहित्य का ज्ञान प्राप्त होता है ।
2. हिन्दी भाषा के द्वारा विद्यार्थियों में विचारशक्ति और साहस को बढ़ावा मिलता है ।  
विद्यार्थियों में समाज के प्रति अधिकार और कर्तव्यपरायणता में सक्रिय
3. अच्छे चारित्रिक गुणों के ज्ञान के द्वारा समाज में व्यक्ति विशेष को आदरणीय बनाता है ।
4. सामाजिक कुरितियों को दूर करने में विद्यार्थी योगदान देने का प्रयत्न कर सकते हैं ।
5. जीवन में धर्म एवं सत्य के मार्ग का अनुसरण करने की शिक्षा मिलती है ।
6. हिन्दी भाषा के द्वारा नुतन साहित्य का निर्माण कर साहित्य सेवा कर सकते हैं ।
7. भाषा साहित्य द्वारा भारतीय संस्कृति का ऐतिहासिक और विवरणात्मक परिचय मिलता है ।

बी. ए, बी. काम, बी. एस्सी ( प्रथम वर्ष -- वर्षार्ध 2 )

( गद्य -- कहानी, जीवन वर्णन, यात्रा वर्णन )

1. यात्रा वर्णन द्वारा विद्यार्थियों को प्रादेशिक सौंदर्य वर्णन से आनंद की अनुभूति होती है ।
2. विकसित भाषा ज्ञान द्वारा राजनीति जैसे विषय पर अपने विचार व्यक्त कर देश का भविष्य उज्वल बना सकते हैं ।
3. पुरानी पीढ़ी - नयी पीढ़ी के मध्य पारिवारिक मूल्यों को विकसित किया जा सकता है ।

4. चरित्र चित्रण के द्वारा नारी के विविध स्वाभाविक पहलुओं को दर्शाया जा सकता है ।
5. जीवन में धर्म एवं सत्य के मार्ग का अनुसरण करने की शिक्षा मिलती है ।
6. नाट्य कला के द्वारा पाखंडपूर्ण, दांभिक जीवन का यथार्थ चित्र प्रस्तुत कर सकते है ।
7. महानुभावों के जीवन से प्रेरित होकर धर्माधता और सामाजिक विषमता को दूर करने का प्रयास कर सकते है ।
8. जन साधारण में प्रदूषण जैसी समस्या के प्रति जागरूकता ला सकते है ।

बी ए, बी. काम, बी.एस्सी, बी बी ए ( द्वितीय वर्ष -- वर्षार्ध 3)

(गद्य -- हिन्दी साहित्य का इतिहास पद्य -- प्राचीन, आधुनिक )

1. दोहे,पद आदि के पठन पाठन से भारतीय प्राचीन भाषा का ज्ञान मिलता है ।
2. आधुनिक कविता पठन के द्वारा संस्कृत निष्ठ शब्दावली का प्राचुर्य दर्शित होता है ।
3. आदिकाल में हिन्दी भाषा तथा उसके काव्य रूप के अंकुरित होने का ज्ञान मिलता है ।
4. आधुनिक कविता में भाव के साथ रसात्मक, प्रवाहात्मक, प्रतिकात्मक तथा लाक्षणिकता जैसे गुण विशेष की जानकारी मिलती है ।
5. साहित्य एक प्रवाहमान धारा के सदृश होता है । इसके द्वारा तत्कालीन जनता की मनोवृत्ति और विचारधारा को समझने में सहायता होती है ।
6. भाषा साहित्य के इतिहास के द्वारा भक्ति मार्ग का महत्व समझ सकते है ।
7. सामान्य विषयों पर निबंध लेखन से विद्यार्थियों की लेखन शैली उत्कृष्ट बनती है ।
8. उत्कृष्ट भाषा ज्ञान तथा विकसित लेखन शैली के द्वारा पत्रकारिता और प्रसार माध्यम के क्षेत्र में कार्य कर सकते है ।

## हिन्दी हिभाग

बी. ए, बी. काम, बी. एस्सी, बी बी ए (द्वितीय वर्ष वर्षार्ध - 4 )

1. दोहे , पद आदि के पठन पाठन से मनुष्य जीवन में नैतिक मूल्यों का महत्व समझ सकते है ।
2. साहित्य की विभिन्न विधाओं का परिचय प्राप्त होता हैं ।
3. कहानियों और लेखको के जीवन परिचय और रचनाओं द्वारा साहित्य का ज्ञान हमें मिलता है।
4. आधुनिक कविता के माध्यम से समयानुकूल मनुष्य की बदलती सोच का ज्ञान प्राप्त होता है ।
5. साहित्य सृजन में साहित्य के लक्षणों का ज्ञान प्राप्त होता है ।
6. सामाजिक परिस्थितियों के कारण बदलते साहित्यिक विषयों का ज्ञान प्राप्त होता है ।
7. अनुवाद , बोधगम्य गद्यांश आदि के कारण भारत की लेखन शैली का विकास होता है ।

## हिन्दी विभाग

बी. ए., बी. कॉम., बी. एससी., बी. बी. ए. ( तृतीय वर्ष - वर्षार्ध – 5 )

1. भाषा के माध्यम से उसके विभिन्न स्वरूपों को जानकारी छात्रों के लिए उपयोगी सिद्ध होती है। विश्वस्तरीय हिन्दी का स्वरूप छात्रों में हिन्दी के प्रति रुचि को और बढ़ता है ।
2. साहित्य के विविध आयाम छात्रों में अपनी रुची अनुसार विधा को समझने में और लेखन में सहायक सिद्ध हुआ है ।
3. जनसंचार के माध्यम से केवल तकनीक की जानकारी बल्कि लुप्त हो चुकी लोक कलाओं का ज्ञान उपयोगी है ।

## हिन्दी विभाग

बी. ए., बी. कॉम., बी. एससी., बी. बी. ए. ( तृतीय वर्ष - वर्षार्ध – 6 )

1. रोजमार्गा की जिंदगी में अनुवादक की भूमिका निभाने वाले छात्रों के लिए अनुवाद की सम्पूर्ण जानकारी इस अध्याय के माध्यम से मिलती है । रोजगार के विभिन्न अवसरों का भी ज्ञान प्राप्त होता है ।
2. पत्रकारिता लोकतंत्र का चतुर्थ स्तम्भ सम्पूर्ण जानकारी प्रदान करता है उसके प्रकार नई जानकारी देते है ।



3. साहित्य के विविध आयामों द्वारा उसकी जानकारी , लेखकों का परिचय और रचनाओं का ज्ञान प्राप्त होता है ।

## TELUGU LANGUAGE Course Outcomes(COs)

**Semester 1. సెమిస్టర్ 1వ.** ప్రాచీన పద్య భాగము.1. శకుంతలోపాఖ్యానం కథ ద్వారా యువతకు సందేశం అందుతుంది ఇందులో ధర్మబోధ ఉంది. 2 గొడగూచికథ నిర్మల భక్తిని కలిగి ఉండాలనే విషయం చెబుతుంది. 3. సంవరణుడు తపస్సు కోసం చేసిన కఠోర దీక్ష వెల్లడి అవుతుంది. ఆధునికపద్యభాగం 4. నిజమైన ధనమేమిటో చెప్పే కవిత కాసులు కవిత. 5. రాజు కంటే కవి గొప్ప వాడని నిరూపించే కవిత రాజు కవి కవిత .6. ఒక జానపద కళారూపాన్ని జానపద కళాకారుని చిత్రించిన కవిత గంగిరెద్దు .7 .జయభేరి కవిత ఉత్సాహాన్ని కలిగిస్తుంది. ఉపవాచకం .రుద్రమదేవి కథ దైర్య సాహసాలను పెంచుతుంది.

**Semester 2 సెమిస్టర్ 2** ప్రాచీన పద్య భాగము 1. గజేంద్రుడు ఆర్తితో ప్రార్థించడం భగవంతుడు పరుగు పరుగున రావడం గజేంద్రమోక్ష కథలో చెప్పబడింది .2.హనుమంతుడు సీతాదేవికి అందించిన సందేశం హనుమత్ సందేశంలో వివరించబడింది.3. మంచి మాటల ఆవశ్యకతను తెలియచేప్పేది సుభాషితాలు . ఆధునిక పద్యభాగం 4.కవి యొక్క భావాలను వ్యక్తం చేసిన కవిత అంతర్నాదం. 5. ప్రపంచ పదులు వ్యక్తిత్వ వికాసానికి తోడ్పడుతాయి 6. స్నేహితుని మరణాన్ని తట్టుకోలేక స్మరించుకుంటూ చెప్పిన కవిత అల్విదా. వచన విభాగం.7. స్వచ్ఛమైన స్నేహానికి ప్రత్యేకత యుగాంతం కథలో చెప్పబడింది.8. జీవులకు కూడా మమతానురాగాలు ఉంటాయనే విషయాన్ని చెప్పేది ఎంకన్న పాఠ్యభాగం. 6. మామిడిపండు లోని వివిధ రకాలు పుట్టుక వ్యాప్తి పై జరిగిన సమగ్ర చర్చ మామిడిపండు .7. ఊరు యొక్క స్వరూప స్వభావాలు మారిపోవడంతో ఆవేదన చెందిన కవి భావాలు మా ఊరు పోయింది లో తెలుస్తాయి.

**Semester-3 మూడవ సెమిస్టర్** ప్రాచీన పద్యభాగం ధర్మజుని వాక్చాతుర్యం వ్యక్తిత్వ వికాసానికి తోడ్పడుతూ ఎలా మాట్లాడాలో నేర్పిస్తుంది 2 ఎవరిని ఆశ్రయించాను ఎవరిని ఏమి కూరలు తెలిపేది విభీషణ శరణాగతి సత్ప్రవర్తనతో మెలగాలని చెప్పే పాఠ్యభాగం గుణ నీతి కథ ఆధునిక పద్యభాగం 1.రైతు ఏ విధంగా గ్రామ ప్రజలకు చేరువైనాడో చెప్పే పాఠ్యభాగం రైతు ప్రశస్తి 2. గురువుపై కల భక్తి గురు శిష్యుల సంబంధం గురుదక్షిణలో వెల్లడవుతాయి.3. గుడిసెలు కాలిపోతున్నాయి పాఠ్యభాగం గుడిసెలు ఎందుకు కాలిపోతున్నాయో అనే ప్రశ్నలతో నిండి ఉన్నది.

**Semester- 4 నాల్గవ సెమిస్టర్** ప్రాచీన పద్యభాగం1.నారద గాన మాత్సర్యంలో చదువులో పోటీ ఉంటే మేలు కలిగిస్తుందని మంచి చెబుతుంది 2 ఇచ్చిన మాట తప్పిన విధానాన్ని తప్పు అని వాగ్దాన భంగం నిరూపిస్తుంది 3. లోకం పోకడను భక్తిని నరసింహ శతకం విశదీకరిస్తుంది. ఆధునిక పద్యభాగం 1. మనిషి తాను మనిషినని గుర్తించాలని నరుడ నేను నరుడ నేను చెబుతుంది 2 మనిషి మానవత్వాన్ని మరచిపోతుండడం పట్ల ఆవేదనను వెల్లడించేది ఆర్ద్రగీతం 3.శిథిలమైపోయిన దుర్గాన్ని చూసిన కవి బాధ దేవరకొండ దుర్గంలో వెల్లడైంది. వచన విభాగం 1.స్వాతంత్ర్య ఉద్యమ సమయంలో భారతదేశ స్థితిగతులను వర్ణించిన పాఠ్యభాగం అర్ధరాత్రి అరుణోదయం. 2. బ్రౌన్ తెలుగు సాహిత్యానికి చేసిన సేవ వర్ణించిన పాఠ్యభాగం సిపి బ్రౌన్ సాహిత్య సేవ 3.గ్రామ నామాల చరిత్రను పరిశోధనాత్మకంగా వెల్లడించిన పాఠ్యభాగం మన గ్రామ నామాలు 4 కష్టాలను అధిగమించి ఐఏఎస్

స్థాయికి చేరుకున్న విద్యార్థి జీవితాన్ని నివృత్తి తొలగిన నిప్పు వివరిస్తుంది. 5. దాంపత్య జీవితంలో అవగాహన ,సంతృప్తి జీవితాన్ని సంతోషమయం చేస్తాయని కొండమల్లెలు ద్వారా సూచించబడింది.

**Semester -5 ఐదవ సెమిస్టర్** - పద్యం, పాట, వచన కవిత, లఘు కవితారూపాలు, ఉర్దూ కవితారూపాలు తెలుసుకోవడం ద్వారా వాటి పుట్టుక, అవి అభివృద్ధి చెందిన విధానం, వాటి లక్షణాలు, వాటి ప్రయోజనాలు విద్యార్థులకు బోధింపబడతాయి. 2. వివిధ పత్రికలలో వెలువడే వ్యాసాలను చదవడం మాత్రమే కాకుండా వ్యాసం వ్యాస పరిణామం, వ్యాసరచనా పద్ధతులు ,వ్యాసంలో వస్తు వైవిధ్యం , వ్యాసరచనలో భాషా ప్రయోగాలు, తెలుసుకోవడం ద్వారా విద్యార్థులు స్వయంగా వ్యాసాలు రాసేందుకు ప్రేరణను కలిగిస్తుంది.

**Semester -6 ఆరవ సెమిస్టర్** .నాటకం, నవల, కథానిక ,జీవిత చరిత్ర , ఉపన్యాస కళ అనే సాహిత్య ప్రక్రియల పరిచయం విద్యార్థులకు భవిష్యత్తులో ఉద్యోగ అవకాశాలకు తోడ్పడు తుంది. జర్నలిజంలో మౌలికాంశాలుఅనే అధ్యాయంలో భాగాలైన వార్త, వార్త నిర్మాణం, వార్తాకథనం, ఇంటర్వ్యూలు, అనువాదాలు, మొదలైన అధ్యాయాలను చదవడం ద్వారా పుష్కలంగా పెరుగుతున్న మీడియా రంగంలో విద్యార్థులు ప్రవేశించేందుకు అవగాహనను కలిగిస్తాయి. ప్రాజెక్టు పరిచయం అనే అధ్యాయంలోవివిధ రంగాలలో సామూహిక చర్చలకు ఉపన్యాసాలకు ప్రాధాన్యం పెరుగుతున్నందువలన ప్రాజెక్టు, అధ్యయనం, పరికల్పన, నివేదిక వంటి అధ్యాయాలు విద్యార్థులకు వెంటనే ఉపకరించేలా ఉన్నాయి.

#### **Learning Outcomes of Telugu language:**

- Develop learners' abilities as a critical reader and writer.
- Strengthens LSRW skills.
- Develop learner public speaking abilities by giving you opportunities to speak in class, both informally and formally.
- Increase your self-awareness about the Telugu language and the culturally-bound conventions.
- Familiarity with and practice in the four modes of literacy: writing, speaking, reading & listening.

## **ENGLISH LANGUAGE**

### **Course Outcome(COs)**

Prescribed General English Text Book for I Year (Sem-I & Sem-II) for B.A/B.Sc/B.Com  
Total Credits = 20 (5 credits per semester for first four semesters) Total hours of instruction = 5 per week

#### **COURSE OBJECTIVES**

- To introduce students to the four genres of English language and to impart proficiency in usage of language.
- To introduce students to the genre of short fiction, to develop writing skills, and to enhance communication skills.
- To promote comprehension of prose content, to improve conversational skills and to develop logical thinking and self-confidence
- To build skills in critical appreciation of the genre of poetry, to develop descriptive writing skills and to strengthen non-verbal communication
- To study the use of language in the genre of drama, to develop dialogue writing skills and interpersonal skills.

Sl.No	PAPER	SEMESTER	COURSE OUTCOME
1	<b>ENGLISH MADE EASY</b> Title: English Made Easy published by Orient Blackswan Editors: Prof. E. Suresh Kumar, Prof. Sumita Roy and Prof. A. Karunaker	I	<ul style="list-style-type: none"> <li>➤ A student in their undergraduate years will be able to read, comprehend, and interpret a variety of written texts.</li> <li>➤ Strengthening their LSRW skills.</li> <li>➤ Strengthening their grammar and vocabulary</li> <li>➤ Improving their reading and writing skills</li> <li>➤ Enhancing their listening and speaking skills</li> <li>➤ Imparting to them important life skills and human values</li> <li>➤ Encouraging them to think creatively and critically</li> <li>➤ Learners identify and connect with the content. While the focus of each lesson is on language learning. (through sections on pronunciation, grammar, vocabulary, spelling, punctuation, writing and conversation)</li> <li>➤ Explain and analyze prose content and</li> </ul>

			<p>demonstrate skill in logical sequencing while writing.</p> <ul style="list-style-type: none"> <li>➤ Undertake guided and extended writing using appropriate vocabulary and correct grammar.</li> <li>➤ Appraise poetry and create descriptive texts in English.</li> <li>➤ Listen with comprehension and speak with confidence in both formal and acceptable pronunciation.</li> <li>➤ The holistic development of students by including sections on soft skills and value orientation.</li> <li>➤ This will help them prepare for future professional endeavours.</li> <li>➤ Become employable with requisite professional skills, ethics and values.</li> </ul>
<b>2</b>	<p><b>ENGLISH MADE EASY</b>  Title: English Made Easy  published by Orient  Blackswan Editors: Prof.  E. Suresh Kumar, Prof.  Sumita Roy and Prof. A.  Karunaker</p>	<b>II</b>	<ul style="list-style-type: none"> <li>➤ A student in their undergraduate years will be able to read, comprehend, and interpret a variety of written texts.</li> <li>➤ Strengthening their LSRW skills.</li> <li>➤ Strengthening their grammar and vocabulary</li> <li>➤ Improving their reading and writing skills</li> <li>➤ Enhancing their listening and speaking skills</li> <li>➤ Imparting to them important life skills and human values</li> <li>➤ Encouraging them to think creatively and critically</li> <li>➤ Learners identify and connect with the content. While the focus of each lesson is on language learning. (through sections on pronunciation, grammar, vocabulary, spelling, punctuation, writing and conversation)</li> </ul>

			<ul style="list-style-type: none"> <li>➤ Explain and analyze prose content and demonstrate skill in logical sequencing while writing.</li> <li>➤ Undertake guided and extended writing using appropriate vocabulary and correct grammar.</li> <li>➤ Appraise poetry and create descriptive texts in English.</li> <li>➤ Listen with comprehension and speak with confidence in both formal and acceptable pronunciation.</li> <li>➤ The holistic development of students by including sections on soft skills and value orientation.</li> <li>➤ This will help them prepare for future professional endeavours.</li> <li>➤ Become employable with requisite professional skills, ethics and values.</li> </ul>
<b>3</b>	<b>PAPER</b>	<b>II YEAR</b>	
	<b>ENGLISH FOR EMPOWERMENT BY ORIENT BLACKSWAN</b>	<b>II YEAR</b>	<ul style="list-style-type: none"> <li>➤ A student in their undergraduate years will be able to read, comprehend, and interpret a variety of written texts.</li> <li>➤ Learners will be able to learn pronunciation, accent and difference between reading a poem and a piece of prose.</li> <li>➤ Strengthening their LSRW skills.</li> <li>➤ Improves thinking skills</li> <li>➤ Vocabulary development</li> <li>➤ Fosters love for literature</li> <li>➤ Develops the ability for creative thinking and language usage</li> <li>➤ Become familiar with the work of African, American, British, Russian and Indian cultural and literary diversity.</li> <li>➤ A student in their undergraduate years will be able to read, comprehend, and</li> </ul>

			<p>interpret a variety of written texts. Appraise poetry and create descriptive texts in English</p> <ul style="list-style-type: none"> <li>➤ Listen with comprehension and speak with confidence in both formal and acceptable pronunciation</li> <li>➤ The holistic development of students by including sections on soft skills and value orientation.</li> <li>➤ This will help them prepare for future professional endeavours.</li> <li>➤ Become employable with requisite professional skills, ethics and values.</li> </ul>
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### **ENGLISH Course outcome**

Prescribed General English Text Book for I Year (Sem-I & Sem-II) for B.A/B.Sc/B.Com

Total Credits = 20 (5 credits per semester for first four semesters) Total hours of instruction = 5 per week

### **LEARNING OUTCOMES**

- Develop learners' abilities as a critical reader and writer.
- Strengthens LSRW skills.
- Understand the demands of academic research at UW-Madison, which means learning about our libraries and the print and electronic sources there and learning to develop good questions, find relevant sources, evaluate those sources and integrate them thoughtfully, responsibly, and ethically in your own writing.
- Develop learner public speaking abilities by giving you opportunities to speak in class, both informally and formally.
- Increase your self-awareness about the English language and the culturally-bound conventions of American academic writing.
- Familiarity with and practice in the four modes of literacy: writing, speaking, reading & listening.
- Critical thinking as it pertains to using these tools for effective communication in an academic setting.

## POST GRADUATE COURSES OUTCOMES

### M.Com

### Course Outcomes(COs)

**CODE: 101**

**Semester-I**

**Title: Managerial Economics**

Upon successful completion of this course, the student will be able to:

1. Understand economic environment, effective managerial decision-making process
2. Understand of the theory and analytical tools that can be used in decision-making problems.
3. Analyze knowledge of the economic theory with decision-making techniques.
4. Use economic models to isolate the relevant elements of a managerial problem, identify their relationships
5. Formulate them into a managerial model to which decision-making tools can be applied.
6. To analyze the knowledge of various markets like perfect competition, monopoly market, monopolistic competition, oligopoly market etc.

**CODE: 102 Titles: Principles of Marketing**

1. To understand how organizations identify customers and their wants/needs.
2. To comprehend marketing decisions, based upon the combination of product, price, promotion, and distribution elements. In this course, you will study consumer and industrial markets and understand the value of the marketing mix in the marketing planning process
3. To understand marketing concepts for product, production, selling and societal concepts.
4. To know the concepts of market segmentation, Target and positioning for customer and services.
5. To differentiate organization buyer and consumer behavior.

6. Evaluate the marketing planning and strategy.

**CODE: 103 Titles: Organizational Theory and Organizational Behavior**

Students will be able to

1. Explain how individual differences—such as personalities, perceptions, attitudes, and ethics—affect employee performance
2. Describe how managers can capitalize on employee diversity.
3. Students will be able to apply different motivational theories and methods to increase the productivity and job satisfaction of employees.

**CODE: 104 Titles: Financial Management**

1. Explain the concept of fundamental financial concepts, especially time value of money.
2. Apply capital budgeting projects using traditional methods.
3. Analyze the main ways of raising capital and their respective advantages and disadvantages in different circumstances
4. Integrate the concept and apply the financial concepts to calculate ratios and do the capital budgeting

**CODE: 105 Title: Indian accounting standards**

UNITS: 1. Introduction

2. Indian Accounting Standards (Accounting Standards No. 1 to 21)
3. Indian Accounting Standards (Accounting Standards No.23 to 41)
4. Indian Accounting Standards (A.S.No.101 to 106)
5. Indian Accounting Standards (A.S.No.107 to 115)

**Learning Objectives:**

With the study of the above subject, students will be enlightened the significance of the accounting standards, the role of the accounting standards and the process of the accounting



standards in formulating the prescribed, procedures, formats, formulas, and principles for journalizing and recording the accounting and business transactions. Students also will have an idea maintaining the systematic accounting records and in preparation of financial statement for the information of stakeholders. As said in the subject, students will get awareness that the accounting records will be useful as readymade information to the beneficiaries. Recording and preparation of accounting books is an art with historical information.

## **SEMESTER –II**

### **CODE: 201 Titles: INTERNATIONAL BUSINESS AND BUSINESS ENVIRONMENT**

UNITS 1: Introduction

2. Liberalization
3. Privatization and Globalization
4. Foreign Capital
5. W.T.O. and Trade Policy

#### **Learning Objectives:**

By studying this subject, students will be able to understand the business environment, location, customer behavior, and the trends of business in the competitive business world. How to satisfy the customers through the fair dealings also will be known to those who selected the business as an economic activity for their life career planning. Liberalization, privatization, and globalization concepts their importance in the international business and in foreign trade to gain foreign exchange also will be enlightened. The policy matters, rules and regulations stipulated by the government from time to time, tax policies will be updated to the students who will be in the business field in their future.

### **CODE: 202 Title: Marketing management**

1. Formulate a *marketing plan* that will meet the needs or goals of a business or organization.

2. To know for new product development and marketing implications.
3. To know the price management for strategy based and demand-based pricing.
4. Develop strategies for the efficiency to promoting mix for various modules.
5. Evaluate the impact of using different marketing intermediaries for marketing channels.
6. Evaluate the digital marketing strategy practices in the real world

**CODE: 203 Titles: Human Recourse Management**

1. To develop the understanding of the concept of human resource management and to understand its relevance in organizations.
2. To develop necessary skill set for application of various HR issues.
3. To analyze the strategic issues and strategies required to select and develop manpower resources.
4. To integrate the knowledge of HR concepts to take correct business decisions.

**CODE: 204 Titles: Investment Management**

1. Students will be able to understand the characteristics of different financial assets such as money market instruments, bonds, and stocks, and how to buy and sell these assets in financial markets.
2. Students will be able to understand the benefit of diversification of holding a portfolio of assets, and the importance played by the market portfolio.
3. Students know how to apply different valuation models to evaluate fixed income securities, stocks, and how to use different derivative securities to manage their investment risks.

**CODE: 205 Title: Advanced Managerial accounting**

Students can:

- 1 Explain the concept and importance of management accounting for businesses

2. Apply different techniques of managerial accounting information in business decisions making
3. Learn various techniques of inflation accounting.
4. Examine the use of budgets in business organizations. Prepare and plan the budget planning for each unit or activity of the firm
5. To acquire the business mergers and acquisition for evaluating the financial performance.

### **SEMESTER-III**

#### **CODE: 301 Title: RESEARCH METHODOLOGY & STATISTICAL ANALYSIS**

- UNITS: 1. Introduction – Quantitative Techniques
2. Sources of Data – Processing & Presentation
  3. Interpretation – Report writing
  4. Probability – Distributions
  5. Association of Attributes – Chi Square test.

**Learning Objectives:** By studying this subject, student habituates statistical analysis and project preparation in their life career because this subject will create awareness on selection of project title, collection and process of data, its analysis, interpretation, tabulation of data, application of statistical testing tools and discussion of the results. Finally, this subject is very much useful to the students in their life to find out a solution for their problems with the available alternative solutions. Analytical techniques, problem solvation capacity will also be improved to students to find out best alternative.

#### **CODE: 302 Title E-Commerce**

1. The students will have insights to the fundamental concept of e-commerce and the importance of e-commerce in today's business environment.
2. The students can benefit from their own ecommerce website, where they can sell their own products or services.
3. Students can learn ecommerce as a flexible solution for both businesses and buyers.
4. Students will be made aware of existing problems and concerns in E-commerce.
5. Students will build the awareness towards different businesses models

6. Students will receive an overview on various issues of legal and regulatory framework and other environmental challenges related to E-commerce
7. To Understand the limitations of manual accounting and advantages of computerized accounting.
8. Integrate technical skills with financial accounting procedures.
9. Explain the process of maintaining inventory and day-to-day transactions in Tally accounting software.
10. Manage account receivables and payables in ERP.

**CODE: 303 Titles: Cost Accounting and Control**

1. Global Oriented – Demonstrate awareness, knowledge and appreciation of global business operations and practices. Multidisciplinary – Demonstrate knowledge about the different functions of
2. Business and show an appreciation and integration of functional business areas. Change Oriented – Make use of adaptive and innovative skills
3. Experiential – Develop practical working experience through participation and
4. Contribution to community and societal causes. Initiative and Problem-Solving Abilities – Collect and analyse data to provide business solutions.

**CODE: 304 Titles: SECURITY ANALYSIS AND PORTFOLIO MANAGEMENT**

UNIT- 1 Security analysis – Fundamental/Technical/ and Company Analysis

2. Valuation of Securities/Bonds
3. Capital Market Theory – Arbitrage Price Theory
4. Portfolio Performance Evaluation
5. Portfolio Revision

**Subject Learning Objectives:**

By studying this subject, Capital investment concepts will be known. To invest in a company or in a project, its thorough fundamental analysis, Economic analysis, Company analysis is must to all before select to invest. This subject will give an idea of analysis. If anybody selected this field for their future career planning, it will be useful to them. Assessment of company stock and its portfolio management also can be known to the students. Selection of a company on different dimensions, like technical and economic progress is the base for investment. Different theories like Dow Theory, Efficient Market Theory, and economic wave theory in the technical analysis will give an idea of stock movement trends to the students.

**CODE: 305 Title: International financial Management**

1. To recognize the difference in the operations in the international and domestic financial markets
2. To explain the various ways the exchange rate evolved over the years in the international markets.
3. To analyses and prepare the Balance of Payments account for a country.
4. To recognize the operations in the currency market and solve the exchange rate determination in spot and forward markets. To examine the Parity relationship in exchange rate determination
- 5.To explain the exchange rate fluctuations in the market and recognize opportunity of managing exchange risk using the forward markets.
- 6.To recognize the operations of the international capital budgeting and cost of capital
- 7.To explain international instruments like euro notes, euro deposits, euro currencies.

**SEMESTER-IV**

**CODE: 401 Titles: Quantitative Techniques for Business Decisions**

1. Apply quantitative techniques to translate a real-world problem for business decisions using Mathematical tools.
2. Understand the topic of linear programming problem and its use in practical problems for optimization.

3. Develop fundamental applications of those tools in industry and public sector in contexts involving uncertainty and scarce or expensive resources.
4. Illustrating with the design implementation and analysis of computational experiments.
5. Understand the concept of operation research to optimize the solution.
6. Ability to work in a team: specifically, to solve larger problems, communicate technical knowledge, partition a problem into smaller tasks, and complete tasks on time.

### **CODE: 402 Titles: BUSINESS CORPORATE TAX**

- UNIT: 1. Assessment of Partnership firms & A.O.P
2. Assessment of Companies I.
  3. Assessment of Companies II
  4. Cooperative Societies and Trusts
  5. G.S.T conceptual theory, assessments, and Practice

By studying this subject, students will get awareness on the tax concepts, assessment of income, total income, assessment of tax liability, procedures of computation tax assessment with appropriate updated tax slabs with allowing deductions under various section. Procedures of computation of income and tax assessment are varied from nature of organization i.e., Partnership, Company, Coop-Societies, trusts in respect of tax slabs and deductions. Students must be able to understand latest slabs, modified deductions according to the latest Finance bill i.e., Budget. Students can select as their future life career as income tax Practice and as Tax advisor to the assesses.

### **CODE- 403 Titles: Strategic Management**

1. To expose students to various perspectives and concepts in the field of Strategic Management
2. The course would enable the students to understand the principles of strategy formulation, implementation and control in organizations.
3. To help students develop skills for applying these concepts to the solution of business problems
- 4 To help students master the analytical tools of EVA, MVA, Balanced scorecard of strategic management

5. The students will know about the various Categories of issues like financial, accounting, marketing, human resource and organizational issues etc.
6. The students will understand the strategic control and operational control.

**CODE: 404 Titles: FINANCIAL SERVICES**

- Unit 1: 1. Introduction of Financial Services.
2. Lease Hire Purchase and Housing Finance
  3. Mutual Funds
  4. Discounting, Factoring & Forfeiting
  5. Securitization of debts

**Learning Objectives:**

By studying this subject student will get awareness on the various Financial Services provided by the banks and Financial Institutions to the business organisations to implement their long-term projects. Some of those are Lease, Bills discounting, hire Purchase, loan syndication, factoring, forfeiting, etc are the common financial services to the business organization. It is useful to the students in their future who wants to start companies, and industrial organizations. Mutual funds, and equity investment are very common in the business organization to meet the future working capital requirements. These concepts will create much awareness to the students for their future business planning and strategies

**CODE-405 Title: Financial Derivatives**

1. Students will understand the needs of financial derivatives
2. The students enable to select right kind of derivatives among forward, futures, options, and swaps
3. To understand the option piecing models.
4. It will be enabled to understand arbitragers, hedgers, and speculation
5. Students will understand swapping problems
6. To understand stock index market.

**CODE: 355 Titles: Project Work**

1. Understand the areas of Business Research Activities with reference to the electives.
2. Conduct the research in the field of electives offered.
3. Develop the most appropriate methodology for their research studies.

- 4 Use different research methods and techniques to conduct data analysis
5. Drive a valid conclusion after detailed analysis.

## M. Sc. Mathematics Course Outcomes(COs)

### SEMESTER-I

#### **PAPER -I: ABSTRACT ALGEBRA (M-101)**

- CO1. Demonstrate competence with the basic ideas of algebra including the concepts of direct products, finitely generated abelian groups.
- CO2. This course is combination of basic group theory and advanced group theory and gives proper understanding of group, after learning these subject students are prepared for basic Algebra.
- CO3. Gain knowledge of normal subgroups, permutation group, normal series, solvable group and nilpotent group.
- CO4. With this course students are prepared to learn about higher mathematics, like prepared to learn about ring theory and field theory, Galois Theory.
- CO5. This course involved rings, ideal, homeomorphism rings and introduction of module.

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#### **PAPER-II: MATHEMATICAL ANALYSIS (M-102)**

- CO1. Describe fundamental properties of the real numbers that lead to the formal development of real analysis.
- CO2: Comprehend regions arguments developing the theory underpinning real analysis
- CO3: Student will understand the generalize metric space, compact-sets, connected sets.
- CO4: Student will understand the need to generalize the concept of Riemann-steiltinjes integration.
- CO5. Acquire the knowledge of sequence, series and uniformly convergence- continuity.

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#### **PAPER-III: ORDINARY DIFFERENTIAL & PARTIAL DIFFERENTIAL EQUATIONS (M-103)**

- CO1: Find solutions of partial differential equations and determine the existence, uniqueness of solution of partial differential equation.



CO2: Find out the complete integral by Charpits method and also find the particular integral, singular integral

CO3: Solve simple eigenvalue problems of Sturm-Lowville type. Classify partial differential equations and transform into canonical form. Solve Elliptic, parabolic and hyperbolic differential equations.

CO4: Solve linear partial differential equations of both first and second order. CO5. student will be understanding the generalize of bessels, lagendre polynomial etc...

CO5: Apply specific methodologies, techniques to conduct research and produce innovative results in the area of specialization.

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#### **PAPER-IV: ELEMENTARY NUMBER THEORY (M-104)**

CO1. Demonstrate factual knowledge including the mathematical notation and terminology of number theory.

CO2. Construct mathematical proofs of statements and find counterexamples to false statements in Number Theory.

CO3. Prove results involving divisibility and greatest common divisors; Solve systems of linearcongruences;

CO4. Find integral solutions to specified linear Diophantine Equations; Apply Euler-Fermat's Theorem to prove relations involving prime numbers;

CO5. Apply the Wilson's theorem.

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#### **PAPER-V: DISCRETE MATHEMATICS (M-105)**

CO1: Demonstrate knowledge of how Tautologies, Quantifiers, Predicates and Validity are defined. Explain Boolean algebra and circuit design.

CO2: Explain Boolean algebra and circuit design. Application of Boolean algebra of switching theory using AND, OR and NOT gates.

CO3: Application of Boolean algebra of switching theory using AND, OR and NOT gates.

CO4: Students will understand the language of graphs and trees, Students will understand the use of graphs as models, Students will understand various types of trees and methods for traversing trees.

CO5: Students will understand the generating functions recurrence relations. Student will describe and solve some real time problems using the concepts of graph theory.

## SEMESTER-II

### **PAPER –I: GALOIS THEORY (M-201)**

CO1. Derive and apply Gauss Lemma, and Eisenstein criterion for irreducibility of Polynomials.

CO2. Demonstrate Field extensions and characterization of finite normal extensions as splitting fields and study prime fields.

CO3. Learn Fundamental theorem of Galois Theory, fundamental theorem of Algebra and related results, appreciate genius in proving strong important theorems at early age.

CO4. Understand cyclotomic polynomials, cyclic extensions, Radical field extensions and Ruler & Compass constructions. Know the important applications of Galois Theory.

CO5. When one completes an introductory course on Galois theory one will be able to visualize and appreciate the necessity of acquiring deep mathematical thought to be able to solve certain seemingly simple questions such as insolvability of quintic by radicals. The course provides an opportunity to the student to learn highly sophisticated and deep concepts in algebra such as algebraically closed fields, splitting fields, normal and separable extensions.

CO6. Apply problem-solving using advanced algebraic techniques applied to diverse situations in physics, engineering and other mathematical.

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### **PAPER-II: LEBESGUE MEASURE & INTEGRATION (M-202)**

CO1. Students will be able to Read analyze and write logical arguments to prove mathematical concepts. Communicate mathematical ideas with clarity and coherence both written and verbally.

CO2. Understand the concept of measure and properties of Lebesgue measure.

CO3. Upon completion of this unit, the student will be able to: Study the properties of Lebesgue integral and compare it with Riemann integral.

CO4. To establish the derivative of the indefinite integral of an inferable function is equal to the integral i.e. To establish the equivalent condition an indefinite integral is absolutely continuous. Jensen inequality becomes a generalization of the inequality between the arithmetic and geometric mean.

CO5. The student will be able to establish several inequalities involving the  $\|\cdot\|_p$  in the  $L^p$  spaces. To find a representation for bounded linear functions.

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### **PAPER- III: COMPLEX ANALYSIS (M-203)**

CO1. Define a function of complex variable and carry out basic mathematical operations with complex numbers. Know the condition(s) for a complex variable function to be analytic and/or harmonic. State and prove the Cauchy Riemann Equation and use it to show that a function is analytic. Define singularities of a function, know the different types of singularities, and be able to determine the points of singularities of a function.

CO2. Evaluate Complex integrals by applying Cauchy integral formula.

CO3. Differentiate the Taylor's series and Laurent series. Understand the concept of sequences and series with respect to the complex numbers system and establish whether a given series/ sequences is convergent/ divergent at a specified point or interval. Evaluate line integrals, curve integrals, singularities and determine the values of integrals using residues.

CO4. Understand Residue theorem, the argument principle and Rouché's theorem, and Compute integrals using residues. Explain the concept of transformation in a complex space (linear and non-linear) and sketch associated diagrams.

CO5. With these course students are prepared to learn about advance complex analysis. Comprehend rigorous arguments developing the theory underpinning complex analysis.

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### **PAPER-IV: TOPOLOGY (M-204)**

CO1. Topology uses to analyses complex network Ex: Social networks, biological networks, Internet etc.

CO2. It applies Differential Topology to probability to identity multivariate interactions. This was used in neuron science recently to deduce how neurons are interacting.

CO3.This paper discusses using cell phones to actually map out the topology of indoor spaces.

CO4. Define and illustrate the concept of topological spaces and continuous functions, concept of product topology and quotient topology, Identify the concepts of distance between two sets, connectedness, denseness, compactness and separation axioms.

CO5. Analyze the concepts to read and write theorem proofs in topology Ability to determine that a given point in a topological space is either a limit point of not for a given subset of a topological space. Apply theorem proofs to do variety of examples and counter examples in topology.

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**PAPER-V : THEORY OF ORDINARY DIFFERENTIAL EQUATIONS. (M-205)**

CO1. Students will learn the variation of parameters method to find the solution of higher order linear differential equations with variable coefficients.

CO2. Students will understand the concept of successive approximations, Lipchitz condition and Picard's theorem

CO3. Gain the knowledge of extremal solutions of non-linear differential Equations.

CO4. Learn the concepts of self-adjoint linear differential equations in oscillation theory.

CO5. Know some standard theorems in osciation theory

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## SEMESTER- II

### **PAPER-I: FUNCTIONAL ANALYSIS (M-301)**

CO.1. Upon successful completion of this course, the student will be able to:

CO.2. Explain the fundamental concepts of functional analysis and their role in modern mathematics and applied contexts

CO.3. Demonstrate accurate and efficient use of functional analysis techniques.

CO.4. Demonstrate capacity for mathematical reasoning through analyzing, proving and explaining concepts from functional analysis.

CO.5. Apply problem-solving using functional analysis technique, applied to diverse situations in physics, engineering and another mathematical context.

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### **PAPER-II: GENERAL MEASURE AND INTEGRATION(M-302)**

CO1. Learn the properties of measurable sets and measurable functions in a measure space

CO2. To know about convergence theorems in measure space.

CO3. Gain knowledge in signed measures, Decomposition theorems and  $L^p$  spaces.

CO4. Learn outer measurability, product measures and fubini's theorem.

CO5. To know the concept of inner measure and relation between inner and outer measure.

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### **PAPER-III: LINEAR ALGEBRA (M-303)**

CO.1. Finding eigenvalues and eigenvectors of a matrix or a linear transformation, and using them to diagonalizable a matrix. Finding minimal polynomial.

CO.2. They will be able to prove and apply the Primary Decomposition Theorem, and the criterion for diagonalisability.

CO.3.They will be able to prove and apply cyclic decomposition theorem, and the rational form.

Co.4. Students will be able to understand bi-linear form, symmetric and skew-symmetric linear form.

CO.5. Demonstrate capacity for mathematical reasoning through analyzing, proving and explaining concepts from field extensions and Galois theory.

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#### **PAPER-IV(A): OPERATIONS RESEARCH (M-304)**

CO1. To impart knowledge in concepts and tools of Operations

Research & solve Linear Programming Problems

CO2.To know about mathematical models used in Operations Research & Solve Transportation and Assignment Problems

CO3. To apply these techniques constructively to make effective business decisions

CO4.To learns the methods of solving dynamic programming problems.

CO5. To know the techniques in PERT & CPM and apply them in construction and software fields.

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#### **PAPER- V(B): NUMERICAL ANALYSIS (M-305)**

CO1: Demonstrate and understanding of common numerical methods and how they are used to obtain approximate solutions to intractable mathematical problems.

CO2: Apply numerical methods to obtain approximate solutions to mathematical problems.

CO3: Derive numerical methods for various mathematical operations and tasks, such as interpolation, differentiation, integration, the solution of linear and nonlinear equations, and the solution of differential equations.

CO4: Analyze and solve several errors and approximation in numerical methods.

CO5: Apply several methods to solve Curve Fitting and Interpolation questions and its related techniques.

#### SEMESTER IV

#### **PAPER-I: INTEGRAL EQUATIONS AND CALCULUS OF VARIATIONS (M-401)**

CO1: Solve linear Volterra and Fredholm integral equations using appropriate methods. Understand the relationship between integral and differential equations and transform one type into another.

CO2: Find out the iterate kernel and Resolvent kernel of Volterra, Fredholm integral equation.

CO3: Application of integral equation and greens function to solve ordinary differential equation. Applying Laplace transformation.

Co4: They will know application of calculus of variation

CO5. Learn easier & systematic way to ordinary and differential equations and partial differential equations. Develop the skills while doing/solving the various problems by using integral equations in all engineering sciences and etc.

#### **PAPER-II: ELEMENTARY OPERATOR THEORY (M-402)**

CO1. Relate the behavior of different kinds of operators acting on finite dimensional and infinite dimensional spaces

CO2. Apply the theory of unbounded operator to differential equations and Difference equations

CO3. Apply the concept of unbounded linear operators in Hilbert spaces Understand the concept of different kinds of bounded linear operators on Hilbert spaces such as, self-adjoint operator, unitary operator, normal operator etc.

CO4. Understand the idea of spectral representation of compact self-adjoint operators and bounded self-adjoint operators

CO5. Understand the difference between the eigenvalue of an operator and spectrum of an operator.

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**PAPER-III: ANALYTICAL NUMBER THEORY (M-403)**

- CO1. Understand the concepts of averages of arithmetical functions prove and apply properties of multiplicative functions such as the Euler’s summation formula
- CO2. Understand the proof of dirichlet’s theorem. Understand Dirichlet characters and analytic properties of Dirichlet functions
- CO3.Understand Chebyshev's functions  $\psi(x)$ and  $I(x)$  and the Relations connecting  $I(x)$  and  $\pi(x)$ , Some equivalent forms of the prime number theorem, Inequalities of  $\pi(n)$  and  $p_n$  to study some applications of Shapiro's Tauberian theorem.
- CO4.Understand the basic methods of analytical numbers including abel’s summation and Mobius inversion.
- CO5.Understanding the concept of finite abelian groups and character.

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**PAPER-IV (B): GRAPH THEORY (M-404)**

- CO1. Understanding of some network and colouring in Graph theory.
- CO2. Understand the concept of trees and algorithms for finding minimal spanning tree.
- CO3. Apply the concepts of connectivity, Blocks and Hamilton cycles in the real life.
- CO4. Demonstrate the concept and familiar with the concepts of colouring develop the reader to apply in day today life.
- CO5. Emphasis on some of the concepts in graph theory and the readers to apply in day today life.

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**PAPER-V (B): ADVANCED OPERATIONS RESEARCH (M-405)**

- CO1. Understand the usage of game theory and simulation for Solving Business Problem
- CO2. To apply inventory techniques constructively to make effective Business decisions



CO3. To learn and construct the legrangian function & solving problems in non-linear programming problem

CO4. To know the concepts and methods to solve Quadratic programming Problems

CO5. To gain flexible problem-solving skills based on a deep knowledge of operational research.

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## M.Sc. Organic Chemistry Course Outcomes (COs)

### **SEMESTER-I**

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#### **PAPER-I CH-101(Inorganic Chemistry)**

Students are able to learn and

Co:1-Explain the concept of symmetry element, symmetry operation and point groups.

Co:2-Classify and identify symmetry elements and their operations.

Co:3- Assign point group from all molecules and identify the molecule to which point group it belongs.

Co:4-Explain crystal field theory remembers the splitting of d-orbital in different geometries like octahedral tetrahedral, square plannae, trigonal plannar, trigonal and pentagonal bipyramidal etc. and CFSE calculations.

Co:5-Classify the molecules into para, diamagnetic, ferro and Anti-ferro, Determination of magnetic suceptability experimentally and magnetic moment and their applications, High-Low spin cross over.

Co:6-Define Binary complexes HSAB rule, stability constants, macrocyclic effect, cryplate effect, john teller effect, ternary complexes.

Co:7-Determination of stability constants experimentally P<sup>H</sup>-metric method, spectrophotometric and polarographic methods.

Co:8-Describe MOB for CO, NO and N<sub>2</sub> and their bonding modes, bond rind techniques, donar and acceptor orbitals.

Co:9-Define 18 electron rules, explain the structures with examples.

## **PAPER-II CH-102 (Organic Chemistry)**

Students are able to learn and

Co:1-Determine the configuration in E and Z isomers.

Co:2-Explain the symmetry elements and symmetry operations in molecules.

Co:3-Explain Racemisation and resolution techniques.

Co:4-Explain the criteria for chirality.

Co:5-Describe the methods of determination of relative and absolute configurations.

Co:6-Explain the mechanism of elimination reactions and electrophilic addition to c-c double bond.

Co:7-Discuss the various methods of determination of reaction mechanism.

Co:8-Discuss the conformations in saturated and unsaturated acyclic compounds and the factors affecting the stability and reactivity od conformations.

Co:9-Expalin the general methods in structure determination of terpenoids and alkaloids.

Co:10-Explain the nomenclature, synthesis and reactivity of heterocyclic compound.

## **PAPER-III-CH-103: PHYSICAL CHEMISTRY**

Students are able to learn and

Co:1-Discuss about concepts of entropy

Co:2-Cetermine the third law of thermodynamics

Co:3-Explain briefly about Gibbs equation for non-equilibrium systems and material equilibrium phase equilibrium

Co:4-Briefly discuss about solutions

Co:5-Discuss about electrochemical cells and applications of EMF measurements

Co:6-Explain the concept of activity and activity of coefficients in electrolytic solutions and mean ionic activity coefficient, Debye Huckel theory of electrolytic solutions

Co:7-Write about concept of ion association

Co:8-Determine the black body radiation, planks concept, quantization and planks equation

Co:9-Discuss about operators and postulates of quantum mechanics

Co:10-Explain theories of reaction rates and complex reaction

Co:11-Write effect of structure on reactivity

#### **PAPER-IV CH-104(Analytical techniques and spectroscopy)**

Students are able to learn and

CO:1- Discuss the classification of chromatographic techniques and explain rate theory in chromatographic separations.

Co:2- Explain the principle and instrumentation of GC and HPLC also briefly describe methods of quantification of GC and HPLC.

CO:3-Explain the principle of  $^1\text{H-NMR}$  spectroscopy, instrumentation, chemical shift, factors affecting them, signal integration, spin-spin coupling, coupling constants and factors affecting them and application of  $^1\text{H-NMR}$  spectroscopy.

CO:4-Discuss the application of rotational spectra in calculation of bond length of diatomic molecule with suitable examples.

Co:5-Explain isotopic effect on rotational spectra with suitable examples.

Co:6-Calculate force constant from vibrational frequency and explain concept of group frequency.

Co:7-Explain how IR-spectroscopy is useful for identification mode of bonding in metal-nitrate complex.

Co:8-Explain quantum theory of Raman effect.

Co:9-Discuss the complimentary nature of IR and Raman spectra.

Co:10-Explain the application of Beer's law in the determination of dissociation constant of weak acid.

Co:11-Briefly account for the absorption spectra of charge transfer complexes.

Co:12-Identify the  $\lambda_{\text{max}}$  value for different compounds based on Woodward-Fieser rule.

## **PAPER V: INORGANIC CHEMISTRY PRACTICAL CO'S**

Students are able to learn

- **PREPARATION OF COMPLEXES:**
- To make the students understand the various requirements for coordination complex preparation and Analysis are practiced.
- After completion of Complex Preparation, students get thorough knowledge in valence bond theory, crystal field theory & hybridization.
- Estimation of metal ion (volumetric method):
- Quantitative analysis procedure based on measures of volumes of reaction in solutions.
- The students learn to estimate metal ion concentration through volume
- Gravimetric Analysis:
- A method of quantitative chemical analysis in which the mass of an ion is measured in pure form & their mass% is calculated
- It is the most accurate and precise method of macro quantitative method.
- Finally, the students learn the difference between the methods volumetric & gravimetric analysis and also accuracy

## **PAPER-VI ORGANIC CHEMISTRY**

**Title: Synthesis of organic molecules**

- Co:1 Students acquired the knowledge about Heating of reaction mixture on

- water bath for a specific time period
- Co:2 Students able to learn Refluxing the reaction mixture with different
- condensers based on requirement
- Co:3 Students experiences Cooling of reaction mixture in ice depending up on
- condition of the reaction
- Co:4 Students practices the Filtering under suction pump to get crude
- Co:5 Students involves in Recrystallization of crude to get pure compound
- Co:6 Students get knowledge on Calculation of yield and percentage of yield
- Co:7 Students know information about Determination of melting point

### **PAPER VII: PHYSICAL CHEMISTRY PRACTICAL CO'S**

- Students able to learn and
- Able to perform experiments individually and gain knowledge about principles and techniques involved in various experiments
- Acquire Experimental skills & handling instruments
- Gain Knowledge in Prediction & verification of Experimental results by graphical method

## **SEMESTER-II**

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### **PAPER-I CH-201(Inorganic chemistry)**

Students are able to learn and

Co:1- Define activated complex, transition state intermediate, from energy profile diagram. Classify substitution reactions like  $SN^1$ ,  $SN^2$ , acid hydrolysis, base hydrolysis, anation reaction, substitution without M-L bond cleavage.

Co:2-Discuss how ligand substitution reaction takes place in octa hedral and square planar complexes. Trans effect, applications and theories, marcus-hush theory.

Co:3-Explain different types of electron transfer reactions and factors affecting them.

Co:4-Define the terms, state and microstate and their calculations.

Co:5-Explain different types of coupling hole formalism, hunds rule and parameters.

Co:6-Classify carbonyl clusters and their structures patterns.

Co:7-Explain metal carbonyl scrambling, polyhedral skeletal electron pair theory total electron count, coupling rule.

Co:8-Describe structural patterns in dinuclear metal-metal systems.

Co:9-Discuss about boranes, carborane, STYX rule.

Co:10-Explain how metal take part in biological system and their concentration effect and physiological effect on biological system.

Co:11-Determine the structures of myoglobin, hemoglobin, oxygenation, cooperativity of hemoglobin and myoglobin.

Co:12-Discuss photosynthesis, PS-I, PS-II vit -b<sub>6</sub> catalyzed reactions.

## **PAPER-II CH-202T (Organic Chemistry)**

Students are able to learn and

Co:1-Explain nucleophilic aromatic substitution reactions.

Co:2-Discuss about neighboring group participation.

Co:3-Explain about the ambient nucleophiles.

Co:4-Discuss about pericyclic reactions.

Co:5-Explain about the FMO theory or HOMO-LUMO approach.

Co:6-Discuss about the aromatic transition state (AST) theory or perturbation molecular orbitals (PMO) approach.

Co:7-Explain the photo-chemistry of ( $\pi-\pi^*$ ) transitions.

Co:8-Discuss about the photo-chemistry of ( $n-\pi^*$ )

## **PAPER- III-CH-203 Physical Chemistry**

Students are able to learn and

Co: 1-Write briefly about ideal solutions, thermodynamic properties of ideal solutions and mixing quantities

Co: 2-Discuss about multicomponent phase equilibrium

Co: 3-Explain the non-ideal systems, concepts of fugacity, activities and activity coefficients

Co: 4-Determine the statistical thermodynamic

Co: 5-Write briefly about electronic transitions in molecules and frank Condon principle, electronically excited molecules

Co: 6-Discuss about actinometry

Co: 7-Explain E-Type delayed florescence and photo physical processes

Co: 8-Determine the types of photochemical reaction

Co: 9-Explain about fast reactions

Co: 10-Explain briefly about Schrodinger equation for the hydrogen atom

Co: 11-Discuss about variation method and variation parameters

Co: 12-Discuss about electronic properties of metals, insulators and semi-conductors and nanoparticles and applications

Co: 13-Explain briefly about introduction of nanoparticles and reduced dimensionality n solids and applications of nanoparticles

## **PAPER-IV CH-204 (Analytical techniques and spectroscopy-II)**

Students are able to learn and

Co:1-Discuss types of thermo analytical methods.

Co:2-Explain the instrumentation, principle and application of cyclic voltametry.

Co:3-Give a brief account of

- i) A.C. polarography
- ii) Square wave polarography
- iii) Pulse polarography
- iv) Different pulse polarography

Co:4-Discuss the principle and application of thermogravimetry, different thermal analysis and different scanning calorimetry.

Co:5-Differentiate first order and non-first order spectra.

Co:6-Explain the phenomenon of NOE with suitable examples.

Co:7-Explain the principle involved in magic angle spinning NMR.

CO:8-Distinguish the enantiomers by using chiral NMR solvents and chiral lanthanide shift reagent and explain Mosher's acid.

Co:9-Discuss the principle and instrumentation of different types of mass spectrometer.

Co:10-Outline salient features of fragmentation pattern of organic compounds.

Co:11-Discuss principle, instrumentation of electron spin resonance spectroscopy and its application.

## **Semester –II**

### **Paper -V: Inorganic practical co's**

Students are able to learn

1. Analysis of two components & three components:

- Students learn how to separate the metal ions from the mixture and estimate separately.
- It helps to limit the number of instrumental errors when measuring the masses of substances.

2. Applied titrimetric analysis:



- Determination of iron and calcium in cement
- Students learn how to estimate the amount of iron & calcium present in cement
- Complex formation takes place, in which a blue dye Eriochrome Black T is used as the indicator
- Ion exchange method of Analysis:
- Students determine the capacity of ion exchange resin.

Students learn separation of zinc & magnesium on an anion exchange resin and estimation of  $Mg^{+2}$  and  $Zn^{+2}$ .

## **PAPER-VI ORGANIC CHEMISTRY**

**Title: Identification of unknown organic compounds by qualitative analysis and spectroscopy**

Co:1 Students know information about Determination of physical constants

Co:2 Students able to learn about ignition test

Co:3 Students experiences Lassaigne test process

Co:4 Students practices sodium metal fusion

Co:5 Students involves in extract preparation to know extra elements

Co:6 Students get knowledge on derivatives preparation

## **Paper -VII: Physical Chemistry practical co's**

Students able to learn and

- Able to perform experiments individually and gain knowledge about principles and techniques involved in various experiments

- Acquire Experimental skills & handling instruments
- Gain Knowledge in Prediction & verification of Experimental results by graphical method

### **SEMESTER-III**

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#### **PAPER-I CH-301T; Synthetic reagents, advanced NMR, conformational analysis and ORD**

Students able to learn and

CO:1-Explain the protection of various functional groups.

Co:2-Explain the methods of preparation and applications of organometallic reagents like organolithium, organo copper, organosilicon, organoborane reagents in organic synthesis.

Co:3-Discuss about the reagents used in carbonyl methylation.

Co:4-Discuss different types of reagents used for oxidation and reduction reactions.

Co:5-Write down the different types of CMR spectra.

Co:6-Discuss the factors affecting chemical shift on CMR and applications of CMR.

CO:7-Discuss about the conformations in cyclic compounds.

Co:8-Explain optical rotator dispersion and how it is used for the determination of structure of chiral molecules.

Co:9-Write down the different types of 2D-NMR techniques.

Co:10-Write down the factors governing the reactivity of axial and equatorial substitutions in cyclohexane.

#### **PAPER-II CH-302T: Modern organic synthesis**

Students able to learn and

Co:1-Explain the conditions for stereoselectivity and methods of inducing enantioselectivity.

Co:2-Determine enantiomeric excess by specific rotation, chiral nmr, chiral derivatizing agents, chiral solvent, chiral shift reagent and by chiral HPLC method.

Co:3-Explain diastereoselective aldol reaction by Zimmerman taxel model.

Co:4-Explain chiral reagent controlled asymmetric synthesis using BINAL-H and asymmetric hydroboration using  $\text{IPC}_2\text{BH}$  and  $\text{IPCBH}_2$ .

CO:5-Discuss the terminology, criteria for selecting target, synthesis involving chemo and region selectivity, reversal of polarity and cyclisation involved in retero synthesis analysis.

Co:6-Explain order of events one bond and two bond c-c and c-x disconnection and control in carbonyl condensation with examples.

Co:7-Define strategic bond and discuss guidelines for disconnection with great simplification using symmetry and corresponding to known reliable reaction, retrosynthesis of retrocenc, longifoline.

Co:8-Explain new synthetic reactions involving c-c coupling reaction, c=c formation reaction, multi component reactions.

Co:9-Explain click reaction, Grubbs first- and second-generation catalyst, olefin cross coupling, ring closing metathesis, ring opening metathesis and its application.

Co:10-Explain the new techniques and concepts used in synthesis of peptides, oligosaccharides and oligodeoxynucleotides.

Co:11-Apply Baldwin rules for cyclisation of various compounds.

Co:12-Discuss Chiron approach in organic synthesis and determine the absolute configuration by Mosher's method.

### **PAPER-III CH-303T (CB1): Bioorganic Chemistry**

Students able to learn and

CO1: Explain the ring size in Glucose, Fructose, and sucrose.

CO2 Have an Synopsis on the structure, synthesis of mono saccharides having amino, halo, thio sugars.

CO3: Discuss the on primary, secondary and tertiary structure of DNA and RNA and their different types

CO4: Remembering the knowledge on Replication, transcription, translation, genetic code and DNA fingerprinting, structure and synthesis of nucleosides and nucleotides.

CO5: Re collect the knowledge on the nomenclature, biological importance of different structure of proteins and Methods for end group analysis.

CO6: Discuss the classification of enzyme based on mode of action and factors affecting enzyme catalysis Enzyme models, Enzyme inhibition and immobilized enzymes.

CO7: Differentiate the liposome, miscel and structure, biosynthesis and biological functions of different type of Coenzymes, vitamins, Lipids, phospholipids, glycolipids.

### **PAPER-IV CH(OC) 304(CB3) Green chemistry and Organic Materials**

Students able to learn and

CO1: Discuss the nano manipulation, molecular wires, molecular switches, molecular muscles

CO2: Explain the microwave assisted organic synthesis

CO3: Have an idea about green solvents & ionic liquids in organic synthesis.

CO4: Discuss the Enantioselective molecular recognition by kemp's tri acid, tartaric acid, crown ethers

CO5: Know about the rectifiers, liquid crystals, nano tubes, flurenes

CO6: Discuss the green synthesis based on principles like designing of safer chemicals, bio degradable products, un necessary dervatization.

### **Laboratory Course Outcomes**

### **Paper CH(OC) 351P: Synthesis of Organic Molecules, Isolation of Natural Products &TLC**

Students able to learn and

- Synthesize the Organic Molecules in laboratory by maintaining different reaction condition.
- Finding the purity and melting point of the prepared organic molecules.
- Have basic knowledge of the source and isolation of natural products.
- Have theoretical knowledge of synthesis above mentioned natural products.
- Via gaining the knowledge of this subject, one can predict the path for structure elucidation of unknown naturally occurring organic compounds.
- By using Thin Layer Chromatography, we can able to separate mixture of compounds depending of  $R_f$  value
- TLC is used to monitoring the progress of chemical reaction
- Purity of prepared organic molecule can be identified by using TLC technique.

### **Paper CH (O) 352P: Separation and identification of organic compounds & Column Chromatography**

Students able to learn and

- To develop Practical skills in separation of organic mixtures.
- Gain hands on experience in identification of organic compounds.
- Separation of mixtures by column chromatography.

## **SEMESTER-IV**

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### **Paper –I CH(OC) 401T: Drug Design and Drug Discovery**

Students able to learn and

CO1: Discuss the strategies involved in drug discovery

CO2: Differentiate Lead modification strategies ring fusion, rigidification

CO3: Compare the Structure-Activity Relationship studies in sulfa drugs, benzodiazepines, and taxol analogs

CO4: Discuss the various physicochemical properties of drug molecules and the linear, non-linear relationship between these and biological activity

CO5: Determine the various tools used in QSAR studies and how these are applied in the design of drugs using examples

CO6: Explain the principles of Computer aided drug design

CO7: Execute the Combinatorial approach in the process of drug discovery and plan and design combinatorial synthesis by different methods.

### **PAPER-II CH-402T (Drug synthesis and mechanism of action)**

Students able to learn and

Co:1-Explain the basic concepts in mechanism of drug action.

Co:2-Write down the mechanism of action of the drugs on metabolic processes.

Co:3-Explain the structure of bacterial cell wall.

Co:4-Discuss the synthesis and mechanism of action of penicillins and cephalosporin on the bacterial cell wall.

Co:5-Discuss the synthesis and action of drugs acting on specific enzymes.

Co:6-Explain about the nervous system, describe the structure of neuron and nerve transmission.

Co:7-Discuss about the classification of receptors.

Co:8-Write down the synthesis and biological activity of some important drugs.

Co:9-Explain about the three-point contact model.

### **Paper –III CH(OC)-403T (CB1): (Advanced Heterocyclic Compounds)**

Students able to

CO1: Explain the different types of strains in heterocyclics such as azirine, aziridine, azetidine, oxetane.

CO2: Understand the synthesis of caffeine, theophylline, theobromine by different methods.

CO3: Recollect the knowledge about the importance of purines & pyrimidines

CO4: Focusing on the differences in aromatic character of heterocyclics having more than two hetero atoms.

CO5: Have an idea about recent advances in drug synthesis by usefulness of five & six membered heterocyclic compounds with hetero atoms.

CO6: Discuss the aromaticity of both benzenoid & non-benzenoid aromatic compound based on Huckel's rule.

#### **PAPER-IV CH(OC)-404(CB3) T- (Advanced natural products)**

Students able to learn and

Co:1-Determine the biosynthetic mechanism, isolation and identification of biosynthetic precursor and feeding experiments of secondary metabolites.

Co:2-Explain Acetate-Malonate pathway, shikimic acid pathway and mevalonic acid pathway of secondary metabolites with examples.

Co:3-Determine structure and stereochemistry of morphine, reserpine, abietic acid, cholesterol and rosenone.

Co:4-Determine structure of natural products through spectroscopic techniques.

Co:5-Explain Mass, IR,  $^1\text{H}$ ,  $^{13}\text{C}$ -NMR, HOMOCOSY, HETCOR, DEPT, 2D-INADEQUATE and NOE of Geraniol, Strigolactone.

CO:6-Discuss shikimic acid synthesis of L-Hexose, Danishefsky synthesis of Indolizomycin.

Co:7-Discuss Takasago synthesis of menthol, Hoffmann-Laroche synthesis of Biotin.

Co:8-Explain Nicolaou synthesis of Taxol, Corey's synthesis of  $\text{E}_2$  and  $\text{F}_2$  prostaglandins.

## **PAPER V CH(OC) 451P: Spectroscopic Identification of Organic Compounds & practice of chemistry software programmes**

Students able to learn and

- To identify the structure of the organic compounds by the applications of different Spectra like IR, UV, Mass, H1NMR &13C-NMR data.
- Able to interpret the structure of Organic compounds by analyzing Spectral data.
- Able to draw chemical structures by using chemistry software programme chemdraw.
- Get an idea on molecular docking.
- Organic qualitative analysis

## **Paper-VI CH (OC) 452P: Synthesis and analysis of drugs**

Students able to learn

- Synthesis and estimation of drugs and knowledge about the techniques and principles of experiments.
- Percentage and purity of synthesized compounds.
- Organic qualitative analysis.

## **M.Sc. ANALYTICAL CHEMISTRY**

### **Course Outcomes (COs)**

#### **SEMESTER-I**

**COURSE CODE: 585 PAPER-I CH-101(Inorganic Chemistry)**

After studying the course, the student shall be able to understand

the following concepts:

Co:1- Able to Explain the concept of symmetry element, symmetry operation and point groups.

Co:2-Classify and identify symmetry elements and their operations.



Co:3- Assign point group for all molecules and identify the molecule to which point group it belongs.

Co:4-Explain crystal field theory, remember the splitting of d-orbital in different geometries like octahedral tetrahedral, square planar, trigonal planar, trigonal and pentagonal bipyramidal etc. and CFSE calculations.

Co:5-Able to classify the molecules into para, diamagnetic, ferro and Anti-ferro, Determination of magnetic susceptibility experimentally and magnetic moment and their applications, High-Low spin cross over.

Co:6-Able to learn and define Binary complexes HSAB rule, stability constants, macrocyclic effect, cryplate effect, john teller effect, ternary complexes.

Co:7-Learn the Determination of stability constants by various methods experimentally, P<sup>H</sup>-metric method, spectrophotometric and polarographic methods.

Co:8-Describe MOB for CO, NO and N<sub>2</sub> and their bonding modes, bond rind techniques, donar and acceptor orbitals.

Co:9-Define 18 electron rules, explain the structures with examples.

## **PAPER-II CH-102 (Organic Chemistry)**

The student will be able to;

Co:1-Determine the configuration in E and Z isomers.

Co:2-Explain the symmetry elements and symmetry operations in molecules.

Co:3-Explain Racemization and resolution techniques.

Co:4-Explain the criteria for chirality.

Co:5- Determination of relative and absolute configurations.

Co:6- Learn the mechanism of elimination reactions and electrophilic addition to c-c double bond.

Co:7- Know various methods of determination of reaction mechanism.

Co:8-Learn the conformations in saturated and unsaturated acyclic compounds and the factors affecting the stability and reactivity of conformations.

Co:9-Explain the general methods in structure determination of terpenoids and alkaloids.

Co:10-Explain the nomenclature, synthesis and reactivity of heterocyclic compound.

### **PAPER-III-CH-103: PHYSICAL CHEMISTRY**

After studying the course, the student shall be able to understand the following concepts:

Co: 1-Learn about concepts of entropy

Co: 2-Determine the third law of thermodynamics

Co: 3-Explain about Gibbs equation for non-equilibrium systems and material equilibrium phase equilibrium

Co: 4- Knowing about solutions

Co: 5-Learn about electrochemical cells and applications of EMF measurements

Co: 6-Understand the concept of activity and activity coefficients in electrolytic solutions and mean ionic activity coefficient, Debye Huckel theory of electrolytic solutions

Co: 7-Know about concept of ion association

Co: 8- Learn to determine the black body radiation, planks concept, quantization and planks equation

Co: 9-Learn about operators and postulates of quantum mechanics

Co: 10-Explain theories of reaction rates and complex reaction

Co: 11-Analyze the effect of structure on reactivity

**PAPER-IV CH-104***(Analytical techniques and spectroscopy)*

The student will be able to;

CO:1- Understand the classification of chromatographic techniques and explain rate theory in chromatographic separations.

Co:2- Explain the principle and instrumentation of GC and HPLC also briefly describe methods of quantification of GC and HPLC.

CO:3-Explain the principle of  $^1\text{H-NMR}$  spectroscopy, instrumentation, chemical shift, factors affecting them, signal integration, spin-spin coupling, coupling constants and factors affecting them and application of  $^1\text{H-NMR}$  spectroscopy.

CO:4-Understand the application of rotational spectra in calculation of bond length of diatomic molecule with suitable examples.

Co:5-Explain isotopic effect on rotational spectra with suitable examples.

Co:6-Calculate force constant from vibrational frequency and explain concept of group frequency.

Co:7-Explain how IR-spectroscopy is useful for identification mode of bonding in metal-nitrate complex.

Co:8-Explain quantum theory of Raman effect.

Co:9-Understand the complimentary nature of IR and Raman spectra.

Co:10-Expalin the application of beers law in the determination of dissociation constant of weak acid.

CO;11-Learn the absorption spectra of charge transfer complexes.

Co:12-Identify the lambda max value for different compounds based on woodward-fieser rule.

## **PAPER V: INORGANIC CHEMISTRY PRACTICAL CO'S**

Students able to learn

- **PREPARATION OF COMPLEXES:**
- To make the students understand the various requirement for coordination complex preparation and Analysis.
- After completion of Complex Preparation, student's get thorough knowledge in valence bond theory, crystal field theory & hybridization.
- Estimation of metal ion (volumetric method):
- It is quantitative analysis procedure based on measures of volumes of reaction in solutions.
- The students learn to estimate metal ion concentration through volume
- Gravimetric Analysis:
- A method of quantitative chemical analysis in which the mass of an ion is measured in pure form & their mass% is calculated
- It is the most accurate and precise method of macro quantitative method.
- Finally, the students learn the difference between the methods volumetric & gravimetric analysis and also accuracy

## **PAPER-VI ORGANIC CHEMISTRY**

**Title: Synthesis of organic molecules**

- Students acquired the knowledge about Heating of reaction mixture on water bath for a specific time period
- Students able to learn Refluxing the reaction mixture with different condensers based on requirement

- Students experiences Cooling of reaction mixture in ice depending up on condition of the reaction
- Students practices the Filtering under suction pump to get crude
- Students involves in Recrystallization of crude to get pure compound
- Students get knowledge on Calculation of yield and percentage of yield
- Students know information about Determination of melting point
- **PAPER VII: PHYSICAL CHEMISTRY PRACTICAL CO'S**
- Students able to learn
- Able to perform experiments individually and gain knowledge about principles and techniques involved in various experiments.
- Acquire Experimental skills & handling instruments
- Gain Knowledge in Prediction & verification of Experimental results by graphical method

## **SEMESTER-II**

### **PAPER-I** *CH-201(Inorganic chemistry)*

After studying the course, the student shall be able to understand

the following concepts:

Co:1- Define activated complex, transition state intermediate, from energy profile diagram. Classify substitution reactions like  $SN^1$ ,  $SN^2$ , acid hydrolysis, base hydrolysis, anation reaction, substitution without M-L bond cleavage.

Co:2-Understand how ligand substitution reaction takes place in octa hedral and square planar complexes. Trans effect, applications and theories, marcus-hush theory.

Co:3-Explain different types of electron transfer reactions and factors affecting them.

Co:4-Define the terms, state and microstate and their calculations.

Co: 5Explain different types of coupling hole formalism, hunds rule and parameters.

Co:6-Classify carbonyl clusters and their structures patterns.

Co:7-Explain metal carbonyl scrambling, polyhedral skeletal electron pair theory total electron count, coupling rule.

Co:8-Describe structural patterns in dinuclear metal-metal systems.

Co:9-Discuss about boranes, carborane, STYX rule.

Co:10-Explain how metal take part in biological system and their concentration effect and physiological effect on biological system.

Co:11-Determine the structures of myoglobin, hemoglobin, oxygenation, cooperativity of hemoglobin and myoglobin.

Co:12-Understand photosynthesis, PS-I, PS-II vit -b<sub>6</sub> catalyzed reactions.

### **PAPER-II CH-202T (Organic Chemistry)**

The student will be able to;

Co:1-Explain nucleophilic aromatic substitution reactions.

Co:2-Understand about neighboring group participation.

Co:3-Explain about the ambient nucleophiles.

Co:4-Understand about pericyclic reactions.

Co:5-Explain about the FMO theory or HOMO-LUMO approach.

Co:6-Understand about the aromatic transition state (AST) theory or perturbation molecular orbitals (PMO) approach.

Co:7-Explain the photo-chemistry of ( $\pi-\pi^*$ ) transitions.

Co:8-Understand about the photo-chemistry of ( $n-\pi^*$ )

### **PAPER- III-CH-203 Physical Chemistry**

After studying the course, the student shall be able to understand the following concepts:

Co: 1-Write briefly about ideal solutions, thermodynamic properties of ideal solutions and mixing quantities

Co: 2-Understand about multicomponent phase equilibrium

Co: 3-Explain the non-ideal systems, concepts of fugacity, activities and activity coefficients

Co: 4-Determine the statistical thermodynamic

Co: 5-Write briefly about electronic transitions in molecules and frank Condon principle, electronically excited molecules

Co: 6-Understand about actinometry

Co: 7-Explain E-Type delayed florescence and photo physical processes

Co: 8-Determine the types of photochemical reaction

Co: 9-Explain about fast reactions

Co: 10-Explain briefly about Schrodinger equation for the hydrogen atom

Co: 11-Understand about variation method and variation parameters

Co: 12-Understand about electronic properties of metals, insulators and semi-conductors and nanoparticles and applications

Co: 13-Explain briefly about introduction of nanoparticles and reduced dimensionality n solids and applications of nanoparticles

#### **PAPER-IV CH-204 (*Analytical techniques and spectroscopy-II*)**

The student will be able to;

Co:1-Understand types of thermo analytical methods.

Co:2-Explain the instrumentation, principle and application of cyclic voltammetry.

Co:3-Give a brief account of

i)A.C.polarography

ii)Square wave polarography

iii)Pulse polarography

iv)Different pulse polarography

Co:4-Understand the principle and application of thermogravimetry, different thermal analysis and different scanning calorimetry.

Co:5-Differentiate first order and non-first order spectra.

Co:6-Explain the phenomenon of NOE with suitable examples.

Co:7-Explain the principle involved in magic angle spinning NMR.

CO:8-Learn to differentiate the enantiomers by using chiral NMR solvents and chiral lanthanide shift reagent and moschers acid.

Co:9-Understand the principle and instrumentation of different types of mass spectrometer.

Co:10-Know the salient features of fragmentation pattern of oraganic compounds.

Co:11-Learn the principle, instrumentation of electron spin resonance spectroscopy and its application.

## **Semester –II**

### **Paper -V: Inorganic practical co's**

Students able to learn

1. Analysis of two components & three components:

- Students learn how to separate the metal ions from the mixture and estimate separately.
- it helps to limit the number of instrumental errors when measuring the masses of substances.

2. Applied titrimetric analysis:

- Determination of iron and calcium in cement
- Students learn how to estimate the amount of iron & calcium present in cement



- Complex formation takes place, in which a blue dye Eriochrome Black T is used as the indicator

Students learn separation of zinc & magnesium on an anion exchange resin and estimation of  $Mg^{+2}$  and  $Zn^{+2}$ .

## **PAPER-VI ORGANIC CHEMISTRY**

**Title: Identification of unknown organic compounds by qualitative analysis and spectroscopy**

Co:1 Students know information about Determination of physical constants

Co:2 Students able to learn about ignition test

Co:3 Students experiences Lassaigne test process

Co:4 Students practices sodium metal fusion

Co:5 Students involves in extract preparation to know extra elements

Co:6 Students get knowledge on derivatives preparation

### **Paper -VII: Physical Chemistry practical co's**

Students able to learn and

- Able to perform experiments individually and gain knowledge about principles and techniques involved in various experiments
- Acquire Experimental skills & handling instruments
- Gain Knowledge in Prediction & verification of Experimental results by graphical method

## SEMESTER III

### **PAPER-I–CODE(CH(AC)301)T:CORE:SAMPLING,DATAHANDLING CLASSICAL AND ATOMIC SPECTRAL METHODS OF ANALYSIS**

After studying the course, the student will be able to understand the following concepts:

**Co 1-** Classification of Analytical Methods

**Co2-** Learn Data Handling Techniques

**Co3-** Understand different kinds of Titrations (Redox & Complexometry)

**Co4-** Learn the theory and Precipitation reagents in gravimetric analysis

**Co5-** Know the instrumentation and applications of TG, DTA, and DSc.

**Co6-** Learn to explain radio chemical methods, Principles and applications.

**Co7-** Understand the principles, Instrumentation, interferences, evaluation and applications of atomic absorption spectroscopy (AES), (AAS).

**Co8-** Understand the principles of plasma spectroscopy instrumentation and applications of ICP-AES

**Co9-** Learn the comparison of ICP-AES with AAS.

### **PAPER-II–CODE(CH(AC)302) T:SPECTROSCOPICMETHODS OF ANALYSIS –I**

The student will be able to;

**Co1-** Classify C-13 NMR spectroscopy.

**Co2-** learns the applications of NMR to various complexes.

**Co3-** Understand about advanced NMR spectroscopy.

**Co4-** Classify two-dimensional NMR.

**Co5-** Understand ESR Principle, Instrumentation and applications.

**Co6-** Understand ESR spectra of d1-d9 Transition metal complexes and interpretation and evidence of metal ligand bond, co-valiancy complexes.

**Co7-** Learn Mossbauer Spectroscopy principle and applications

**Co8-** Understand NQR Spectroscopy.

**PAPER-III-CH(AC)303-I ELECTIVE-III A-MISCELLANEOUS METHODS OF ANALYSIS**

After studying the course, the student will be able to understand the following concepts:

**Co1-** Learn to Classify different types of surface measurements.

**Co2-** Learn the principle instrumentation and applications of SEM, EPXMA, RBS, SIMS, STM, & AFM.

**CO3-** Remember X-ray Generation and properties.

**CO4-** Understand Braggs Equation, Powder and crystal methods.

**Co5-** Able to explain the principle and applications of electron diffraction, Neutron diffraction, XRF methods.

**Co6-** Understand Principle instrumentation, applications of electro analytical methods.

**Co7-** Explain theory, instrumentation and applications of high frequency titrations.

**Co8-** Know Micro metrics and particle size analysis.

**Co9-** Understand theories of drug dissolution.

**Co10-** Explain dissolution tests and disintegration tests for tablets, capsules and enteric coated tablets.

**PAPER IV-CH(AC)304-T- EELECTIVE III A- APPLIED ANALYSIS:**

The student will be able to;

**Co1-** Understand about analysis of Ferro and anti-Ferro alloys and cement.

**Co2-** Learn the analysis of oils and fats, soaps and detergents, paints and pigments.

**Co3-** Learn the analysis of air pollutants.

**Co4-** Understand about analysis of water pollutants with different experimental techniques.

**Co5-** Learn to estimate different clinical compounds with different techniques.

**Co6-** Understand about different type of pharmaceutical substances with different spectro photo metric methods.

**Co7-** Learn about analysis of food.

**Co8-** Understand about agricultural analysis and micro-macro nutrients.

### **SEMESTER-III**

#### **COURSE OUTCOMES OF PRACTICE PAPER**

##### **CH :( AC) 351P: Titrimetry, Solvent Extraction, Chromatography and Water Analysis**

-Student will able to do:

-The analysis of metal cations, present in soil, cement and Vitamin D tablet sample.

-Gain knowledge about analysis of oil sample by using methods like saponification value and Iodine value.

-Able to separate Metal ions by solvent extraction learn how to separate analysis of mixture of amino acids by thin layer chromatography.

-Understand the concept of Water analysis and how to analyze Dissolved Oxygen, COD, Fluorine and Chlorine in water samples.

##### **CH :( AC) 352P: Colorimetry, Spectrophotometry**

-Students will be able to estimate biological samples like blood sugar, blood cholesterol.

-Also be able to determine Paracetamol, Ampicillin and Ascorbic acid tablets.

-Know about analysis of Serum Cholesterol and Creatinine samples.

-Able to perform simultaneous analysis of metal atoms present in mixture by Spectrophotometric method.

## **SEMESTER IV**

### **PAPER I- CH (AC)401:T SPECTROSCOPIC METHODS OF ANALYSIS –II**

After studying the course, the student will be able to understand the following concepts:

**Co1-** Understand about UV- visible spectroscopy, instrumentation, classification.

**Co2-** Understand selection rules and factors effecting bond shapes

**Co3-** Explain Orgel diagrams for d1-d9 configurations and crystal field spectra of Oh and Td metal complexes of 3d metals.

**Co4-** Understand about IR spectroscopy principles instrumentation and applications.

**Co5-** Explain Raman spectroscopy theory instrumentation and applications

**Co6-** Understand about refractometry and polarimetry, theory, instrumentation and applications

**Co7-** Explain resonance Raman spectroscopic principle theory and applications

**Co8-** Explain about rotator dispersion and circular dichorism and applications

**Co9-** Briefly Understand about fluorimetry and phosphorimetry.

**Co10-** Applications of fluorimetry and phosphorimetry.

**Co11-** Explain nephelometry and turbidimetry principles instrumentations and applications

### **PAPER II –CH (AC)402 T-CORE : SEPARATION METHODS**

Student will able to

**Co1-** Explain Distribution co-efficient, distribution ratio relation between KD and D

**Co2-** Describe the solvent extraction of metals.

**Co3-** Explain the theoretical basis for use of organic reagents in organic analysis.

**Co4-** Understand the theory, instrumentation and applications of HPTLC, GC, HPLC.

**Co5-** Describe the principle, instrumentation and applications of size exclusion chromatography and UPLC

**Co6-** Classify mass analyzers and interfaces used in Hyphenated technique's

**Co7-** Explain principle, instrumentation and application of GC-MS, GC-FT-IR, LC-MS, LC-MS-MS-ICP-MS.

**Co8-** Learn to define electrophoresis

**Co9-** Understand the principles, techniques and applications of electrophoresis

### **PAPER III CH(AC)403 T- ELECETIVE III A-LABORATORY MANAGEMENT**

After studying the course, the student will be able to understand

the following concepts:

**Co1-** Classify analytical and instrumental methods

**Co2-** Explain flow injection and discrete automatic systems.

**Co3-** Describe good laboratory practices.

**Co4-** Understand Laboratory management system

**Co5-** Explain Computer aided analysis

**Co6-** Understand various disciplines represented in the laboratory.

**Co7-** Explain different SRM'S used in laboratories

**Co8-** Understand accreditation of laboratories

**Co9-** Explain Analytical methods

**Co10-** Learn TQM and essentials of TQM

**Co11-** Classify analytical methods and process validation

### **PAPER IV-CH (AC)404 T QUALITY ASSURANCE & ACCREDITATION**

Student will able to:

**Co1-** Explain quality control and quality assurance concepts and significant

**Co2-** Describe quality control and statistical techniques

**Co3-** Understand about calibration maintenance of instruments.

- Co4-** Describe documentation of quality assurance of raw data
- Co5-** Understand about good laboratory practices, quality program
- Co6-** Explain briefly about computers and quality assurance.
- Co7-** Understand establishing a quality assurance program.
- Co8-** Describe the laboratory accreditation.
- Co9-** Understand the evolution and significance of quality management
- Co10-** Understand the ISO standards and advantages
- Co11-** Define quality manual, Quality policy, Conformities and non-conformities

## **SEMESTER-IV**

### **COURSE OUTCOMES OF PRACTICE PAPER**

#### **CH: (AC) 451P: Electro Analytical Techniques**

- The student will be able to Perform Potentiometric and Conductometric titrations.
- Able to determine  $P^{K_a}$  value or dissociation constant of Histidine Monohydrochloride.
- Can estimate the concentration of mixture of strong acids and strong bases by PH Metry and Conductometry.
- Will understand the determination of metals and redox reactions by Potentiometry.

#### **CH: (AC) 452P: Spectroscopic Techniques, Spectral Problems and Evaluation of Physical Parameters of Tablets**

- Students can perform metal cations analysis by Flame Photometry
- The student will be able to achieve advanced knowledge of structural Elucidation based on spectral data from UV-visible, IR, NMR and Mass spectrometry.
- Know the procedure of Dissociation and Disintegration test for tablets.

-Can predict the molecule structure by analyzing the given Spectral Data

## M.Sc. STATISTICS

### Course Outcomes (COs)

#### *SEMESTER-I*

##### *PAPER-I*

##### *TITLE: Mathematical Analysis*

At the end of the course students should be able to:

- Gives intuitive understanding of linear algebra and real and complex analysis.
- Acknowledge the Basic concepts of vector spaces, Moore Penrose and generalised inverses and homogeneous and non-homogeneous linear equations.
- Understand the Concepts of characteristic roots and vectors and the concept of multi-collinearity.
- Learn the topics of Power, Taylor's and Laurent's series. Zeroes and poles. Statement of Cauchy residue theorem.
- Understand the Functions of several variables-concepts of limit, continuity, directional derivatives, partial derivatives, total derivative, extreme and saddle points with examples.
- Penetrate Taylor's expansion, Multiple Integration and application of Jacobians in the evaluation of multiple integrals.
- Understand the Vector spaces with an inner product, Gram-Schmidt orthogonalization process, orthonormal basis and orthogonal projection of a vector.
- Recognize Real quadratic forms (QFs), reduction and classification of QFs, index and signature Cauchy-Schwartz and Hadamard inequalities for matrices.

#### *SEMESTER-I*

##### *PAPER-II*

##### *TITLE: Linear Algebra & Linear Models (LA, LM)*



At the end of the course students should be able to:

- To find solutions to sets of equations using linear algebraic techniques.
- To manipulate matrices without altering their fundamental properties.
- Application of matrices in real-world scenarios. Expressing equations in General Linear Model (GLM) form for parameter estimation.
- Students will proficiently solve sets of equations using various linear algebraic techniques.
- They will be able to manipulate matrices effectively while retaining their essential characteristics.
- Students will apply matrices in real-world scenarios, demonstrating their understanding of practical applications.
- They will express equations in GLM form for parameter estimation, facilitating the analysis of linear relationships in data
- Overall, this course equips students with a strong foundation in linear algebra and linear models, providing them with essential tools for statistical analysis and problem-solving in diverse fields.

### *PAPER –III*

#### *TITLE: Probability Theory*

At the end of the course students should be able to:

- Students able to calculate probabilities, and derive the marginal and conditional distributions of bivariate random variables.
- Use the basic probability rules, including additive and multiplicative laws, independent and mutually exclusive events.
- Interpret the real-world problems into probability models and knows about Classes of sets, fields, sigma-fields, minimal sigma-fields,

- Understand Borel sigma-fields in  $\mathbb{R}$ , Measure, Probability Measure, and Properties of a Measure, Caratheodory extension theorem, measurable function, random variables, distribution function and applications of monotone convergence theorem.
- Learn Fatou's lemma, dominated convergence theorem, Inversion theorem, uniqueness theorem, Levy's continuity theorem, Chebyshev, Markov, Cauchy-Schwartz, Jensen, Lyapunov, Holder's and Makowski's inequalities.
- Learn the Slutsky's theorem, Borel-Cantelli lemma Borel 0-1 law, Kolmogorov 0-1 law, Khintchen's WLLN's, Kolmogorov Inequality.
- Understand the Kolmogorov SLLN and Central Limit theorems: Damiere - Laplace CLT, Lindberg-Levy CLT, Lyapunov's CLT, Statement of Lindberg-Feller CLT.

### ***PAPER –IIV***

#### ***TITLE: Distribution Theory***

At the end of the course students should be able to:

- Understand the most common discrete and continuous probability distributions and their real-life applications.
- Compute marginal and conditional distributions from joint distributions.
- Get familiar with transformation of univariate and multivariate densities.
- Understanding of distribution helps to understand the nature of data and to perform appropriate analysis.
- Apply compound, Truncated, mixture and non-central probability distributions to solve problems.

### **PAPER V – PRACTICAL**

#### ***TITLE: STATISTICAL METHODS USING PYTHON PROGRAMMING***

At the end of the course students should be able to

- To understand why Python is a useful scripting language for developers.
- To learn how to design and program Python applications.
- To learn how to use lists, tuples, and dictionaries in Python programs.
- To learn how to identify Python object types.
- To learn how to use indexing and slicing to access data in Python programs.
- To define the structure and components of a Python program.
- To learn how to write loops and decision statements in Python.
- To learn how to write functions and pass arguments in Python.
- To learn how to build and package Python modules for reusability.
- Students will acquire proficiency in Python programming for statistical analysis, enabling them to manipulate data, perform calculations, and visualize results.
- They will develop problem-solving skills by implementing algorithms for matrix operations, sorting, searching, and descriptive statistics.
- Students will gain hands-on experience in fitting probability distributions to data and conducting statistical tests for hypothesis testing and analysis of variance.
- They will learn to interpret statistical results and draw meaningful conclusions from data analysis, preparing them for further studies or careers in data science, research, or academia.

## **PAPER VI – PRACTICAL**

***TITLE: LINEAR ALGEBRA & LINEAR MODELS (CONVENTIONAL & USING R)***

At the end of the course students should be able to

- Knowing the manual procedures and also their implementation using R.
- Finding the inverse of a matrix in various methods.
- Applying any transformations on matrices
- Applying the matrix operations on the given data sets (Determinant, Eigen values, Eigen vectors, transformations etc.).
- Summarization of properties of the data sets based on matrix operations.
- Students acquire advanced skills in matrix operations, including matrix inversion, spectral decomposition, and quadratic form reduction.
- They develop proficiency in regression analysis techniques, including model fitting, hypothesis testing, and diagnostic checks.
- Students gain practical experience in applying advanced statistical methods to real-world datasets, preparing them for careers in data analysis, research, or academia.

## **PAPER VII– PRACTICAL**

### ***TITLE: DISTRIBUTION THEORY & ESTIMATION***

#### ***(CONVENTIONAL & USING R)***

At the end of the course students should be able to

- Knowing the manual procedures and also their implementation using R
- Generation of random samples from any distribution
- Identifying an appropriate probability distribution to the given data.
- Fitting and testing the probability distribution.
- Drawing the probability distribution curves and stating its nature of the distributional curve properties for the given data sets.
- Students acquire advanced skills in statistical modeling and distribution fitting, enabling them to analyze complex datasets and make informed decisions.

- They develop proficiency in generating random samples from various distributions and fitting distribution models to data.
- Students gain practical experience in assessing the goodness of fit of distribution models and estimating parameters with confidence intervals.
- They learn to apply resampling techniques for estimating bias, variance, and MSE, enhancing their understanding of statistical inference and robust estimation methods.

## **PAPER VIII– PRACTICAL**

### ***TITLE: Data Handling using R***

At the end of the course students should be able to

- Students acquire a strong foundation in data analysis techniques, including descriptive statistics, data transformations, and visualization.
- They develop proficiency in applying parametric and non-parametric tests for hypothesis testing and inferential statistics.
- Students gain practical experience in model evaluation, validation, and performance assessment, enhancing their skills in predictive modeling and machine learning.
- They learn to interpret and communicate data insights effectively through written reports and graphical representations, preparing them for careers in data analysis, research, or academia.
- Students learn about parametric tests such as z-tests,  $\chi^2$ -tests, t-tests, and F-tests, as well as ANOVA for hypothesis testing.
- They also gain knowledge about non-parametric tests including the sign test, median test, Wilcoxon signed-rank test, Mann-Whitney U test, and run test.
- This course aims to equip students with the necessary knowledge and skills to understand, analyse, and visualize data effectively. Through theoretical concepts and

practical exercises, students will learn about data types, measurement scales, descriptive statistics, data transformations, visualization techniques, statistical tests, model evaluation, and data interpretation.

## ***SEMESTER-II***

### ***PAPER –I***

#### ***TITLE: Estimation Theory***

At the end of the course students should be able to:

- Understand the Point Estimation Vs. Interval Estimation, properties of a good estimator: Unbiasedness, consistency, efficiency and sufficiency - examples.
- Learns the Neyman factorization theorem, Rao-Blackwell theorem, Cramer-Rao inequality and Bhattacharya bounds.
- Comprehend the estimation of bias and standard deviation of point estimation by the Jack-knife, the bootstrap methods with applications.
- Identify the method of moments and maximum likelihood method, examples and learns definition of CAN and BAN and Concept of U statistics and examples.
- Interpret the data to find estimator of MLE by scoring method.

Acknowledge the large sample confidence limits in case of Binomial, Poisson, Exponential distributions

## ***SEMESTER-II***

### ***PAPER –II***

#### ***TITLE: Multivariate Analysis***

At the end of the course students should be able to:

- Learns the Multinomial distribution Multivariate normal distribution, marginal and conditional distributions.
- Understand the Maximum likelihood estimators of parameters and Independence of sample mean vector and variance-covariance matrix.
- Understand the Wish art distribution and Null distribution of simple, partial and multiple correlation coefficients.
- Comprehends the Null distribution of Hotelling's  $T^2$  statistic, Mahalanobi's  $D^2$  statistic. Walk's  $\Lambda$  - criterion.
- Acknowledge about the classification and discrimination procedures for discrimination between two multivariate normal populations.
- Identify the Concepts of Principal components, cluster analysis and Factor analysis

## ***SEMESTER-II***

### ***PAPER-III***

#### ***TITLE: Design and Analysis of Experiments (DOE)***

At the end of the course students should be able to

- Students will be able to perform analysis of covariance for one-way and two-way classifications.
- They will understand the concept of multiple comparisons and be able to conduct Fisher Least Significance Difference (L.S.D) test and Duncan's Multiple Range Test (DMRT).
- Students will learn to estimate main effects, interactions, and analyse factorial experiments with various factors, including  $2^k$ ,  $3^k$ , and  $4^k$  factorial designs.
- They will comprehend total and partial confounding in factorial designs, particularly in the case of  $2^3$ ,  $2^4$ , and  $3^2$  factorial designs, and understand the concept of Balanced Partial Confounding. Students will understand the concept of Partially

Balanced Incomplete Block Design with two associate classes (PBIBD (2)), parametric relations, and intra-block analysis.

- They will learn about the Simple Lattice Design and its analysis.

Students will gain knowledge about Response Surface Methodology (RSM), the method of steepest ascent, and Response Surface Designs.

## ***SEMESTER-II***

### ***PAPER –IV***

#### ***TITLE: Sampling Theory***

At the end of the course students should be able to:

- Identify and recognize the appropriate sample survey design for related problems.
- Determine an estimate of a population mean, total and proportion for various types of sampling schemes
- Understand the Simple Random Sampling (SRS) method and Stratified Sampling method.
- Composes the optimum allocation of the sample size to stratum.
- Applies the Ratio Estimation method for SRS and Stratified Random Sampling and regression estimators in SRS and Stratified sampling.
- Learns the Systematic Sampling (SS) and Cluster Sampling (CS) methods and estimates the parameters using SS method and applies SS method to strata.

## ***SEMESTER-II***

### ***PAPER V– PRACTICAL***

#### ***TITLE: Estimation Theory+ Multivariate Analysis (ET+MA)***

At the end of the course students should be able to:



- Computation of Principal Components.
- Classification between two normal populations by discriminant analysis using Maximum likely hood ratio approach and Bayesian miss classification.
- Cluster analysis using Single, Complete and Average linkages.
- Computation of Canonical variables and correlation.
- Computation of Orthogonal Factor Model
- Computation of Path coefficients and drawing Path diagram
- Computation of Multidimensional PROBLEMS
- Confidence limits for parameters of normal population
- Large sample confidence limits in case of Binomial, Poisson, Exponential distributions

## ***SEMESTER-II***

### **PAPER VI– PRACTICAL**

#### ***TITLE: Design and Analysis of Experiments (DOE) and Sampling Theory (ST)***

At the end of the course students should be able to:

- Analysis of total and partial confounding in factorial designs.
- Conducting variance analysis for fractional factorial designs.
- Analysis of Split-Plot designs, Balanced Incomplete Block Designs, You den Square Designs, and Partially Balanced Incomplete Block Designs. Conducting Cluster analysis using Single, Complete, and Average linkages.
- Calculation of Canonical variables, Orthogonal Factor Model, and Path coefficients.
- Computation of Multidimensional Scaling for visual representation of data. Hands-on experience in conducting various statistical tests and analyses.
- Applies the Ratio Estimation method for SRS and Stratified Random Sampling and regression estimators in SRS and Stratified sampling.

- Learns the Systematic Sampling (SS) and Cluster Sampling (CS) methods and estimates the parameters using SS method and applies SS method to strata.

## ***SEMESTER-II***

### **PAPER VII– PRACTICAL**

#### ***TITLE: DATA ANALYSIS USING SPSS & OR USING TORA***

At the end of the course students should be able to

- Proficiency in basic operations of data entry, import/export, and handling I/O files.
- Ability to create various types of visualizations including pie diagrams, bar diagrams, histograms, line plots, scatter plots, Gantt charts, and box plots for effective data representation. Proficiency in basic operations of data entry, import/export, and handling I/O files.
- Ability to create various types of visualizations including pie diagrams, bar diagrams, histograms, line plots, scatter plots, Gantt charts, and box plots for effective data representation. Competence in conducting parametric tests such as testing for means, variances, proportions, and ANOVA for one-way, two-way, and interactions.
- Proficiency in conducting non-parametric tests including sign test, Wilcoxon sign rank test, Mann-Whitney U-test, Run test, Kolmogorov-Smirnov test, and Chi-square tests for goodness of fit and independence. Competence in conducting parametric tests such as testing for means, variances, proportions, and ANOVA for one-way, two-way, and interactions.

## ***SEMESTER-II***

### **PAPER VIII– PRACTICAL**

#### ***TITLE: DATA SCIENCE USING PYTHON***

At the end of the course students should be able to

- Implement the ETL (extract, transform, and load) pipeline for data processing.
- Develop proficiency in extracting, transforming, and loading various types of input data using Python libraries/modules.
- Practice data visualization techniques to gain insights from the processed data. Proficiency in using Pandas data structures (Data Frame and Series) for data storage and manipulation.
- Competence in handling single-level and hierarchical indexing, missing data, arithmetic and Boolean operations on columns and tables, database-type operations (merging and aggregation), and plotting individual columns and whole tables.
- Skill in reading data from files and writing data to files using Pandas.
- By the end of this laboratory course, students will have practical experience in implementing the ETL pipeline, handling various types of data, and performing data manipulation and visualization tasks using Python libraries/modules. They will be well-equipped to work with real-world datasets and extract meaningful insights for decision-making and analysis purposes.

### ***SEMESTER-III***

#### ***PAPER –I***

##### ***TITLE: Non-Parametric Inference (NPI)***

At the end of the course students should be able to:

- Understand the Concepts of non-parametric estimation.
- Understand the Nonparametric methods for one & two samples' problems like sign test, Wilcoxon signed Rank test, run test and Kolmogorov – Smirnov test.
- Understand the Wilcoxon Mann-Whitney test, Kolmogorov – Smirnov Test, Wald–Wolfowitz Runs test and Normal scores test.

- Understand the Kendall's Tau, Ansari–Bradley test for two sample dispersions, Kruskal–Walli's test for one-way layout, and Friedman test for two-way layout.
- Identify the Asymptotic Relative Efficiency (ARE) and Pitman's theorem and concept of Rao's second order efficiency and Hodges–Lehman's deficiency with examples

## *PAPER –II*

### *TITLE: Quality Control & Optimization Techniques (QCOT)*

At the end of the course students should be able to:

- Understand the Moving Average and exponentially weighted moving average charts, Cu-sum charts using V-Masks and decision intervals.
- Learns Process Capability Analysis: Capability indices Cp, Cpk and Cpm.
- Identify the Acceptance sampling plans for attributes, single, double and sequential sampling plans and their properties;
- Identify the Sampling Plans for inspection by variables for one & two–sided specifications.
- Acknowledge of Sensitivity Analysis, parametric programming, Integer Programming Problem.
- Understand the concepts of Networks models and Inventory controls.

## *PAPER –III*

### *TITLE: ADVANCED DESIGN & ANALYSIS OF EXPERIMENTS (ADAE)*

At the end of the course students should be able to:

- Students will comprehend the concept of incomplete block designs and their applications in experimental design.
- They will be able to analyse the parametric relations and perform intra-block analysis of BIBD.

- Students will learn to recover inter-block information and distinguish between symmetric, resolvable, and affine resolvable BIBDs.
- They will understand the construction of BIBDs using Mutually Orthogonal Latin Squares (MOLS). Students will understand the parametric relations and perform intra-block analysis of PBIBD (2).
- They will learn about four different association schemes and their implications in experimental design. Students will understand the parametric relations and perform intra-block analysis of PBIBD (2).
- They will learn about four different association schemes and their implications in experimental design.

#### *PAPER –IV*

#### *TITLE: Advanced Machine Learning Techniques (MDLT)*

At the end of the course students should be able to:

- Students will understand the principles of pattern recognition systems and the fundamental problems in pattern recognition.
- They will learn about linear classifiers, including multiple linear regression, logistic regression, and linear discriminant function for binary outputs with minimum squared error.
- Students will be able to implement classification algorithms such as the Naïve Bayes classifier, Support Vector Machines (SVM), and the K-Nearest Neighbors (KNN) algorithm. Students will learn about decision tree algorithms, including Random Forest, Bagging, Gradient Boosting, Ada-Boosting, and XG-Boosting algorithms.
- They will understand the concept of market-basket analysis and its applications in pattern recognition. Students will understand the principles of cluster analysis and the similarities and dissimilarities between data points.

- They will learn about hierarchical clustering methods such as the single linkage method and k-means clustering.

### ***SEMESTER-III***

#### **PAPER V– PRACTICAL**

##### ***TITLE: NON-PARAMETRIC INFERENCE & QUALITY CONTROL & OPTIMIZATION TECHNIQUES (NPI & QCOT)***

At the end of the course students should be able to:

- Students will conduct Ansari-Bradley test to evaluate differences in variability between two samples.
- Students will learn Spearman's rank correlation and Kendall's Tau tests for assessing independence in contingency tables.
- Students will be able to apply sign test and Wilcoxon signed rank test to analyse paired data and make inferences about the population median. Students will learn to construct operating characteristic (OC) and average sample number (ASN) curves for X and R-charts.
- Students will conduct time-cost analysis using CPM and PERT to determine the optimal project schedule considering time and budget constraints.
- Students will calculate AOQ and AFI curves for CSP–I sampling plans and interpret their performance.

#### **PAPER VI– PRACTICAL**

##### ***TITLE: ADVANCED DESIGN OF EXPERIMENTS (ADAE) & Advanced Machine Learning Techniques***

At the end of the course students should be able to:

- Learn how to use conditional probability and Bayes' theorem to classify data into classes based on predictor variables' probability distributions.
- Gain proficiency in finding the optimal hyper plane that separates data points into different classes while maximizing the margin between them.
- Learn how to build multiple decision trees and combine their predictions to improve overall accuracy and robustness.
- Understand how to train multiple models sequentially or in parallel and aggregate their predictions to achieve better accuracy and reduce over fitting.
- Learn how to train a neural network with multiple hidden layers using back propagation and gradient descent to classify complex patterns in data.

## **PAPER VII– PRACTICAL**

### ***TITLE: STATISTICAL ANALYSIS USING R & TORA***

At the end of the course students should be able to:

- Navigate and optimize the R integrated development environment (IDE) Studio.
- Install and load add-in packages and import external data into R for data processing and statistical analysis
- learn the main R data structures – vector and data frame and compute basic summary statistics
- Data visualizations with the ggplot package like Charts and Diagrams
- Interpret the data by Central tendency, Measures of dispersion, discriminate analysis, cluster analysis and factor analysis.
- Interpret the data by using parametric tests and Non–Parametric tests, statistical quality control and regression analysis.
- Acknowledge the Operations Research techniques by using TORA.

## **PAPER VIII– PRACTICAL**

### ***TITLE: DATA ANALYSIS PROJECT (MINI PROJECT)***

At the end of the course students should be able to:

- To familiarize tools and techniques and content for presentation
- To enhance practical presentation, effective communication and professional skills
- To expose the students to answer the queries raised on the topic of presentation.
- To encourage students to work with innovative and entrepreneurial ideas
- Demonstrate the ability to synthesize and apply the knowledge and skills acquired in the academic program to real-world problems
- Evaluate different solutions based on economic and technical feasibility
- Effectively plan a project and confidently perform all aspects of project management
- Demonstrate effective written and oral communication skills

## ***SEMESTER-IV***

### ***PAPER –I***

#### ***TITLE: Stochastic Process (SP)***

At the end of the course students should be able to:

- Understand the concepts of stochastic processes; Markov chains; time-homogeneity; Chapman-Kolmogorov equations;
- Define basic concepts from the theory of Markov chains and present proofs for the most important theorems.
- Compute probabilities of transition between states and return to the initial state after long time intervals in Markov chains.



- Understand the Ergodic state and ergodic chain, stationary distribution, Random walk and gambler's ruin problem.
- Understand the Discrete state-space, continuous time Markov Processes and weiner process as limit of random walk.
- Acknowledge the Renewal process, Branching process – fundamental theorem of Branching process with applications.

## *PAPER –II*

### *TITLE: Time Series Analysis (TSA)*

At the end of the course students should be able to:

- Understand the Time series with different structures and its applications.
- Construct stationary time series model and interpret AR, MA & ARMA models.
- Construct nonlinear stochastic models and interpret ARIMA models.
- Acknowledge the ACF and spectrum of mixed processes and ARMA (1, 1) process.
- Understand the Model Diagnostic checking – checking the stochastic model diagnostic checks applied to residuals.
- Learns the Forecasting: Minimum mean square error forecasts

## *PAPER –III*

### *TITLE: Advanced Operation Research (AOR)*

**At the end of the course students should be able to:**

- Understand the Concept of Non-linear Programming problem, Wolfe's and Beale's Algorithms for solving QPP and Separable Programming Problem LPP.
- Understand the Dynamic Programming technique, goal Programming problems.
- Acknowledge the Decision Analysis: under uncertainty, tree analysis and utilities.
- Linear Fractional Programming Problem and its applications

- Acknowledge about the Inventory controls and Replacement models.

## ***PAPER –IV***

### ***TITLE: Artificial Neural Networks (ANN)***

at the end of the course students should be able to:

- Understand the basic structure and functioning of artificial neural networks, including neuron models and activation functions.
- Gain insights into various artificial neuron models such as McCulloch-Pitts, Perceptron, Adeline, and Hebbian models.
- Learn about different types of activation functions and their properties, such as monotonicity and signal functions.
- Understand the derivation of the perceptron learning algorithm, its convergence theorem, and limitations.
- Explore applications and challenges of multilayer perceptron learning.
- Gain practical knowledge of gradient descent learning, least mean square learning, and Windrow-Hoff learning. Understand feed-forward and feedback back-propagation algorithms, along with their difficulties and improvements.

## **PAPER V– PRACTICAL**

### ***TITLE: Stochastic Processes & Time Series Analysis***

**At the end of the course students should be able to:**

- Compute of Markov chain models, finite dimensional and marginal distributions; higher dimensional transition probabilities.
- Classification of states, identification of recurrent classes, Probabilities of absorption into recurrent classes
- Compute of stationary distribution and M|M|1 queue

- Compute Mean and variance of nth generation size and probability of extinction of Branching processes
- Compute Time series by means of simple time series models, correlograms & Periodogram analysis
- Classification of ARIMA models and computation of weights, identification AR, MA, ARMA models, computation of forecasts, updating and probability limits for forecasts.
- Graphing the reliability function of the systems when the life times of components are exponentially distributed.
- Compute the Wolfe and Beale's methods for QPP, Separable Programming problem
- Compute the Dynamic Programming Problem, Goal Programming Problem
- Problems on Decision under uncertainty and Replacement Problem.

## **PAPER VI– PRACTICAL**

***TITLE: Advanced Operation Research (AOR) & Artificial Neural Networks (ANN)***

**At the end of the course students should be able to learn**

- Implementation of Perceptron Learning Algorithm.
- Implementation of Multi-layer Perceptron Learning
- Implementation of Gradient Descent Learning,
- Implementation of Least Mean Square
- learning Wolfe and Beale's methods for QPP
- Separable Programming problem
- Dynamic Programming Problem
- Goal Programming Problem
- Problems on Decision under uncertainty

- Replacement Problem

## **PAPER VII– PRACTICAL**

### ***TITLE: Major Project***

**At the end of the course students should be able to:**

- Problem To familiarize tools and techniques and content for presentation
- To enhance practical presentation, effective communication and professional skills
- To expose the students to answer the queries rose on the topic of presentation.
- To encourage students to work with innovative and entrepreneurial ideas
- Demonstrate the ability to synthesize and apply the knowledge and skills acquired in the academic program to real-world problems
- Evaluate different solutions based on economic and technical feasibility
- Effectively plan a project and confidently perform all aspects of project management
- Demonstrate effective written and oral communication skills

## **M.Sc. APPLIED STATISTICS** **Course Outcomes (COs)**

### ***SEMESTER-I***

#### ***PAPER-I***

##### ***TITLE: Mathematical Analysis***

At the end of the course students should be able to:

- Gives intuitive understanding of linear algebra and real and complex analysis.
- Acknowledge the Basic concepts of vector spaces, Moore Penrose and generalised inverses and homogeneous and non-homogeneous linear equations.
- Understand the Concepts of characteristic roots and vectors and the concept of multi-collinearity.

- Learn the topics of Power, Taylor's and Laurent's series. Zeroes and poles. Statement of Cauchy residue theorem.
- Understand the Functions of several variables-concepts of limit, continuity, directional derivatives, partial derivatives, total derivative, extreme and saddle points with examples.
- Penetrate Taylor's expansion, Multiple Integration and application of Jacobians in the evaluation of multiple integrals.
- Understand the Vector spaces with an inner product, Gram-Schmidt orthogonalization process, orthonormal basis and orthogonal projection of a vector.
- Recognize Real quadratic forms (QFs), reduction and classification of QFs, index and signature Cauchy-Schwartz and Hadamard inequalities for matrices.

### ***SEMESTER-I***

#### ***PAPER-II***

##### ***TITLE: Linear Algebra & Linear Models (LA, LM)***

At the end of the course students should be able to:

- To find solutions to sets of equations using linear algebraic techniques.
- To manipulate matrices without altering their fundamental properties.
- Application of matrices in real-world scenarios. Expressing equations in General Linear Model (GLM) form for parameter estimation.
- Students will proficiently solve sets of equations using various linear algebraic techniques.
- They will be able to manipulate matrices effectively while retaining their essential characteristics.
- Students will apply matrices in real-world scenarios, demonstrating their understanding of practical applications.

### ***SEMESTER-I***

#### ***PAPER-III***

##### ***TITLE: APPLIED PROBABILITY THEORY (APT)***

At the end of the course students should be able to:

To find the probability based on the conditions that are specified.

- To obtain distribution function of random variable based on its probability function & vice-versa.
- To derive characteristic function from the density and vice-versa and identifying the characteristic function.
- To obtain the probability bounds or moment bounds for the given random variables.
- To study convergence properties of the sequence random variables based on its probability laws.
- Students will have a deep understanding of probability measures and random variables, enabling them to model uncertain events effectively.
- They will be proficient in calculating expectations and variances of random variables and functions, essential for statistical analysis.
- Students will demonstrate competence in applying various probability and moment inequalities to solve complex problems.
- They will understand the convergence of sequences of random variables and its implications in statistical theory and inference.

## ***SEMESTER-I***

### ***PAPER-IV***

#### ***TITLE: DISTRIBUTION THEORY AND ESTIMATION (DTE)***

At the end of the course students should be able to:

- Understand the most common discrete and continuous probability distributions and their real-life applications.
- Compute marginal and conditional distributions from joint distributions.
- Get familiar with transformation of univariate and multivariate densities.
- Understanding of distribution helps to understand the nature of data and to perform appropriate analysis.
- Apply compound, Truncated, mixture and non-central probability distributions to solve problems.
- Understand the Point Estimation Vs. Interval Estimation, properties of a good estimator: Unbiasedness, consistency, efficiency and sufficiency - examples.
- Learns the Neyman factorization theorem, Rao-Blackwell theorem, Cramer-Rao inequality and Bhattacharya bounds.

## **PAPER V – PRACTICAL**

### ***TITLE: STATISTICAL METHODS USING PYTHON PROGRAMMING***

At the end of the course students should be able to

- To understand why Python is a useful scripting language for developers.
- To learn how to design and program Python applications.
- To learn how to use lists, tuples, and dictionaries in Python programs.
- To learn how to identify Python object types.
- To learn how to use indexing and slicing to access data in Python programs.
- To define the structure and components of a Python program.
- To learn how to write loops and decision statements in Python.
- To learn how to write functions and pass arguments in Python.
- To learn how to build and package Python modules for reusability.

## **PAPER VI – PRACTICAL**

### ***TITLE: LINEAR ALGEBRA & LINEAR MODELS***

#### ***(CONVENTIONAL & USING R)***

At the end of the course students should be able to

- Knowing the manual procedures and also their implementation using R.
- Finding the inverse of a matrix in various methods.
- Applying any transformations on matrices
- Applying the matrix operations on the given data sets (Determinant, Eigen values, Eigen vectors, transformations etc.).
- Summarization of properties of the data sets based on matrix operations.
- Students acquire advanced skills in matrix operations, including matrix inversion, spectral decomposition, and quadratic form reduction.

- They develop proficiency in regression analysis techniques, including model fitting, hypothesis testing, and diagnostic checks.
- Students gain practical experience in applying advanced statistical methods to real-world datasets, preparing them for careers in data analysis, research, or academia.

## **PAPER VII– PRACTICAL**

### ***TITLE: DISTRIBUTION THEORY & ESTIMATION***

#### ***(CONVENTIONAL & USING R)***

At the end of the course students should be able to

- Knowing the manual procedures and also their implementation using R
- Generation of random samples from any distribution
- Identifying an appropriate probability distribution to the given data.
- Fitting and testing the probability distribution.
- Drawing the probability distribution curves and stating its nature of the distributional curve properties for the given data sets.
- Students acquire advanced skills in statistical modeling and distribution fitting, enabling them to analyze complex datasets and make informed decisions.
- They develop proficiency in generating random samples from various distributions and fitting distribution models to data.

## **PAPER VIII– PRACTICAL**

### ***TITLE: Data Handling using R***

At the end of the course students should be able to

- Students acquire a strong foundation in data analysis techniques, including descriptive statistics, data transformations, and visualization.
- They develop proficiency in applying parametric and non-parametric tests for hypothesis testing and inferential statistics.
- Students gain practical experience in model evaluation, validation, and performance assessment, enhancing their skills in predictive modeling and machine learning.



- They learn to interpret and communicate data insights effectively through written reports and graphical representations, preparing them for careers in data analysis, research, or academia.
- Students learn about parametric tests such as z-tests,  $\chi^2$ -tests, t-tests, and F-tests, as well as ANOVA for hypothesis testing.

## ***SEMESTER-II***

### ***PAPER-I***

#### ***TITLE: STATISTICAL INFERENCE (SI)***

At the end of the course students should be able to

- Students learn about Most Powerful and Uniformly Most Powerful tests, understanding their properties and applications in hypothesis testing.
- They study Neumann-Pearson lemma and its applications to the one-parameter exponential family of distributions.
- Concepts of unbiased and consistent tests are discussed, along with the Likelihood Ratio Criterion and its simple applications, including homogeneity of variances.
- The asymptotic properties of the Likelihood Ratio test are stated, and the concept of robustness in testing is introduced. Students explore sequential vs. fixed sample size techniques and learn about Wald's sequential probability ratio test (SPRT) for testing simple null hypotheses vs. simple alternatives.
- They understand the termination property of SPRT and study SPRT procedures for Binomial, Poisson, Normal, and Exponential distributions, along with associated operating characteristic (OC) and average sample number (ASN) functions.
- Statements about the optimality properties of SPRT are provided, enhancing students' understanding of sequential hypothesis testing.

## ***SEMESTER-II***

### ***PAPER-II***

#### ***TITLE: SAMPLING THEORY AND SURVEYS (STS)***

At the end of the course students should be able to

- Students will learn how to estimate population parameters such as mean and total using various sampling methods.
- They will be able to compute variances for the estimated population parameters and understand their significance in assessing the precision of the estimates.
- Subsampling (Two-Stage only) will be discussed, including equal and unequal first stage units and determination of optimum sample size for a given cost.
- Planning of Sample Surveys will be covered, including methods of data collection, problem of sampling frame, choice of sampling design, pilot survey, and processing of survey data.
- Non-sampling errors, sources, and treatment of non-sampling errors including bias and variance will also be addressed.
- Overall, upon completion of the course, students will be equipped with the knowledge and skills necessary to design and conduct sample surveys effectively, estimate population parameters accurately, and understand the sources and treatment of errors in sampling. Students will grasp the concept of Regression estimators and learn about their application in SRS and stratified random sampling.
- Cluster Sampling will be covered, including cluster sampling with clusters of equal sizes, estimator of mean per unit, and determination of optimum sample and cluster sizes.

## ***SEMESTER-II***

### ***PAPER-III***

#### ***TITLE: MULTIVARIATE DATA ANALYSIS (MDA)***

At the end of the course students should be able to

- Students will understand the concept of bivariate and multivariate random variables, including random vectors, their expectations, and variance-covariance matrices.
- They will be able to describe marginal and joint distributions, as well as understand stochastic independence of random vectors and conditional distributions.
- Students will gain knowledge about the properties of Multinomial and Multivariate Normal distributions, including marginal, conditional distributions, moment generating functions, characteristic functions, and correlations.

- They will learn about the distribution of sample mean vector, independence of sample mean vector and sample variance-covariance matrix, and maximum likelihood estimates of parameters such as mean vector and covariance matrix. Students will be familiar with Wilk's  $\lambda$  criterion and its distribution, and they will understand its properties.
- They will gain proficiency in using Hotelling's  $T^2$  statistic and understanding its null distribution and applications, including cases of single and two-sample mean vectors.

## ***SEMESTER-II***

### ***PAPER-IV***

#### ***TITLE: DESIGN OF EXPERIMENTS (DOE)***

At the end of the course students should be able to

- Students will be able to perform analysis of covariance for one-way and two-way classifications.
- They will understand the concept of multiple comparisons and be able to conduct Fisher Least Significance Difference (L.S.D) test and Duncan's Multiple Range Test (DMRT).
- Students will learn to estimate main effects, interactions, and analyse factorial experiments with various factors, including  $2^k$ ,  $3^k$ , and  $4^k$  factorial designs.
- They will comprehend total and partial confounding in factorial designs, particularly in the case of  $2^3$ ,  $2^4$ , and  $3^2$  factorial designs, and understand the concept of Balanced Partial Confounding. Students will understand the concept of Partially Balanced Incomplete Block Design with two associate classes (PBIBD (2)), parametric relations, and intra-block analysis.
- They will learn about the Simple Lattice Design and its analysis.
- Students will gain knowledge about Response Surface Methodology (RSM), the method of steepest ascent, and Response Surface Designs.

## ***SEMESTER-II***

### ***PAPER V– PRACTICAL***

#### ***TITLE: STATISTICAL INFERENCE AND SAMPLING THEORY***

At the end of the course students should be able to

- Conducting experiments to understand Type I and Type II errors in hypothesis testing.
- Implementing Most Powerful tests for hypothesis testing scenarios.
- Application of Uniformly Most Powerful tests in various statistical inference problems.
- Conducting Likelihood Ratio Tests for hypothesis testing.
- Implementing Sequential Probability Ratio Test (SPRT) procedures for Binomial, Poisson, and Normal distributions, and analysing their Operating Characteristic (OC) and Average Sample Number (ASN) functions.
- Performing the Wilcoxon Signed rank test for paired samples.
- Conducting the Wilcoxon Mann-Whitney test for independent samples.
- Implementing Kolmogorov – Smirnov tests for one-sample and two-sample distributions.
- Performing the Ansari – Bradley test for comparing dispersion in two samples.
- Conducting the Kruskal-Wallis test for comparing medians in a one-way layout. Calculating separate and combined ratio estimators and comparing their performance.
- Implementing Regression estimators in Simple Random Sampling (SRS) and comparing them with SRS and Ratio estimators.

## ***SEMESTER-II***

### **PAPER VI– PRACTICAL**

#### ***TITLE: DESIGNS & ANALYSIS OF EXPERIMENTS AND MULTIVARIATE DATA ANALYSIS***

At the end of the course students should be able to

- Understanding of Duncan's Multiple Range (DMR) and Least Significant Difference (LSD) tests.
- Ability to perform Analysis of Covariance for one-way and two-way classifications.
- Proficiency in conducting Analysis of Variance (ANOVA) for factorial experiments.
- Identification and construction of confounded terms in factorial experiments.
- Analysis of total and partial confounding in factorial designs.
- Conducting variance analysis for fractional factorial designs.

- Analysis of Split-Plot designs, Balanced Incomplete Block Designs, Youden Square Designs, and Partially Balanced Incomplete Block Designs. Conducting Cluster analysis using Single, Complete, and Average linkages.
- Calculation of Canonical variables, Orthogonal Factor Model, and Path coefficients.
- Computation of Multidimensional Scaling for visual representation of data. Hands-on experience in conducting various statistical tests and analyses.

## **PAPER VII– PRACTICAL**

### ***TITLE: DATA ANALYSIS USING SPSS & OR USING TORA***

At the end of the course students should be able to

- Proficiency in basic operations of data entry, import/export, and handling I/O files.
- Ability to create various types of visualizations including pie diagrams, bar diagrams, histograms, line plots, scatter plots, Gantt charts, and box plots for effective data representation. Proficiency in basic operations of data entry, import/export, and handling I/O files.
- Ability to create various types of visualizations including pie diagrams, bar diagrams, histograms, line plots, scatter plots, Gantt charts, and box plots for effective data representation. Competence in conducting parametric tests such as testing for means, variances, proportions, and ANOVA for one-way, two-way, and interactions.
- Proficiency in conducting non-parametric tests including sign test, Wilcoxon sign rank test, Mann-Whitney U-test, Run test, Kolmogorov-Smirnov test, and Chi-square tests for goodness of fit and independence. Competence in conducting parametric tests such as testing for means, variances, proportions, and ANOVA for one-way, two-way, and interactions.

## **PAPER VIII– PRACTICAL**

### ***TITLE: DATA SCIENCE USING PYTHON***

At the end of the course students should be able to

- Implement the ETL (extract, transform, load) pipeline for data processing.
- Develop proficiency in extracting, transforming, and loading various types of input data using Python libraries/modules.

- Practice data visualization techniques to gain insights from the processed data. Proficiency in using Pandas data structures (Data Frame and Series) for data storage and manipulation.
- Competence in handling single-level and hierarchical indexing, missing data, arithmetic and Boolean operations on columns and tables, database-type operations (merging and aggregation), and plotting individual columns and whole tables.
- Skill in reading data from files and writing data to files using Pandas.
- By the end of this laboratory course, students will have practical experience in implementing the ETL pipeline, handling various types of data, and performing data manipulation and visualization tasks using Python libraries/modules. They will be well-equipped to work with real-world datasets and extract meaningful insights for decision-making and analysis purposes.



