

Programme Code BA1001
Micro Economics – I, Sem – I
Course Code-UAR2EC1
(Academic Year: 2019-20)

Module –I: Introduction to microeconomics (lectures 12)

Micro economics: meaning, scope, nature, importance and limitations- Basic economic problems – distinguish between micro economics and macroeconomics – positive economics and normative economics – concepts of equation, functions, graph, diagrams, line-slope and intercepts.

Module –II: Ten Principles of Economics (lectures 12)

Trade-offs faced by the individuals – significance of opportunity cost in decision making – thinking at the margin- responses to incentives-benefits from exchange- organization of economic activities through markets and its benefits – role of government in improving market outcomes – dependence of standard of living on production- growth in quantity of money and inflation- inflation and unemployment trade-off.

Module –III: Markets, Demand and Supply (lectures 12)

What is a market- what is competition-demand curves: market demand versus individual demand - movements along the demand curve-shifts in the demand curve, supply curves: market supply and individual supply- shifts in supply curve–market equilibrium – price elasticity of demand- total outlay method, percentage method and point method-concepts of income elasticity of demand- cross elasticity of demand.

Module –IV: Consumers Behavior (lectures 12)

Cardinal and ordinal approaches – law of equi-marginal utility – indifference curve analysis – properties of indifference curve – budget line – consumers equilibrium – income, Price and substitution effects – derivation of demand curve – consumers surplus –strong ordering and weak ordering.

Reference Books

Micro Economics - Paper I
1. N.Gregory Mankiw, Principles of Microeconomics, 7 th edition, Cengage Learning, 2015
2. Sen Anindya (2007), <u>Microeconomics: Theory and Applications</u> , Oxford University Press, New Delhi.
3. Salvatore D. (2003), <u>Microeconomics: Theory and Applications</u> , Oxford University Press, New Delhi.
4. M.L.Jhingan “Microeconomics theory” 5 th edition (2006) Vrinda publication (P) Ltd.

Programme Code BA1002
Micro Economics – I, Sem – II
Course Code-UAR2EC1
(Academic Year: 2019-20)

Module I: Production Analysis

(12 Lectures)

Production Function: Concept And Types; Concepts of Total, Average and Marginal Product; Law of Variable Proportion and Returns to Scale, Isoquant and Producer's Equilibrium

Module II: Cost & Revenue Analysis

(12 lectures)

Concepts of Costs: Money and Real Cost, Social Cost, Private Cost, Explicit and Implicit Cost, Opportunity Cost; Relationship between Average, Marginal and Total Cost; Derivation of Short Run and Long Run Cost Curves; Concepts of Revenue: Types and Interrelationship

Module III: Factor pricing

(12 lectures)

Marginal Productivity Theory of Distribution; Rent: Ricardian Theory of Rent, Modern Theory of Rent, Quasi Rent; Wages: Modern Theory of Wages; Collective Bargaining; Supply Curve of Labour; Interest: Classical Theory of Interest, Loanable Funds Theory of Interest; Profit: Risk and Uncertainty Theory, Innovation Theory

Module IV: Equilibrium in Different Market Structure

(12 Lectures)

Concept Of Equilibrium: TR - TC And MR - MC Approach; Features of Perfect Competition; Monopoly and Monopolistic Competition, Short Run and Long Run Equilibrium of Firm and Industry under each Market Condition; Selling Cost and Wastages under Monopolistic Competition

Reference Books

Micro Economics - Paper I
1.Reference 1. A. Koutsoyainnis, (2015), Modern Microeconomics, 2nd edition, Palgrave Macmillan.
2. Paul Samuelson and W. Nordhaus, (2009), Economics, 19th edition: Economics, McGrawHill Publications.
3. Mankiw M.G (2015), Principles of Micro economics 7 th edition - Cengage Learning.
4. Anindya Sen, (2006), Microeconomics, OUP India Publisher.
5. M.L.Jhingan, (2006), "Microeconomics Theory", 5 th edition,Vrinda Publication (P) Ltd. 6. H.L.Ahuja, (2016), "Advance Economics Theory" S.Chand & Company Ltd.

Macro Economics - II
S.Y.B.A. Semester – III Paper II
Course Code-UAR3EC2
(Academic Year: 2020 - 21)

Preamble: This course is designed to provide an introduction to the students about the basic building blocks of Macro Economics which will serve as a foundation throughout their career.

Module – I: Introduction to Macro Economics and National Income (12 Lectures)

Introduction: Meaning and Scope of Macro Economics; Concepts of National Income: GNP, NNP, NDP, Per Capita Income, Personal Income and Disposal Income; Methods and Difficulties in Measurement of National Income; Circular Flow of National Income: Closed Economy (Two and Three Sector) and Open Economy Models (Four Sector Model)

Module – II: Consumption and Investment (12 Lectures)

Consumption and Investment; Says Law of Market; Theory of Effective Demand; Consumption Function; Subjective factors and Objective factors, Investment Function; Marginal Efficiency of Capital and Rate of Interest- Investment Multiplier , Accelerator.

Module – III: Supply of Money and Demand for Money (12 Lectures)

Supply of Money; Determinants of Money Supply; Velocity of Circulation of Money; RBI's Approach to Measurement of Money Supply; Demand for Money: Classical, Keynesian and Friedman's Approaches

Module – IV: Banking (12 Lectures)

Banking: Commercial Bank, Functions of Commercial Banks, Multiple Credit Creation, Balance Sheet of Commercial Bank; Development in Commercial Banking Sector Since 1990-91; Central Bank: Functions of Central Bank - Traditional, Developmental, Promotional, Exim Bank, NABARD.

Reference –

- 1) N. Gregory Mankiw, (2015), Principle of Macroeconomics, 7th edition, Cengage Learning.
- 2) Abel A. B. B. S. Beranake and D. Croushore (2011), Macroeconomics, Pearson, New Delhi.
- 3) Ahuja H. L., (2008), Macroeconomics theory and Policy, S. Chand and company Ltd. New Delhi.
- 4) Dwivedi D.N., (2007), Macroeconomics theory and Policy, TATA Mcgraw – Hill Publication company Ltd. Delhi.
- 5) Dornbusch Rudiger, Fischer, Stanley and Startz, (2017) (Indian Edition), Macroeconomics Delhi: Mcgraw Hill Publication.
- 6) Paul Samuelson and William Nordhaus, (2010), Economics, Mcgraw Hill Publication.

Macro Economics - II
S.Y.B.A. Semester – IV Paper II
Course Code-UAR4EC2
(Academic Year: 2020-21)

Preamble: This course is designed to make students aware of macroeconomic terminologies and make them familiar with macroeconomic terms and concepts in order to understand economics at aggregate level. It also aims to make the students aware about recent developments in macroeconomic literature.

Module - I: Inflation (12 Lectures)

The Economics of Depression, Hyper Inflation; Inflation: Features and Causes Demand Pull Inflation and Cost Push Inflation, Effects of Inflation; Measures to control inflation, Nature of Inflation in Developing Economy; Phillips Curve; Stagflation: Meaning, Causes and Consequences.

Module – II: Economic Policy (12 Lectures)

Monetary Policy: Objectives, Instruments, Limitations, Role of Monetary Policy in Developing Economies; Fiscal Policy - Objectives, Instruments, Limitations and Role of Fiscal Policy in Developing Economies, Narsimhan committee report 1998, Mutual Fund

Module – III: Post Keynesian Economics (12 Lectures)

The IS-LM Model of Integration of Commodity and Money Market; IS Curve: Derivation of IS Curve, Shift in IS Curve, Equilibrium in Goods Market; LM Curve: Derivation of LM Curve, Shift in LM Curve, Equilibrium in Money Market; Simultaneous Equilibrium in Goods and Money Market

Module – IV: External Sector (12 Lectures)

Balance of Payment: Structure, Disequilibrium in Balance of Payment, Types, Causes and Measures to Correct Balance of Payment Disequilibrium; Foreign Exchange Market: Determination of Exchange Rate: Fixed and Flexible Exchange Rate; Exchange Rate Policy, SEBI.

Reference

- 1 Richard Froyan, (2012), Macroeconomics: Theories and policies, Pearson Education.
- 2 Eroll D'Souza, (2008), Macroeconomics, Pearson Education.
- 3 Suman Kalyan Chakravarty, (2010), Macroeconomics, Himalaya Publishing House.
- 4 N. Gregory Mankiw, (2015), Principle of Macroeconomics Cengage Learning.
- 5 Francis Cherunilam, (1999), International Economics, Tata McGraw-Hill.
- 6 Bo Soderstein, (1994), International Economics, Palgrave Macmillan.

Public Finance
SYBA – Semester-III Paper- III
Course Code-UAR3EC3
(Academic Year: 2020 - 21)

Preamble

Public Finance is the study of government policy from the point of economic efficiency and equity. The role and functions of the government have been changing throughout time. The existence of externalities, acceleration of economic growth, raising the level of employment, the need and concern for adjustment in the distribution of income and wealth etc. require the use of package of policies which require tax systems, expenditure programmes, rising of debt, issues of deficit etc. This paper deals with basic concepts which explain the need for government intervention. It exposes the student to public budget through issues of taxation, expenditure, debt and concepts of deficit. The last Unit is related to topics concerning Indian Public Finance.

Unit – I Introduction (12 Lectures)

Meaning and Scope of Public Finance; Public Finance versus Private Finance; Market Failure: Public Goods and Private Goods, Externalities, Efficiency versus Equity; Principles of Sound Finance and Functional Finance; Allocation, Distribution, Stabilisation and Growth Functions of the Government

Unit - II Fiscal Policy: Budget and Taxation (12 Lectures)

Dalton's and Musgrave Versions of the Law of Maximum Social Advantage; Role of Government in a Modern Economy; Types of Public Budget; Structure of Public Budget; Role of Taxation; Merits and Demerits of Direct and Indirect Tax Policy; Features of Good Tax System; Concept of Impact, Incidence and Shifting of Taxation; Elasticity and Determination of Tax Burden

Unit III Fiscal Policy: Public Expenditure and Debt (12 Lectures)

Canons of Public Expenditure; Classification of Public Expenditure; Wagner's Law of Public Expenditure; Public Expenditure as an Instrument of Fiscal Policy; Meaning and Types of Public Debt; Burden of Public Debt; Principles of Public Debt Management; Concepts of Deficits

Unit IV Indian Public Finance (12 Lectures)

Budget of The Government of India (Previous Financial Year); Sources of Public Receipts (Tax And Non-Tax, Introduction To GST); Components of Public Expenditure; Sources of Public Borrowing and Debt Liabilities; Deficits; Appraisal of FRBM Act 2004; Fiscal Federalism: Fourteenth Finance Commission Recommendations

References:

1. J. Hindriks, G. Myles, (2006), Intermediate Public Economics, MIT Press.
2. Harvey Rosen, (2005), Public Finance, Seventh Edition, McGraw Hill Publications.
3. Kaushik Basu and Maertens (ed), (2013), The New Oxford Companion to Economics in India, Oxford University Press.
4. Sury M.M., (1990), Government Budgeting in India, Commonwealth Publishers.
5. Bhatia H.L., (2012), Public Finance, Vikas Publications.
6. Report of the Fourteenth Finance Commission, Government of India.

Indian Economy
SYBA – Semester-IV Paper- III
Course Code-UAR4EC3
(Academic Year: 2020 - 21)

Preamble

This paper deals with the nature and sector wise composition of Indian economy. The learners shall be able to understand the problems and prospects of Indian Economy. The content has also intended to orient the learners about the recent developments in the economy.

Module- I: Introduction (12 Lectures)

Trends in India's National Income and PCI Since 1990; Structural Changes In Indian Economy; Brief Overview of the Employment Generation and Poverty Alleviation Programmes; Regional Inequalities; Measures to Reduce Regional Inequalities in India

Module - II: Agricultural Sector (12 Lectures)

Role of Agriculture in Economic Development; Causes of Low Productivity; Agricultural Inputs; Agricultural Price Policy: Recent Minimum Support Price Policy; Income Support for Farmers; Sources of Agricultural Finance; Micro Finance; NABARD: Role and Function; Agricultural Marketing: Structure and Problems; National Policy for Farmers, 2007; Organic Farming Policy; Food Security in India

Module -III: Industrial Sector (12 Lectures)

Infrastructure for Industrial Development; Industrial Policies in India; Industrial Policy of 1991; Micro, Small and Medium Enterprises (MSMEs): Classification, Role and Policy Measures; Growth of Large Scale Industries and Economic Development; Recent Policies and Programs for Industrial Development: Start Up India, Make in India, Skill India; Role and Trends of FDI in Industrial Sector Development

Module -IV: Service Sector (12 Lectures)

Role of Service Sector in Indian Economy; Growth and Performance of Healthcare; Performance of Trade and Tourism, Information Technology and IT - Enabled Services; Research and Development Services With Reference to Education and Skill Development in Employment Generation in India; Performance of Service Sector during XIIth Five Year Plan

Reference

- 1) Ashwini Mahajan, Gaurav Datt, (2018) 'Indian Economy', S. Chand and Company, New Delhi.
- 2) Brahmananda, P.R. and V.R. Panchmukhi (Eds.), (2001), 'Development Experience in the Indian Economy: Inter-State Perspectives', Bookwell, New Delhi.
- 3) Datt, Ruddra and K.P.M, Sundaram, (2017), 'Indian Economy', S. Chand & Company Ltd., New Delhi.
- 4) Misra, S. K. and V. K. Puri, (2018) 'Indian Economy', Himalaya Publishing House, Mumbai.
- 5) Gaurav Datt and Ashwani Mahajan, (2016) 'Indian Economy', S Chand Publishing House, New Delhi.

Demography- Applied Economics
SYBA – Semester-III Paper- I
Course Code-UAR3EC1
(Academic Year: 2020 - 21)

Demography

Preamble: The modules incorporated in this paper educate the students about the inter-relationship between economic development and population along with an exposition of the established theories of population. Issues related to demographic techniques and basic sources of demographic data in the Indian economy have also been included. Aspects of the population policy and the study of its social characteristics are other important components of the modules of this paper.

Semester III

1. Introduction :

15 Lectures

- Demography – Its definition, nature and scope, its relation with other disciplines.
- Theories of Population - Malthusian Theory, Optimum theory of population and theory of demographic transition.
- Population growth in India- Causes and Measures.
- Features of Indian population.

2. Sources of demographic data in India :

15 Lectures

- Census –Features, Population Census in India, Merits and Demerits of Census.
- Civil Registration System- Merits and Demerits.
- Demographic Survey – National Family Health survey -1, 2 and 3.
- Sample Registration System –Merits and demerits.

3. Techniques of Analysis :

15 Lectures

- Crude birth rate and death rate, Age specific birth rate and death rate, standardized birth rate and death rate.
- Study of fertility – total fertility rate, gross reproduction rate and net reproduction rate.

REFERENCES :

1. Agarwal S.S. (1985) - 'India's Population Problem' – Tata McGraw Hill Publication, Bombay.
2. A.K. P.C. Swain (2008) – 'Population Studies' – Kalyani Publications, Ludhiana.
3. Bhende A.A. & Tara Kanitkar (1982) – 'Principles of Population Studies'– Himalaya Publishing House, Bombay.
4. Hans Raj (1984) – 'Fundamentals of Demography – Surjeet Publication, Delhi.
5. Jhingan, Bhat & Desai – 'Demography' –
6. Dr. D.D.Kachole (2001) – 'Demography' – Kailasha Publication, Aurangabad.

Demography-Applied Economics
SYBA – Semester-III Paper- I
Course Code-UAR3EC1
(Academic Year: 2020 - 21)

1. Fertility, Nuptiality and Mortality

15 Lectures

- Fertility – concept and factors affecting fertility.
- Mortality - concept and factors affecting mortality.
- Nuptiality – concept, age at marriage and factors affecting nuptiality.

2. Migration and Urbanization:

15 Lectures

- Migration – concept and types, factors affecting migration, Theory of Migration (Harris and Todaro model), issues related to migration.
- Urbanization - Concept, trends and patterns of urbanization in India, problems of urbanization in India.
- Structure and Features of Population in India.

3. Population Policy:

15 Lectures

- Salient features and evolution of India's population policy.
- Shift in policy focus from population control to family welfare to women empowerment.
- Family Planning – Meaning, importance and methods of family planning.
- Population Projection in India.

REFERENCES :

1. Agarwal S.S. (1985) - 'India's Population Problem' – Tata McGraw Hill Publication, Bombay.
2. A.K. P.C. Swain (2008) – 'Population Studies' – Kalyani Publications, Ludhiana.
3. Bhende A.A. & Tara Kanitkar (1982) – 'Principles of Population Studies'– Himalaya Publishing House, Bombay.
4. Hans Raj (1984) – 'Fundamentals of Demography – Surjeet Publication, Delhi.
5. Jhingan, Bhat & Desai – 'Demography' –
6. Dr. D.D.Kachole (2001) – 'Demography' – Kailasha Publication, Aurangabad.

Programme Code - BA1005

ADVANCED MICRO ECONOMICS: PAPER IV

SEMESTER –V

COURSE CODE	PAPER TITLE	CREDITS	MARKS
UAR5EC4	ADVANCED MICROECONOMICS	4	100

Course Objectives –

The course is designed to provide sound understanding in micro economic theory. Since students have been taught perfect competition, this course focuses on three main pillars of microeconomics such as imperfect competition, welfare economics and information economics.

Course Outcomes

- Enables students will get knowledge on new market structure, imperfect competition.
- Provides understanding on the welfare economics and economics of information.

Module 1: General Equilibrium and Welfare Economics (12 Lectures)

Concept of General Equilibrium and Walrasian General Equilibrium Model - Pareto Optimality – The Pareto Optimality Condition of Social Welfare - Marginal Conditions for Pareto Optimal Resource Allocation - Perfect Competition and Pareto Optimality - Arrow's Impossibility Theorem

Module 2: Market Structure: Monopoly and Monopolistic Competition (14 Lectures)

Concept of Monopoly - Measurement of Monopoly Power - Price Discrimination: Types and Classification of Price Discrimination (Degrees of Price Discrimination) - Equilibrium under discriminating Monopoly - Regulation of Monopoly Market Product Differentiation in Monopolistic Competition - Chamberlin's Alternative approach- Equilibrium under Monopolistic Competition - Excess Capacity

Module 3: Oligopoly (12 Lectures)

The Cournot Model - Meaning and Characteristics of Oligopoly Market - Rigid Prices - The Sweezy Model of Kinked Demand Curve - Collusive Oligopoly - Cartel: Centralised and Market Sharing Cartel - Imperfect Collusion- Price Leadership Models, Game Theory - Prisoner's Dilemma, Nash Equilibrium and Dominant Strategy Equilibrium

Module 4: Information Economics (12 Lectures)

Economics of Search and Search Cost - The Theory of Asymmetric Information-The Market for Lemons and Adverse Selection - Risk Preference and Expected Utility - The Problem of Moral Hazard - Market Signaling - Principal-Agent Problem

References:

1. Jhingan MLL. (2012), Advanced Economic Theory, Vrinda Publications, Delhi.
2. Mankiw N. Gregory (2015), Principles of Microeconomics, Cengage Learning.
3. Mansfield, Edwin (1985), Micro-economics: Theory & Applications, 5th edition, W.W. Norton & Company, New York.
4. Patil K. A (Second edition, 2011, Marathi), Advanced Economic Theory-Micro Analysis, Shri Mangesh Prakashan, Nagpur.
5. Salvatore D. (2006), Microeconomics: Theory and Applications, Oxford University Press, New Delhi.
6. Varian Hal R. (8 Edition 2010) Intermediate Microeconomics A Modern Approach, East-West Press, New Delhi

Programme Code - BA1006

ADVANCED MACROECONOMICS (SEMESTER-VI) PAPER NO - IV

COURSE CODE	PAPER TITLE	CREDIT	MARKS
UAR6EC4	ADVANCED MACROECONOMICS	4	100

Course Objectives –

This course introduces the students to formal modeling of a macro economic theory with analytical tools. Since students have been taught Keynesian Synthesis, this course focuses on four aspects which are the study of Post Keynesian Synthesis, Trade Cycles, Exchange Rate Regimes and International Monetary System.

Course Outcomes –

- To make student aware about Post Keynesian Synthesis and understand various aspects of Trade Cycles.
- Students will be able to describe the contemporary Exchange Rate Regimes and International Monetary System.

Module 1: Post Keynesian Synthesis

(14 Lectures)

Derivation of Aggregate Demand Curve with IS-LM - Aggregate Supply Curve - Determination of Equilibrium National Income and Price Level under Aggregate Demand and Aggregate Supply Model - Extension of IS-LM Model with Labour Market and Flexible Prices - Natural Rate of Unemployment Long run Philips Curve - Friedman's Expectation Model - Tobin's Modified Philips Curve - Adaptive Expectations and Rational Expectations.

Module 2: Trade Cycles

(12 Lectures)

Meaning- Nature- Features and Types of Trade Cycles - Phases of Trade Cycles - Theories of Trade Cycles- Hawtrey's, Kaldor, Paul Samuelson and Hicks - Measures to Control Trade Cycles.

Module 3: Exchange Rate Regimes and Currency Crises

(12 Lectures)

Managed Exchange Rate- Advantage and Disadvantage - Policy of Managed Flexibility-Adjustable Peg System, Crawling Peg System, Managed Floating System, Clean and Dirty Float System - Balance of Payment and Exchange Rate - Is Balance of Payments Always in Balance? – Convertibility of Currency - Currency Crisis-Causes, Impact and Measures.

Module 4: International Monetary System

(12 Lectures)

Rise and Fall of International Gold Standard - Bretton Woods System- Breakdown of the Bretton Woods System - Monetary System after the Collapse of Bretton Woods System - Maastricht Treaty, Features, Effects and Importance of Euro- Currency Market - Causes and Consequences of Global Economic Crisis - Impact of Global Recession on the Indian Economy - Asia Infrastructure Investment Bank (AIIB) - New Development Bank (NDB): Asian Development Bank (ADB).

References:

1. Blanchard, Oliver (2008), Macroeconomics, Pearson education, New Delhi, India.
2. Dornbusch, Fisher and Startz (2018): Macroeconomics, McGraw Hill Education (India) Pvt. Ltd.
3. Mankiw N Gregory (2003), Macroeconomics, 6" edition, Worth Publishers, New York.
4. Patil J. F (2005, Marathi Edition), Macroeconomic Analysis, Phadke Prakashan, Kolhapur.
5. Rana K. C. & Verma K.N (2017), International Economics, Vishal Publishing CO. Jalandhar.
6. Salvatore D. (1997), International Economics, Printice Hall, New York.

RESEARCH METHODOLOGY (SEMESTER-V) PAPER NO - VII

COURSE CODE	PAPER TITLE	CREDIT	MARKS
UAR5EC7	RESEARCH METHODOLOGY	4	100

Course Objectives –

This paper contains within the various objectives, such as to understand and make aware as well as inculcate research in Economics amongst the learners, to encourage exchange of ideas and application of results of economic research at the same time to enable students in understanding data collection and presentation for quality research in social sciences.

Course Outcomes-

- The learners will understand and inculcate research in Economics
- The learners will exchange ideas and application of results of economic research.
- The course will help in formulation of problems in social science research.
- The students will understand data collection and presentation for quality research in social sciences.

Module 1: Introduction to Research

(12 Lectures)

Meaning and scope of social science research- Basic assumptions of research- Features and importance of social science research- Objectives and types of research; Basic, Applied, Pure, Descriptive, Analytical, and Empirical research- Limitations of social science research- Difficulties in social science research

Module 2: Formulation of Problem in Social Science Research

(12 Lectures)

Research process: Identification, selection and formulation of research problem-Sources of research problem - Criteria of a good research problem- Review of literature-Formulation of hypothesis- Research design: Definition, Concepts, and types- Data Collection and analysis- Interpretation and report writing- Use of web search in research process.

Module 3: Types of Data: Primary and Secondary

(12 Lectures)

Types of Data: Primary data and its collection methods: Observation method- Interview Technique - Design of schedule and questionnaire - Survey method and Field visits - Secondary data : Meaning- advantages- sources- relevance and limitations of secondary data- Sampling Techniques : Census and sample survey- Essentials of a good sampling - Advantages and limitations of sampling- Types of sampling: Random sampling and Non-random sampling-Sampling and Non-Sampling errors.

Module 4: Representation and Analysis of Data

(12 Lectures)

Classification, Tabulation and Graphical presentation of socio-economic data- Need and importance of data analysis- Statistical analytical tools: Measures of Central Tendency - Measures of Variation : Absolute and relative measures - Quartile deviation, standard deviation, coefficient of variation- Skewness: Meaning and measurement (Karl Pearson's and Bowley's methods) - Preliminaries of computer applications in data organization and data processing.

References:

1. Bhandarkar P.L., (1994), Samajik Sanshodhan Padhati, Himalaya Publication, New Delhi.
2. Dawson, Catherine (2002), Practical research methods, UBS Publishers, New Delhi.
3. Ghosh, B.N. (1992), Scientific methods and social research, Sterling Publishers Pvt. Ltd, New Delhi.
4. Gupta S P, (1987), Statistical methods, Sultan Chand and Sons, New Delhi.
5. Kothari R.C. (2008), Research methodology, methods and techniques, New Age International Publishers, New Delhi.
6. Krishnaswamy O.R.(1993), Methodology of research in social sciences, Himalaya publishing House, Mumbai.

RESEARCH METHODOLOGY (SEMESTER-VI) PAPER NO - VII

COURSE CODE	PAPER TITLE	CREDIT	MARKS
UAR6EC7	RESEARCH METHODOLOGY	4	100

Course Objectives-

This paper 'Research methodology-II' has various objectives, like to enable students in understanding application of statistics in research, to prepare learners to realize about various analytical tools and methods in research, to orient the students to know index numbers, hypothesis formulations and testing and to make student understand about the research report writing.

Course Outcomes-

- The learners get assimilated to the research culture in Economics through application of statistics.
- The learners will understand the concept of index number with its use and applications.
- The course will help in formulation of hypotheses and its testing in social science research.
- The students will understand the writing of social science research reports with its various types, organization and styles.

Module 1: Application of Statistics in Research (10 Lectures)

Methods of studying correlation- measurement of simple correlation: graphic method- Scatter diagram Coefficient of correlation- Karl Pearson and rank correlation- Interpretation of $r = +1$. Linear regression analysis: Meaning, regression lines, regression equation, regression equation relationship between correlation and regression- Analysis of time series- Components- Trend analysis- Moving averages (3, 4 and 5 Yearly)- Method of least square.

Module 2: Index Number: (14 Lectures)

Meaning and classification of index number - Problems encountered while constructing index numbers Uses and limitation of index numbers - Methods of constructing index numbers: Simple index: i) Aggregate method ii) Simple average of Relative method - Weighted index: Laspeyres's, Paache's, Fisher's and Marshall- Edgeworth - Base shifting - Deflating and Cost of living index number: Weighted average of Relative method - Aggregate Expenditure method- Chain based index - Concepts of base shifting, splicing, and deflating - Consumer price index- Meaning, need and construction.

Module 3: Hypothesis Formulation and Testing (10 Lectures)

Definition and functions of Hypothesis - Criteria of workable Hypothesis - Forms and sources of hypothesis- Concepts in testing of hypothesis: Universe / Population parameter and sample statistics Types of hypotheses: Null and Alternative Hypotheses-Levels of significance-Critical region -Type I and Type II Errors -Student t- test.

Module 4: Research Report Writing (14 Lectures)

Types of research reports: Technical, Popular, Interim, Summary, Article- Format of a research report Principles of writing the research report: Organization and style - Contents- Styles of reporting- Steps in drafting reports- Editing the final draft-Evaluating the final draft -Organization of the research report: Preliminaries, Contents of report, Structuring the report: Chapter format- Pagination- Identification Using quotations, Presenting footnotes- Abbreviations- Presentation of tables and figures- Referencing documentation-Use and format of appendices- Indexing - Bibliography, Appendices.

References-

1. Allen, T. Harrell (1978), New methods in social science research, Praeger Publishers, New York
2. Bhandarkar P.L., (1994), Samajik Sanshodhan Padhati, Himalaya Publication, New Delhi,
3. Ghosh, B.N, (1992). Scientific methods and social research, Sterling publishers Pvt. Ltd, Delhi.
4. Gupta S. P, (1987), Statistical methods, Sultan Chand and Sons, New Delhi
5. Kothari R.C. (2008), Research methodology, methods and techniques, New Age International Publishers, 2nd revised edition, New Delhi.
6. Krishnaswamy O.R. (1993), Methodology of research in social sciences, Himalaya Publishing House, Mumbai.

Micro Economics –I, Sem - I

COURSE CODE	PAPER TITLE	CREDITS	MARKS
PAR1EC1	MICRO ECONOMICS	06	100

SYLLABUS

Module –I: Consumer Behavior

(lectures 12)

Axioms of rational choice, Utility function and its existence, revealed preference approach to consumer choice, consumer's optimization problem, income and substitution effects, indirect utility function and its properties, indifference curve analysis, cardinal and ordinal approaches.

Module –II: Production, cost and supply

(lectures 12)

Production: Returns to scale and varying proportions, production function (Cobb-Douglas), variations in scale, variations in input proportions, problem of profit maximization for a firm, cost: long run and short run cost curves, cost minimization, profit function, supply function

Module –III: Price and Output determination under perfect competition

(lectures 12)

Features of perfect competitions, price and output determination in the long and short run, Equilibrium of the firm and the industry, existence and stability of General equilibrium in a pure consumption economy, first and second fundamental theorems of welfare economics, welfare effects of price changes, market failures and theory of the second best.

Module –IV: Monopoly

(lectures 12)

Monopoly: Its features, measures market power, price and output determination in a monopoly, the welfare effects of monopoly, first, second and third degree price determination under monopoly, natural monopoly, regulation of monopolies.

Reference Books

Micro Economics - Paper I
1. Gravelle H. and Rens R. (2004) : Microeconomics., 3 rd Edition, Pearson edition Ltd, New Delhi.
2. Varian H. (2000) : Intermediate microeconomics : A Modern Approach, 8 th Edition, W. W. Norton and company.

Micro Economics –I, Sem - II

COURSE CODE	PAPER TITLE	CREDITS	MARKS
PAR2EC1	MICRO ECONOMICS	06	100

SYLLABUS

Module –I: Introduction to Game Theory

(lectures 12)

Introduction to Game theory, normal form games and extensive form games, dominant strategy equilibrium, Prisoner's dilemma, Nash equilibrium in Pure and Mixed strategies, sub game perfection, Uncertainty and choice under uncertainty, Certainty Equivalence, measures of Risk Aversion.

Module –II: Oligopoly and Monopoly Market

(lectures 12)

Oligopoly and its features, Cournot Model, Bertrand Model, Stackelberg Model, Comparison with monopoly, Oligopoly in repeated games and tacit collusion, Monopoly and its features, limit pricing and entry deterrence in monopoly.

Module –III: Asymmetric information

(lectures 12)

Moral hazard and adverse selection, market for lemons, principle – agent models, optimal contracts under symmetric information, contracts under asymmetric information, screening and signaling applications.

Module –IV: Alternative Theories of the firms

(lectures 12)

Alternative theories of the firm: Morris model of managerial enterprise, Williamson's model of managerial discretion, behavioral theories of the firm, Full cost pricing Principle, Existence, Purpose and Boundaries of firms, Transactions costs, resource based, Knowledge based, Transactions based theories of the firm.

Reference Books

Micro Economics - Paper I
1. Gravelle H. and Ress R. (2004) : Microeconomics., 3 rd Edition, Pearson edition Ltd, New Delhi,
2. Varian H. (2000) : Intermediate microeconomics : A Modern Approach, 8 th Edition, W. W. Norton and company.
3. Gibbons R. A. Primer in Game Theory, Harvester – Wheatsheaf, 1992

Statistical Methods in Economics –IV, emester-I

COURSE CODE	PAPER TITLE	CREDITS	MARKS
PAR1EC4	STATISTICAL METHODS IN ECONOMICS	06	100

SYLLABUS

Module –I: (lectures 12)

Random **variables** mean and variance of a random variable, basic laws of probability, Discrete random variables (Geometric, Binomial and Poisson), Continuous distributions (The Normal Distribution), Covariance and Correlation (Pearson's and Spearman's coefficients), the law of large numbers (without proof)

Module –II: (lectures 12)

Tests of **Hypothesis**: Tests of hypothesis, null and alternative hypothesis, one tailed and two tailed tests, the standard normal distribution and its applications, the Chi-square distribution and its applications, the T distribution and its application, the F distribution and its application the central Limit Theorem (without proof)

Module –III: (lectures 12)

Simple **linear regression**: Estimation and hypothesis testing, properties of estimators, R Square and adjusted R square, the F test in regression, interpreting regression coefficients.

Module –IV: (lectures 12)

Problems in simple Linear Regression model: Heteroskedasticity and its consequences, autocorrelation and its consequences, multicollinearity and its consequences.

Reference Books

Statistical Methods in Economics - Paper IV
1. Hatekar Neeraj R: <i>Principles of Econometrics : an introduction Using R</i> , SAGE publications, 2010
2. Kennedy P.: <i>A Guide to Econometrics</i> , Sixth Edition, Wiley Blackwell edition, 2008
3. D. N. Gujarati and D.C. Porter, <i>Basic Econometrics</i> , McGraw Hill, 5th edition, International Edition, 1 July 2017
4. Wooldridge, J., <i>Introductory Econometrics: A Modern Approach</i> , Cengage Learning, 2009

Mathematical Techniques for Economics –IV, Semester –II

COURSE CODE	PAPER TITLE	CREDITS	MARKS
PAR2EC4	MATHEMATICAL TECHNIQUES FOR ECONOMICS	06	100

SYLLABUS

Module –I: (lectures 12)

A **set** and its elements, basic set theoretic operations, De Morgan's laws, slope and intercept of a straight line, higher order functions, logarithmic and exponential functions, rules of logarithms and exponentiation, limits of sequences.

Module –II: (lectures 12)

Derivative of a function, addition, multiplication and chain rule, application of derivatives in economics, Unconstrained optimization in economics, partial derivatives and their applications in Economics, introduction to integration and its applications in Economics.

Module –III: (lectures 12)

Constrained optimization in Economics, Lagrange multipliers and equality constraints, constrained optimization with inequality constraints, applications in economics.

Module –IV: (lectures 12)

Introduction to **matrices**, adding and multiplying matrices, transpose and inverse of a matrix, solving simultaneous equations with matrices.

Reference Books

Mathematical Techniques for Economics - Paper IV
1. Chiang, A.C., Fundamental Methods of Mathematical Economics, McGraw-Hill, 2005
2. K. Sydsaeter and P. Hammond, Mathematics for Economic Analysis, Pearson Educational Asia: Delhi, 2002.
3. Dowling Edward T : Introduction to Mathematical Economics, Schaum Outline Series in Economics, Tata McGraw -Hill, New Delhi,2004

Research Project
Semester –IV-Course Code –PAR4EC4

Objectives

Sr. No.	Objectives
01	To study the Introduction of Public Finance.
02	To study the nature and scope Fiscal Policy: Budget and Taxation.
03	To study the importance Public Expenditure and Debt.
04	To study the Indian Public Finance.

Course Outcome

Sr. No.	Course Outcome
01	Students will understand the concepts of Public Finance.
02	Students will understand scenario of Fiscal Policy: Budget and Taxation.
03	Students will learn Public Expenditure and Debt.
04	Students will get basic idea of Indian Public Finance.

COURSE CODE	PAPER TITLE	CREDITS	MARKS
PAR4EC4	Research Project	06	100

SYLLABUS

- | | |
|---|---------------|
| 1. Research Methodology: An Introduction. | (12 Lectures) |
| 2. Defying the research problem. | (12 Lectures) |
| 3. Research Design. | (12 Lectures) |
| 4. Sampling Design. | (12 Lectures) |
| 5. Methods of Data collection. | (12 Lectures) |
| 6. Hypothesis. | (12 Lectures) |
| 7. Index. | (12 Lectures) |
| 8. Report writing. | (12 Lectures) |

UNIVERSITY OF MUMBAI

No. UG/60 of 2018-19

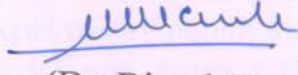
CIRCULAR:-

Attention of the Principals of the Affiliated Colleges and Directors of the recognized Institutions in Humanities Faculty is invited to this office circular No. UG/213 of 2010, dated 27th July, 2010 relating to syllabus of Bachelor of Arts.

They are hereby informed that the recommendations made by the Board of Studies in Hindi at its meeting held on 11th June, 2018 have been accepted by the Academic Council at its meeting held on 14th June, 2018 vide item No. 4.8 and that in accordance therewith, the revised syllabus as per the (CBCS) for the T.Y.B.A. in Hindi – Sem V & VI has been brought into force with effect from the academic year 2018-19, accordingly. (The same is available on the University's website www.mu.ac.in).

MUMBAI – 400 032

6th June, 2018
To July


(Dr. Dinesh Kamble)
I/c REGISTRAR

The Principals of the affiliated Colleges and Directors of the recognized Institutions in Humanities Faculty. (Circular No. UG/334 of 2017-18 dated 9th January, 2018.)

A.C./4.8/14/06/2018

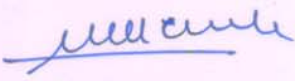
No. UG/60 -A of 2018

MUMBAI-400 032

6th June, 2018
July

Copy forwarded with Compliments for information to:-

- 1) The I/c Dean, Faculty of Humanities,
- 2) The Chairman, Board of Studies in Hindi,
- 3) The Director, Board of Examinations and Evaluation,
- 4) The Director, Board of Students Development,
- 5) The Professor-cum-Director, Institute of Distance and Open Learning (IDOL),
- 6) The Co-Ordinator, University Computerization Centre,


(Dr. Dinesh Kamble)
I/c REGISTRAR



UNIVERSITY OF MUMBAI
Revised Syllabus and
Pattern of Question Paper in the
Subject of
Hindi
at the
T.Y.B.A. Examination
Choice Based Credit System (CBCS)
(Paper - IV, V, VI, VII, VIII, IX)
(With effect from the Academic Year: 2018-2019-2020)

UNIVERSITY OF MUMBAI

**Revised Syllabus and
Pattern of Question Paper in the
Subject of
Hindi
at the
T.Y.B.A. Examination**

हिन्दी अध्ययन मंडल
निमंत्रक : डॉ. विष्णु र. सरवदे,

पाठ्यक्रम समिति :

- | | |
|---|------------------------------|
| १. डॉ. प्रकाश धुमाल | — (समन्वयक, पाठ्यक्रम समिति) |
| २. डॉ. मनप्रीत कौर | — सदस्य |
| ३. डॉ. विद्या शिंदे | — सदस्य |
| ४. डॉ. शीला आहुजा | — सदस्य |
| ५. डॉ. संतोष मोटवाणी | — सदस्य |
| ६. डॉ. गौतम सोनकांबळे | — सदस्य |
| ७. डॉ. मोहसिन खान | — सदस्य |
| ८. डॉ. एस. के. पवार (धारवाड विश्वविद्यालय, कर्नाटक) | — सदस्य |
| ९. डॉ. संजय सिंह (Zee TV) | — सदस्य |

T.Y.B.A. HINDI COURSE - IV
(History of Hindi Literature)

Course Code - UAHIN - 501

कुल व्याख्यान — 60

SEMESTER - V

Credit - 4

प्रश्न पत्र — IV

हिंदी साहित्य का इतिहास

- इकाई I हिंदी साहित्य का इतिहास — नामकरण और काल विभाजन की समस्याएँ
- इकाई II आदिकाल
- आदिकालीन हिंदी साहित्य की पृष्ठभूमि।
 - सिद्ध, नाथ, जैन एवं रासों साहित्य की सामान्य विशेषताएँ।
- इकाई III भक्तिकाल
- भक्तिकालीन हिंदी साहित्य की पृष्ठभूमि।
 - संत काव्यधारा, सूफ़ी काव्यधारा, राम भक्तिकाव्य, कृष्ण भक्तिकाव्य की सामान्य विशेषताएँ।
- इकाई IV रीतिकाल
- रीतिकालीन हिंदी साहित्य की पृष्ठभूमि।
 - रीतिबद्ध, रीतिसिद्ध एवं रीतिमुक्त काव्य की विशेषताएँ।

निर्धारित वस्तुनिष्ठ प्रश्नों की सूची :

1. 'दोहाकोश' किसकी रचना है?
2. 'जयचंद प्रकाश' के रचयिता कौन हैं?
3. 'खुमानरासो' का लेखक कौन हैं?
4. 'संदेश रासक' के रचयिता कौन हैं?
5. 'कीर्तिपताका' के रचनाकार कौन हैं?
6. 'राऊलवेल' किसकी रचना है?
7. 'बीसलदेव रासो' के रचनाकार कौन हैं?
8. 'जय मयंक जस चंद्रिका' नामक ग्रंथ के रचनाकार कौन हैं?
9. 'रणमल्ल छंद' नामक काव्य की रचना किसने की है?
10. 'भरतेश्वर बाहुबलीरास' के रचनाकार कौन हैं?
11. 'दुलहिन गावहु मंगलचार' किसकी पंक्ति हैं?
12. कबीर की रचनाओं का संकलन किस नाम से किया गया है?
13. 'मैं कहता आंखिन देखी, तू कहता कागद की लेखी' किसकी पंक्ति है?
14. रैदास किस काव्यधारा के कवि हैं?
15. 'प्रभुजी तुम चन्दन हम पानी, जाकी अंग—अंग बास समानी।' किसकी पंक्ति है?
16. नानक—पंथ के प्रवर्तक कौन हैं?
17. नामक के पद किस ग्रंथ में संकलित हैं?
18. रज्जब किसके शिष्य थे?
19. दादु दयाल के पद किस शीर्षक से संग्रहित हैं?
20. 'बारहखड़ी' किसकी रचना है?
21. 'ज्ञानसमुद्र' के रचयिता का नाम लिखिए।
22. 'चंदायन' के रचयिता का नाम लिखिए।
23. आचार्य रामचन्द्र शुक्ल के अनुसार भक्तिकाल की समय सीमा क्या है?
24. प्रेमाख्यान काव्यधारा पर किस शैली का प्रभाव है?
25. प्रेमाश्रयी शाखा के प्रमुख कवि कौन हैं?
26. 'मृगावती' के रचनाकार का नाम लिखिए?
27. रत्नसेन किस महाकाव्य का नायक है?
28. 'अखरावट' के रचयिता का नाम लिखिए।
29. 'छिताई वार्ता' किसकी रचना है?
30. 'ज्ञानदीप' की रचना किसने की?
31. 'विशिष्टाद्वैत—सिद्धांत की स्थापना किसने की?
32. आलवार संत संख्या में कितने थे?
33. 'ध्यानमंजरी' किसकी रचना है?
34. 'विनय पत्रिका' के रचयिता का नाम लिखिए।

35. 'लाज न आई आपको दौरे आएहु साथ' — पंक्ति का संबंध किससे है?
36. 'गौड़ीय सम्प्रदाय के प्रवर्तक कौन हैं?
37. 'हरिदासी सम्प्रदाय किस अन्य नाम से जाना जाता है?
38. 'सूरदास किसके शिष्य थे?
39. 'साहित्य लहरी' किसकी रचना है?
40. 'सूरसागर' के रचयिता का नाम लिखिए।
41. 'पुष्टिमार्गीय भक्ति—संप्रदाय की स्थापना किसने की?
42. "उर में माखन चोर गड़े।" किसकी पंक्ति है?
43. 'विरहमंजरी' किसकी रचना है?
44. "जग सुहाग मिथ्या री सजनी हांवा हो मिट जासी।" किसकी पंक्ति है?
45. 'गीतगोविन्द की टीका' किसकी रचना है?
46. 'अर्द्ध कथानक' किसकी रचना है?
47. 'बरवै नायिकाभेद' की रचयिता कौन है?
48. 'रामचंद्रिका' के रचयिता का नाम लिखिए।
49. 'कविप्रिया' किसकी रचना है?
50. 'रसिकप्रिया' के रचयिता का नाम लिखिए।
51. 'स्थूलिभद्ररास' में स्थूलिभद्र के साथ किस वेश्या की कथा कही गई है?
- | | |
|------------|--------------|
| i) प्रदिशा | ii) शेफालिका |
| iii) कोशा | iv) मदनिका |
52. कौनसी शैली जैन रचनाओं की नहीं है?
- | | |
|-----------|-------------|
| i) रास | ii) फागु |
| iii) चरित | iv) चर्यापद |
53. 'कवि स्वयंभू' किस भाषा के कवि हैं?
- | | |
|------------|-------------|
| i) प्राकृत | ii) अपभ्रंश |
| iii) हिंदी | iv) पाली |
54. 'गोरख जगायो जोग, भक्ति भगायो भोग' किसकी पंक्ति है?
- | | |
|--------------|-----------------|
| i) ईश्वरदास | ii) तुलसीदास |
| iii) रामानंद | iv) वल्लभाचार्य |
55. 'भरतेश्वर बाहुबली रास' को जैन साहित्य के रास परंपरा का पहला ग्रंथ किसने माना है?
- | | |
|------------------------|----------------------|
| i) राहुल सांस्कृत्यायन | ii) गणपतिचंद्र गुप्त |
| iii) मुनिजिन विजय | iv) रामचंद्र शुक्ल |
56. 'संधा भाषा' का प्रयोग किन कवियों ने किया है?
- | | |
|--------------|---------|
| i) सिद्ध | ii) जैन |
| iii) अपभ्रंश | iv) संत |

57. 'कवि स्वयंभू' किस भाषा के कवि है?
- | | |
|------------|-------------|
| i) प्राकृत | ii) अपभ्रंश |
| iii) हिंदी | iv) पाली |
58. कबीर को 'वाणी का डिक्टेटर' किसने कहा?
- | | |
|-------------------------|----------------------------|
| i) हजारीप्रसाद द्विवेदी | ii) आचार्य रामचन्द्र शुक्ल |
| iii) श्यामसुंदर दास | iv) डॉ. गणपतिचन्द्र गुप्त |
59. संत काव्यधारा का प्रमुख रस कौन—सा है?
- | | |
|---------------|----------|
| i) वीर | ii) करुण |
| iii) श्रृंगार | iv) शांत |
60. निर्गुण ब्रह्म किस काव्यधारा का प्रमुख आधार है?
- | | |
|----------|-----------|
| i) संत | ii) सूफी |
| iii) राम | iv) कृष्ण |
61. राम काव्यधारा के प्रमुख कवि कौन है?
- | | |
|---------------|------------|
| i) कबीर | ii) जायसी |
| iii) तुलसीदास | iv) सूरदास |
62. निम्नलिखित में से कौन पुष्टिमार्ग के कवि नहीं है?
- | | |
|-------------|---------------|
| i) नागरीदास | ii) छितस्वामी |
| iii) नंददास | iv) सूरदास |
63. निम्नलिखित में से कौन—सी रचना सूरदास की नहीं है?
- | | |
|-----------------|-----------------|
| i) साहित्य—लहरी | ii) सूरसारावली |
| iii) सूरसागर | iv) रामचरितमानस |
64. "मो मन गिरधर छवि पर अटक्यौ।" किसकी पंक्ति है?
- | | |
|---------------|--------------|
| i) मीराबाई | ii) सूरदास |
| iii) कृष्णदास | iv) कुंभनदास |
65. निम्नलिखित में से कौन—सी रचना केशवदास की नहीं है?
- | | |
|------------------|------------------|
| i) रतन बावनी | ii) साहित्य—लहरी |
| iii) विज्ञानगीता | iv) रसिकप्रिया |
66. 'नायिका भेद' किसकी रचना है?
- | | |
|-------------------|--------------------|
| i) रहीम | ii) नाभादास |
| iii) सुंदर कविराय | iv) न्यामत खाँ जान |
67. 'रतन बावनी' के रचयिता कौन है?
- | | |
|--------------|--------------|
| i) तुलसीदास | ii) ईश्वरदास |
| iii) केशवदास | iv) नाभादास |
68. राधा वल्लभ सम्प्रदाय के प्रवर्तक कौन है?
- | | |
|------------------|-------------------|
| i) स्वामी हरिदास | ii) निम्बाकाचार्य |
|------------------|-------------------|

- iii) चैतन्य महाप्रभु iv) हितहरिवंश
69. निम्नलिखित में से कौन—सी रचना नंददास की है?
- i) सूरसागर ii) अनेकार्थ मंजरी
- iii) राम रत्नाकर iv) परमानंद सागर
70. 'हित चौरासी' किसकी रचना है?
- i) हित हरिवंश ii) ध्रुवदास
- iii) कृष्णदास iv) छितस्वामी
71. 'अजगर करै न चाकरी, पंछी करै न काम' किसकी उक्ति है?
- i) सुंदरदास ii) मीराबाई
- iii) मलूकदास iv) कबीरदास
72. दादू—पंथ के प्रवर्तक कौन है?
- i) मलूकदास ii) नाभादास
- iii) लालदास iv) दादूदयाल
73. 'जपुजी' के रचनाकार का नाम क्या है?
- i) कबीरदास ii) गुरु नानकदेव
- iii) नाभादास iv) सुंदरदास
74. "दशरथ सुत तिहुं लोक बखाना।" किसकी उक्ति है?
- i) कबीरदास ii) जायसी
- iii) सूरदास iv) तुलसीदास
75. "बकरी पाती खात है, ताकि काढ़ी खाल।" यह किसकी उक्ति है?
- i) रैदास ii) कबीरदास
- iii) धर्मदास iv) कल्लोल कवि
76. 'मूल गोसाईं चरित' किसका ग्रंथ है?
- i) अग्रदास ii) तुलसीदास
- iii) बेनी माधवदास iv) नंददास
77. इनमें से कौन—सा ग्रंथ सेनापति का है?
- i) रामचन्द्रिका ii) कवित्त—रत्नाकर
- iii) रामरक्षा—स्तोत्र iv) रामचरितमानस
78. 'कबीर ग्रंथावली' का सम्पादन किसने किया?
- i) डॉ. श्यामसुंदरदास ii) आचार्य रामचन्द्र शुक्ल
- iii) डॉ. नगेन्द्र iv) डॉ. गणपतिचन्द्र गुप्त
79. 'आखिरी कलाम' किसकी रचना है?
- i) जायसी ii) कुतुबन
- iii) मंझन iv) बनारसीदास
80. 'साखी' शब्द का अर्थ क्या है?

- 8

92. रीतिकाल को 'अलंकृत काल' की संज्ञा किसने दी है?
 i) मिश्रबन्धु ii) रामकुमार वर्मा
 iii) धीरेंद्र वर्मा iv) हजारीप्रसाद द्विवेदी
93. 'इश्कनामा' किसकी कृति है?
 i) आलम ii) बोधा
 iii) ठाकुर iv) द्विजदेव
94. 'छत्रप्रकाश' किसकी रचना है?
 i) लालकवि ii) श्रीधर
 iii) ग्वाल iv) मंझन
95. 'बिहारी सतसई' पर किस ग्रंथ का प्रभाव है?
 i) नवरसतरंग ii) शृंगारसागर
 iii) गाथासप्तशती iv) ब्रजविलास
96. "कुंदन को रंग फिकौ लगे" किसकी पंक्ति है?
 i) रसलीन ii) वृंद
 iii) मतिराम iv) आलम
97. इनमें से किस कवि ने लक्षण ग्रंथ नहीं लिखा?
 i) मतिराम ii) चिंतामणि
 iii) भूषण iv) घनानंद
98. रीतिकाल के किस कवि में भक्ति और शृंगार का समन्वयात्मक योग है?
 i) सेनापति ii) घनानंद
 iii) भिखारीदास iv) जनकवि
99. "देखन में छोटे लगै, घाव करै गंभीर" यह उक्ति किस कवि की रचनाओं के संबंध में है?
 i) ठाकुर ii) देव
 iii) बोधा iv) बिहारी
100. "मोहितो मोरे कवित्त बनावत" उक्ति किस कवि की है?
 i) मतिराम ii) चिंतामणि
 iii) रसलीन iv) घनानंद

संदर्भ ग्रंथ :

1. हिंदी साहित्य का इतिहास — आचार्य रामचंद्र शुक्ल
2. हिंदी साहित्य की पृष्ठभूमि — आचार्य हजारी प्रसाद द्विवेदी
3. हिंदी साहित्य का आदिकाल — आचार्य हजारी प्रसाद द्विवेदी
4. हिंदी साहित्य उद्भव और विकास — आचार्य हजारी प्रसाद द्विवेदी
5. हिंदी साहित्य का आलोचनात्मक इतिहास — रामकुमार वर्मा
6. हिंदी साहित्य का वैज्ञानिक इतिहास — डॉ. गणपतिचन्द्र गुप्त
7. हिंदी साहित्य का इतिहास — डॉ. विजयेन्द्र स्नातक
8. हिंदी साहित्य का दूसरा इतिहास — डॉ. बच्चन सिंह
9. हिंदी साहित्य (3 खण्ड) — हिंदी साहित्य सम्मेलन, प्रयाग
10. हिंदी साहित्य का इतिहास — संपादक : डॉ. नगेन्द्र और डॉ. हरदयाल
11. हिंदी साहित्य का संक्षिप्त इतिहास — डॉ. विश्वनाथ त्रिपाठी
12. हिंदी साहित्य का इतिहास — लक्ष्मी सागर वार्ष्णेय
13. हिन्दी और मराठी संत साहित्य : समाजशास्त्रीय रचनात्मक प्रासंगिकता का तुलनात्मक अध्ययन — सम्पादक : डॉ. विद्या शिंदे

नमूना प्रश्न पत्र
Semester - V
Course - IV

अवधि : 03 घंटे

पूर्णांक : 100

सूचना : 1. अंतिम प्रश्न अनिवार्य है।

2. सभी प्रश्नों के लिए समान अंक है।

प्रश्न 1 आदिकाल के नामकरण के संबंध में विभिन्न विद्वानों के मत स्पष्ट कीजिए। 20

अथवा

हिन्दी साहित्य के इतिहास के नामकरण की समस्या पर प्रकाश डालिए।

प्रश्न 2 हिन्दी साहित्य की आदिकालीन पृष्ठभूमि का सामान्य परिचय दीजिए। 20

अथवा

रासो साहित्य की सामान्य विशेषताओं को स्पष्ट कीजिए।

प्रश्न 3 सन्त काव्य की प्रमुख प्रवृत्तियों पर प्रकाश डालिए। 20

अथवा

कृष्ण भक्ति काव्य की सामान्य विशेषताओं को स्पष्ट कीजिए।

प्रश्न 4 रीतिकालीन साहित्य की राजनीतिक एवं सामाजिक पृष्ठभूमि पर प्रकाश डालिए। 20

अथवा

रीतिमुक्त काव्यधारा की प्रमुख प्रवृत्तियाँ स्पष्ट कीजिए।

प्रश्न 5 अ) किन्हीं दो विषयों पर टिप्पणियाँ लिखिए :— 10

1. आदिकाल का नामकरण
2. जैन साहित्य
3. सूफी काव्य
4. रीतिसिद्ध काव्य

ब) वस्तुनिष्ठ प्रश्न —

05

1. 'भारतेश्वर बाहुबलीरास' के रचनाकार कौन हैं?
2. रैदास किस काव्यधारा के कवि है?
3. नानक—पंथ के प्रवर्तक कौन है?
4. आचार्य रामचन्द्र शुक्ल के अनुसार भक्तिकाल की समय सीमा क्या है?
5. आलवार संत संख्या में कितने थे?

1. 'शिवा बावनी' के रचयिता कौन है?
 - i) गोविन्द सिंह
 - ii) भूषण
 - iii) आलम
 - iv) जायसी
2. कबीर को 'वाणी का डिक्टेटर' किसने कहा?
 - i) हजारीप्रसाद द्विवेदी
 - ii) आ. रामचंद्र शुक्ल
 - iii) श्यामसुंदर दास
 - iv) डॉ. गणपतिचंद्र शुप्त
3. निम्नलिखित में से कौन—सी रचना केशवदास की नहीं है?
 - i) रतन बावनी
 - ii) साहित्य—लहरी
 - iii) विज्ञानगीता
 - iv) रसिकप्रिया
4. इनमें से कौन—सा ग्रंथ सेनापति का है?
 - i) रामचन्द्रिका
 - ii) कवित्त—रत्नाकर
 - iii) रामरक्षा—स्तोत्र
 - iv) रामचरितमानस
5. 'इश्कनामा' किसकी कृति है?
 - i) आलम
 - ii) बोधा
 - iii) ठाकुर
 - iv) द्विजदेव

T.Y.B.A. HINDI COURSE - IV
(History of Modern Hindi Literature)
Course Code - UAHIN - 601

कुल व्याख्यान - 60

SEMESTER - VI

Credit - 4

प्रश्न पत्र — IV

आधुनिक हिंदी साहित्य का इतिहास

आधुनिक हिंदी कविता का विकास

- इकाई I
- आधुनिक काल — हिंदी साहित्य की पृष्ठभूमि एवं प्रवृत्तियों का सामान्य परिचय
 - भारतेन्दु—युग
 - द्विवेदी—युग
 - छायावाद
- इकाई II
- प्रगतिवाद
 - प्रयोगवाद
 - नई कविता
 - समकालीन कविता

आधुनिक हिंदी गद्य का इतिहास

- इकाई III
- उपन्यास
 - कहानी
 - नाटक
- इकाई IV
- निबंध
 - आलोचना
 - आत्मकथा

निर्धारित वस्तुनिष्ठ प्रश्नों की सूची :

1. आधुनिक काल को 'गद्य काल' किसने कहा है?
2. हिंदी साहित्य के आधुनिक काल का प्रारंभ कब से माना जाता है?
3. खड़ीबोली का पहला महाकाव्य कौन—सा है?
4. 'रानी केतकी की कहानी' रचना किसने लिखी?
5. द्विवेदी युग की मुख्य विशेषता क्या है?
6. छायावादी काव्य के ब्रम्हा, विष्णु और महेश किसे कहा जाता है?
7. 'शोषकों के प्रति घृणा और रोष' यह कौन से काव्य की विशेषता है?
8. जयशंकर प्रसाद का प्रसिद्ध महाकाव्य कौन—सा है?
9. जयशंकर प्रसाद किस युग के कवि थे?
10. छायावादी युग की सर्वश्रेष्ठ कवयित्री कौन है?
11. 'ठिठुरता हुआ गणतन्त्र' किस रचनाकार का निबंध संग्रह है?
12. 'कुआनो नदी' नामक रचना किस कवि की है?
13. 'नदी के द्वीप' नामक रचना किस कवि की है?
14. 'तार सप्तक' का प्रकाशन किसने किया?
15. 'इत्यलम्' किसका काव्य संग्रह है?
16. "सिंहासन खाली करो कि जनता आती है।" प्रसिद्ध पंक्तियाँ किस कवि की हैं?
17. प्रगतिवाद का मूल आधार किसे माना जाता है?
18. वैद्यनाथ मिश्र किस कवि का मूल नाम है?
19. 'इतिहास के आँसू' नामक काव्य संग्रह किस कवि का है?
20. 'चाँद का मुँह टेढ़ा है' नामक कविता किस कवि की है?
21. अज्ञेय की कौन सी रचना यात्रा पर आधारित है?
22. 'जंग और व्यंग्य' किसकी कृति है?
23. 'ब्रजवर्तिका' के रचनाकार कौन हैं?
24. 'छन्दशती' के रचयिता कौन हैं?
25. 'भूरी—भूरी खाक धूल' रचनाकार का नाम बताईये?
26. 'मछलीघर' के रचयिता कौन हैं?
27. 'शबरी' प्रबंध—काव्य किसने लिखा है?
28. रामदरश मिश्र द्वारा लिखित गीतिकाव्य का नाम बताईये?
29. 'संशयात्मा' के लेखक कौन हैं?
30. 'प्रेम की भूतकथा' के उपन्यासकार कौन हैं?
31. 'कहानी एक नेताजी की' किस प्रकार की रचना है?
32. 'नीलाम घर' किसका उपन्यास है?
33. जैनेन्द्र का अंतिम उपन्यास कौन सा है?

34. 'डूब' किस प्रकार का उपन्यास है?
35. 'छोटे—छोटे सुख' किसका निबंध है?
36. 'आदि अन्त और आरम्भ' के निबंधकार कौन हैं?
37. 'नैपथ्य राग' किसकी नाट्य कृति है?
38. 'भूख हड़ताल' किसकी एकांकी है?
39. हिन्दी कहानियों का नाट्यरूपांतर किसने प्रारम्भ किया?
40. प्रेमचन्द के कहानियों का नाट्यरूपांतर किसने किया?
41. 'कांसे का गिलास' किसकी कहानी है?
42. 'आँखों देखा पाकिस्तान' किस प्रकार की रचना है?
43. 'ज़माने मे 'हम' आत्मकथा किसकी है?
44. 'आखरी चट्टान तक' रिपोर्ताज के लेखक कौन है?
45. 'मंटो ज़िन्दा है' जीवनी किसने लिखी है?
46. 'नंगा तलाई गाँव' किसका संस्मरण है?
47. राजेन्द्र यादव द्वारा लिखित 'अब वे वहाँ नहीं रहते' किस प्रकार की कृति है?
48. 'आते—जाते दिन' रचनाकार का नाम लिखिए?
49. 'राह किनारे बैठ' हास्य—व्यंग्यात्मक कृति किसकी है?
50. भोजपुरी साहित्य का इतिहास किसने लिखा?
51. निराला की किस कृति में प्रगतिवाद की अभिव्यक्ति हुई है?
- i) कुकुरमुत्ता ii) नए पत्ते
iii) अणिमा iv) उपर्युक्त सभी
52. प्रगतिशील लेखक संघ का प्रथम अधिवेशन कब हुआ?
- i) 1935 बनारस में ii) 1937 पटना
iii) 1936 लखनऊ में iv) 1938 पेरिस में
53. यह कथन किसने कहा है कि "मैं प्रयोगवाद का अगुवा नहीं पिछलगुवा हूँ।"
- i) अज्ञेय ii) पंत
iii) दिनकर iv) जगदीश गुप्त
54. प्रयोगवाद का आरंभ किस पत्रिका से हुआ?
- i) प्रतीक ii) हिंदी प्रदीप
iii) इत्यलम् iv) पल्लव
55. सुमन किस प्रगतिशील कवि का उपनाम है?
- i) केदारनाथ अग्रवाल ii) त्रिलोचन
iii) रामेश्वर शुक्ल iv) शिवमंगल सिंह
56. हिंदी के मौलिक उपन्यासों का उद्भव कौन से युग में हुआ है?
- i) भारतेन्दु ii) प्रसाद
iii) यशपाल iv) प्रेमचंद

57. उपन्यास सम्राट किसको कहा जाता है?
- i) जैनेन्द्र ii) नागार्जुन
iii) यशपाल iv) मुंशी प्रेमचंद
58. “युद्ध में मर्यादाएँ टूट जाती हैं, विवेक पराजित हो जाता है और अंधेपन की विजय होती है।” यह कथन किस नाटक का है?
- i) अंधायुग ii) अँधेरे बंद कमरे में
iii) टूटते परिवेश iv) घंटियाँ गूँजती हैं
59. ‘शेखर एक जीवनी’ के रचयिता कौन है।
- i) जैनेन्द्र ii) इलाचंद्र जोशी
iii) अज्ञेय iv) नागार्जुन
60. इनमें से कौन ललित निबंधकार नहीं है?
- i) हजारी प्रसाद द्विवेदी ii) महवीर प्रसाद द्विवेदी
iii) कुबेरनाथ राय iv) विद्यानिवास मिश्र
61. ‘अपने अपने अजनबी’ उपन्यास किसने लिखा है?
- i) अज्ञेय ii) प्रेमचंद
iii) जैनेन्द्रकुमार iv) यशपाल
62. इनमें से कौन सा निबंध संग्रह कुबेरनाथ राय का नहीं है?
- i) रस आखटेक ii) प्रिया नीलकंठी
iii) निषाद बांसुरी iv) तुम चंदन हम पानी
63. ‘दादा कॉमरेड’ किसकी रचना है?
- i) यशपाल ii) मनीष झा
iii) जैनेन्द्र iv) मधुरेश
64. ‘जिदंगीनामा’ उपन्यास किसने लिखा है?
- i) कृष्णा सोबती ii) मृदुला गर्ग
iii) महादेवी वर्मा iv) अनामिका
65. इनमें से कौन सा जोड़ा असंगत है?
- i) जगदीशचन्द्र माथूर — पहला राजा
ii) लक्ष्मी नारायण लाल — मादा कैक्टस
iii) मोहन राकेश — लहरों के राजहंस
iv) देवराज दिनेश — आधे अधूरे
66. ‘शेष—अशेष’ उपन्यास के लेखक कौन हैं?
- i) उदय शंकर भट्ट ii) उदयकुमार
iii) प्रेमचंद iv) यशपाल
67. ‘आवारा मसीहा’ किसकी जीवनी है?
- i) रविन्द्रनाथ ठाकुर ii) विष्णु प्रभाकर

- iii) शरतचंद्र चटर्जी iv) राजेंद्र यादव
68. 'वैशाली की नगरवधू' किस विधा की रचना है?
- i) नाटक ii) कविता
- iii) उपन्यास iv) आत्मकथा
69. इनमें से कौन सी कृति रामविलास शर्मा की है?
- i) आस्था और सौन्दर्य
- ii) मार्क्स और प्राचीन साहित्य का मूल्यांकन
- iii) भाषा और समाज
- iv) नए साहित्य का सौन्दर्य शास्त्र
70. 'आधा गाँव' उपन्यास किसने लिखा है?
- i) प्रेमचंद ii) राही मासूम रज़ा
- iii) अमरकांत iv) यशपाल
71. 'नीला चाँद' उपन्यास किसने लिखा है?
- i) नंदिता जैन ii) शिवप्रसाद सिंह
- iii) यशपाल iv) जैनेन्द्र
72. 'ताश के पत्तों का शहर' उपन्यास किसने लिखा है?
- i) राजकमल चौधरी ii) नरेश मेहता
- iii) नागार्जुन iv) रांगेय राघव
73. 'पारिजात' उपन्यास किसने लिखा है?
- i) मन्नू भंडारी ii) अनामिका
- iii) मैत्रेयी पुष्पा iv) नासिरा शर्मा
74. 'अग्निपंखी' उपन्यास किसने लिखा है?
- i) सूर्यबाला ii) मैत्रेयी पुष्पा
- iii) मृदुला गर्ग iv) नासिरा शर्मा
75. 'तत्सम' उपन्यास की लेखिका कौन है?
- i) मृदुला गर्ग ii) मंजूला भगत
- iii) राजी सेठ iv) नीरजा
76. कौनसी रचना हिंदी नाट्य साहित्य की पहली रचना मानी जाती है?
- i) शंकुतला ii) हनुमन्नाटक
- iii) राजी सेठ iv) नीरजा
77. वर्ष 2008 में प्रकाशित 'हिन्दी साहित्येतिहास की भूमिका' किसका ग्रन्थ है?
- i) सूर्यप्रसाद दीक्षित ii) बच्चन सिंह
- iii) सुमन राजे iv) प्रबोध चंद्रोदय
78. जगदीश गुप्त द्वारा ब्रजभाषा में रचित काव्यकृति कौन—सी है?
- i) गंगा लहरी ii) लंकादहन

- iii) ब्रजवर्तिका iv) छंदशती
79. इनमें से कौन—सी कृति गिरजा कुमार माथुर की नहीं है?
- i) छाया मत छूना मन ii) भीतरी नदी की यात्रा
- iii) गुलमेहंदी iv) कल्पांतर
80. इनमें से 'कालजयी' प्रबंध काव्य के रचयिता कौन है?
- i) भवानी प्रसाद मिश्र ii) नरेश मेहता
- iii) जगदीश चतुर्वेदी iv) भारतभूषण अग्रवाल
81. निम्नलिखित में से कौन—सा गीतिकाव्य रमेश रंजक का नहीं है?
- i) इतिहास दुबारा लिखों ii) मेरे प्रिय गीत
- iii) दरिया का पानी iv) मिट्टी बोलती है
82. 'लौटा है विजेता' काव्य—संग्रह किसका है?
- i) अर्चना वर्मा ii) कात्यायनी
- iii) निर्मला गर्ग iv) अनामिका
83. 'बंधन' उपन्यास के लेखक का नाम बताइएँ।
- i) रमाकांत ii) पंकज बिष्ट
- iii) मनोज सिंह iv) देवेश ठाकुर
84. इनमें से नारी समस्या पर आधारित उपन्यास कौन—सा है?
- i) अनारो ii) अनायास
- iii) अपुरुष iv) बेदखल
85. इनमें से पहला दलित उपन्यास कौन—सा है?
- i) काला पहाड़ ii) कफ़न
- iii) आत्मदान iv) छप्पर
86. सहज कहानी के प्रवर्तक कौन हैं?
- i) अमृतराय ii) मार्कण्डेय
- iii) कमलेश्वर iv) निर्मल वर्मा
87. 'कहानी : स्वरूप और संवेदना' पुस्तक के लेखक कौन है?
- i) धनंजय ii) राजेन्द्र यादव
- iii) इन्द्रनाथ मदान iv) उदय प्रकाश
88. 'दलित कहानी संचयन' कहानी संग्रह किसके द्वारा संपादित किया गया है?
- i) रमणिका गुप्ता ii) रजनी तिलक
- iii) कुसुम वियोगी iv) कुसुम मेधवाल
89. इनमें से नाट्य लेखक का कौन—सा मेल सही है?
- i) मृदुला गर्ग — जादू का कालीन
- ii) सुरेन्द्र वर्मा — जादू जंगल
- iii) भीष्म सहानी — रेत की दीवार

- iv) शंकर शेष — अधूरी आवाज़
90. निम्नलिखित नाटकों में स्वदेश दीपक की नाट्यकृति नहीं है?
- i) कोर्ट मार्शल ii) जलता हुआ रथ
iii) काला पहाड़ iv) काल कोठरी
91. इनमें से 'देश की मिट्टी' एकांकीकार को चुनिए।
- i) हरीकृष्ण 'प्रेमी' ii) जयनाथ नलिन
iii) प्रभाकर माचवे iv) विनोद रस्तोगी
92. 'फुरसत के दिन' कृति के आत्मकथाकार कौन है?
- i) रामदरश मिश्र ii) रमणिका गुप्ता
iii) मिथिलेश्वर iv) देवेश ठाकुर
93. 'पिंजरे की मैना' किस प्रकार की कृति है?
- i) उपन्यास ii) कहानी
iii) आत्मकथा iv) जीवनी
94. 'रास्ते की तलाश में' किसका यात्रा वृत्त है?
- i) श्रीकांत वर्मा ii) सतीश आलोक
iii) गोविन्द मिश्र iv) असगर वजाहत
95. 'सैलानी की डायरी' किस प्रकार की विधा है?
- i) संस्मरण ii) डायरी
iii) यात्रा वृत्त iv) जीवनी
96. 'प्रातः एक स्वप्न' किसका रिपोर्टाज है?
- i) निर्मल वर्मा ii) विवेकीराय
iii) धर्मवीर भारती iv) रामकुमार वर्मा
97. 'कमलेश्वर : मेरे हमसफ़र' जीवनी के रचयिता कौन है?
- i) मदन मोहन ii) गायत्री कमलेश्वर
iii) महिमा मेहता iv) बिन्दु अग्रवाल
98. कौन—सा मेल गलत है।
- i) महादेवी वमौ — स्मृति की रेखा
ii) रामकमल राय — स्मृतियों का शुक्ल पक्ष
iii) रामनाथ सुमन — मैंने स्मृति के दीप जलाये
iv) पद्मा सचदेव — स्मृति की त्रिवेणियाँ
99. अमृतलाल नागर को सोवियत लैण्ड नेहरू पुरस्कार किस कृति के लिए दिया गया?
- i) मानस का हंस ii) अमृत और विष
iii) खंजन नयम iv) बूँद और समुद्र
100. 'सम्मेलन पत्रिका' कहाँ से प्रकाशित होती है?

i) दिल्ली
iii) मुंबई

ii) प्रयाग
iv) कानपुर

संदर्भ ग्रंथ :

1. आधुनिक हिंदी साहित्य का इतिहास — डॉ. बच्चन सिंह
2. स्वातंत्र्योत्तर हिंदी साहित्य का इतिहास — डॉ. लक्ष्मीसागर वाष्णीय
3. हिंदी का गद्य साहित्य — डॉ. रामचंद्र तिवारी
4. छायावाद — डॉ. नामवर सिंह
5. आधुनिक हिंदी काव्य की प्रवृत्तियाँ — डॉ. नामवर सिंह
6. भारतेन्दु हरिश्चंद्र — डॉ. रामविलास शर्मा
7. भारतेन्दु युग और हिंदी भाषा की विकास परंपरा — डॉ. रामविलास शर्मा
8. आचार्य महावीर प्रसाद द्विवेदी और हिंदी नवजागरण — डॉ. रामविलास शर्मा
9. प्रेमचंद और उनका युग — डॉ. रामविलास शर्मा
10. कहानी नई कहानी — नामवर सिंह
11. नई कहानी संवेदना और शिल्प — देवीशंकर अवस्थी
12. हिंदी नाटक — डॉ. बच्चन सिंह
13. नटरंग — डॉ. नेमीचंद्र जैन
14. नया साहित्य नये प्रश्न — आचार्य नंददुलारे वाजपेयी
15. नई कविता के प्रतिमान — लक्ष्मीकांत वर्मा
16. कविता के नये प्रतिमान — डॉ. नामवर सिंह
17. जगदीश गुप्त हिंदी गद्य विन्यास और विकास — रामस्वरूप चतुर्वेदी
18. आधुनिक साहित्य — नंददुलारे वाजपेयी
19. हिंदी साहित्य का इतिहास — संपादक : डॉ. नगेंद्र और डॉ. हरदयाल

नमूना प्रश्न पत्र
Semester – VI
Course – IV

अवधि : 03 घंटे

पूर्णांक : 100

- सूचना:** 1. सभी प्रश्न अनिवार्य हैं।
2. सभी प्रश्नों के लिए समान अंक हैं।
- प्रश्न 1 आधुनिक काल की युगीन पृष्ठभूमि पर प्रकाश डालिए। 20
अथवा
छायावादी काव्य की प्रमुख प्रवृत्तियों का परिचय कीजिए।
- प्रश्न 2 प्रगतिवादी काव्य की विशेषताओं को स्पष्ट कीजिए। 20
अथवा
समकालीन कविता की विशेषताओं पर प्रकाश डालिए।
- प्रश्न 3 हिन्दी कहानी के विकास—क्रम को स्पष्ट कीजिए। 20
अथवा
हिन्दी नाटक के विकास—क्रम को प्रस्तुत कीजिए।
- प्रश्न 4 हिन्दी निबंध के विकास—क्रम पर प्रकाश डालिए। 20
अथवा
हिन्दी आत्मकथा के विकास—क्रम को समझाइए।
- प्रश्न 5 अ) किन्हीं दो विषयों पर टिप्पणियाँ लिखिए :— 10
1. द्विवेदी—युगीन कविता
2. प्रयोगवादी काव्य
3. प्रेमचन्द—युगीन हिन्दी उपन्यास
4. हिन्दी आलोचना
- ब) वस्तुनिष्ठ प्रश्न :— 10

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Course Code - UAHIN - 502

कुल व्याख्यान - 60

SEMESTER - V

Credits - 4

प्रश्न पत्र — V

स्वातंत्र्योत्तर हिंदी साहित्य

निर्धारित पाठ्य पुस्तकें

आधुनिक हिंदी कविता का विकास

इकाई I

काव्य नाटक —

- परिभाषा, स्वरूप, तत्त्व, भेद, प्रवृत्तियाँ एवं स्वातंत्र्योत्तर काव्य नाटक का विकास

इकाई II

- रेखाचित्र — स्वरूप, परिभाषा, विकास—क्रम
- संस्मरण — परिभाषा, स्वरूप, विकास—क्रम

इकाई III

- खंड—खंड अग्नि — काव्य नाटक, लेखक : दिविक रमेश, वाणी प्रकाशन, नई दिल्ली

इकाई IV

- गद्य गरिमा — रेखाचित्र और संस्मरण, संपादन : हिंदी अध्ययन मंडल मुंबई विश्वविद्यालय, वाणी प्रकाशन, नई दिल्ली

- i) भक्तिन — महादेवी वर्मा
- ii) रज़िया — रामवृक्ष बेनीपुरी
- iii) तुम्हारी स्मृति — माखनलाल चतुर्वेदी
- iv) ये हैं प्रोफ़ेसर शशांक — विष्णुकांत शास्त्री
- v) स्मरण का स्मृतिकार — अज्ञेय
- vi) कमला — पद्मा सचदेव
- vii) हृषिकेश मुखर्जी के साथ ढाई दिन — मनोहरश्याम जोशी
- viii) मेरा हमदम मेरा दोस्त कमलेश्वर — राजेंद्र यादव

संदर्भ ग्रंथ :

1. दिविक रमेश आलोचना की दहलीज़ पर — संपादक : प्रेम जन्मेजय
2. हिंदी काव्य—नाटक और युगबोध — डॉ. मृगेन्द्र राय
3. हिंदी नवगीत उद्भव और विकास — राजेंद्र गौतम
4. समकालीन हिंदी कविता — रवीन्द्र भ्रमर
5. हिंदी नवगीत की विकास यात्रा — माधव कौशिक
6. खंड—खंड अग्नि : भाव, संवेदना और शिल्प — संपादक : मोहसिन खान

नमूना प्रश्न पत्र
Semester – V
Course – V

अवधि : 03 घंटे

पूर्णांक : 100

सूचना: 1. सभी प्रश्न अनिवार्य हैं।

2. सभी प्रश्नों के लिए समान अंक हैं।

प्रश्न 1 रेखाचित्र का स्वरूप स्पष्ट करते हुए उसका विकास क्रम लिखिए। 20

अथवा

काव्य नाटक से क्या अभिप्राय है? उसके तत्वों पर प्रकाश डालिए।

प्रश्न 2 निम्नलिखित अवतरणों की संदर्भ सहित व्याख्या कीजिए। 20

क) “नहीं,

सीता नहीं है कोई आम नारी

भावी महारानी है

खबर है वह।”

अथवा

“अब और रहा चुप

चाटुकारिता हो जाएगी भक्ति

जरूरतो तो आपको है समझने की

आपने समझा ही कहाँ सीता को!”

ख) “कभी उतर—पुस्तको को बाँधकर, कभी अधूरे चित्र को कोने में रखकर, कभी रंग की प्याली धोकर और कभी चटाई को आँचल से झाड़कर वह जैसी सहायता पहुँचाती है, उससे भक्ति का अन्य व्यक्तियों से अधिक बुद्धिमान होना प्रमाणित हो जाता है।”

अथवा

“जाने उसके कितने भाई और चाचा हैं जिनके अक्सर एक्सीडेंट हो जाते और वह अपने एपाइण्टमेंट निभा नहीं पाता। इसके अलावा अपनी तरफ से गढ़—गढ़कर झूठ बोलना, या घटनाओं को बढ़ा—चढ़ाकर नामक मिर्च लगाकर सुनाना उसकी प्रिय हाँबी है।”

प्रश्न 3 खण्ड—खण्ड अग्नि का उद्देश्य स्पष्ट कीजिए। 20

अथवा

वर्तमान युग में खण्ड—खण्ड अग्नि नाटक प्रांसगिकता को स्पष्ट कीजिए।

प्रश्न 4 रजिया का चरित्र—चित्रण कीजिए। 20

अथवा

ऋषिकेश मुखजी की चारित्रिक विशेषताएँ स्पष्ट कीजिए।

प्रश्न 5 किन्ही दो विषयों पर टिप्पणी लिखिए :— 20

क) राम का स्वरूप

ख) सीता : वर्तमान नारी की प्रतिकात्मकता

ग) तुम्हारी स्मृति में व्यक्त दो रास्ते

घ) रामकृष्णदास का व्यक्तित्व

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कुल व्याख्यान - 60

SEMESTER - VI

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प्रश्न पत्र — V

स्वातंत्र्योत्तर हिंदी साहित्य

निर्धारित पाठ्य पुस्तकें

इकाई I

- गीत — परिभाषा, तत्त्व, स्वातंत्र्योत्तर, गीत का विकास

इकाई II

- गीत — पुंज
संपादन, हिन्दी अध्ययन मंडल,
मुंबई विश्वविद्यालय,
राजकमल प्रकाशन, नई दिल्ली
- i) जीवन नहीं मरा करता है — गोपालदास 'नीरज'
- ii) सितारों ने लूटा.... — गोपाल सिंह 'नेपाली'
- iii) जीवन अनुभव की पुस्तक.... — ज्ञानवती सक्सेना
- iv)जाती साँसें दो सहेलियाँ हैं—आती — कुंअर बेचैन
- v) बेटी..... — सरिता शर्मा
- vi) आँसू गंगाजल हो बैठे.... — विष्णु सक्सेना
- vii) अपनी गंध नहीं बेचूंगा..... — बालकवि बैरागी
- viii) आकाश सारा..... — बुद्धिनाथ मिश्र
- ix) असंभव..... — रमानाथ अवस्थी
- x) मेघयत्री..... — वीरेंद्र मिश्र

इकाई III

- निबंध — परिभाषा, तत्त्व, भेद तथा स्वातंत्र्योत्तर हिन्दी निबंध
साहित्य का विकास

इकाई IV

- निबंध—मंजूषा
संपादन, हिन्दी अध्ययन मंडल,
मुंबई विश्वविद्यालय,
लोकभारती प्रकाशन, नई दिल्ली
- i) उत्साह — आचार्य रामचंद्र शुक्ल
- ii) देवदारू — आचार्य हजारीप्रसाद द्विवेदी
- iii) संस्कृति है क्या? — रामधारी सिंह 'दिनकर'

- iv) राष्ट्र का स्वरूप — वासुदेवशरण अग्रवाल
- v) ठिठुरता हुआ गणतन्त्र — हरिशंकर परसाई
- vi) मिले तो पछताए — इन्द्रनाथ मदान
- vii) बुद्धिजीवी — शंकर पुणतांबेकर
- viii) पानी है अनमोल — श्रीराम परिहार

संदर्भ ग्रंथ :

1. हिंदी का गद्य साहित्य — रामचंद्र तिवारी
2. आधुनिक हिंदी गद्य का साहित्य — हरदयाल
3. छायावादोत्तर हिंदी गद्य साहित्य — विश्वनाथ प्रसाद तिवारी
4. हिंदी रेखाचित्र — हरवंशलाल शर्मा
5. निबंधों की दुनिया विजयदेव नारायण साही — संपादक : निर्मल जैन और हरिमोहन शर्मा
6. निबंधों की दुनिया शिवपूजन सहाय — निर्मला जैन और अनिल राय
7. प्रतिनिधि हिन्दी निबंधकार — ज्योतीश्वर मिश्र

नमूना प्रश्न पत्र
Semester - VI
Course - V

अवधि : 03 घंटे

पूर्णांक : 100

सूचना : 1. अंतिम प्रश्न अनिवार्य है।

2. सभी प्रश्नों के लिए समान अंक है।

प्रश्न 1 गीत से क्या अभिप्राय है? उसके तत्वों पर प्रकाश डालिए। 20

अथवा

निबंध साहित्य की परिभाषा बताते हुए उसके प्रकारों का विवेचन कीजिए।

प्रश्न 2 निम्नलिखित अवतरणों की संदर्भ सहित व्याख्या कीजिए। 20

क) “लूट लिया माली ने उपवन
लुटी न लेकिन गन्ध फूल की
तुफानों तक ने छेडा पर
खिड़की बन्द न हुई धूल की,
नफरत गले लगाने वालो!
सब पर धूल उड़ाने वालो।
कुछ मुखडो की नाराजी से
दर्पन नही मरा करता है?”

अथवा

“ओ प्रबंध के विक्रेताओ
महाकाव्य के ओ क्रेताओ
ये व्यापार तुम्ही को शुभ हो मुक्तक छंद नही बेचूँगाँ
अपनी गंध नहीं बेचूँगाँ — चाहे सभी सुमन बिक जाएँ।”

ख) “दान—वीर में अर्थ—त्याग का साहस अर्थात् उसके कारण होने वाले कष्ट या कठिनता को सहने की क्षमता अन्तर्हित रहती है। दानवीरता तभी कही जाएगी जब दान के कारण दानी को अपने जीवन निर्वाह में किसी प्रकार का कष्ट या कठिनता दिखाई देगी।”

अथवा

“कहा गया है कि मनुष्य विवेकशील (रैशनल) प्राणी है। विवेक का सम्बन्ध बुद्धि से है। इस मायने में सभी मनुष्य बुद्धिजीवी है। पर ऐसा है नहीं। हम श्रमजीवी है जिन्हें हमने निम्नवर्ग में डाल दिया

हम बुद्धिजीवी है जिन्हें मध्यवर्ग में डाल दिया गया

हम धनजीवी है जिन्हें उच्चवर्ग में डाल दिया है।”

- प्रश्न 3 सितारो ने लूटा में व्यक्त मानवीय वेदनाओं और टूटन को 20
अभिव्यक्त कीजिए।

अथवा

आसूँ गंगाजल हो बैठे कविता का मूलभाव स्पष्ट कीजिए।

- प्रश्न 4 संस्कृति है क्या निबंध के माध्यम से संस्कृति का स्वरूप स्पष्ट 20
कीजिए।

अथवा

पानी है अनमोल निबंध का उद्देश्य स्पष्ट कीजिए।

- प्रश्न 5 किन्हीं दो विषयों पर टिप्पणियाँ लिखिए :— 20

- क) जीवन क्या है कविता का भाव सौंदर्य
- ख) मेघयात्री में व्यक्त आशा, निराशा और समर्पण
- ग) देवदारू की विशेषताएँ
- घ) जन का महत्व (राष्ट्र कविता का स्वरूप)

T.Y.B.A. HINDI COURSE - VI
(Information Technology in Hindi)
Course Code - UAHIN - 503

कुल व्याख्यान - 45

SEMESTER - V

Credit – 4

प्रश्न पत्र — VI

हिन्दी में सूचना प्रौद्योगिकी

इकाई I

- सूचना प्रौद्योगिकी : अर्थ, परिभाषा और स्वरूप
- कम्प्यूटर पर हिन्दी में कामकाज का परिचय
(हिन्दी फॉन्ट, कम्प्यूटर पर आधारित हिन्दी के सॉफ्टवेअर्स)
- गूगल अनुवाद उपयोगिता, समस्याएँ और प्रतिक्रियाएँ।

इकाई II

- इन्टरनेट और हिन्दी
(हिन्दी में ईमेल, नेट पर हिन्दी विज्ञापन, नेट पर हिन्दी समाचार चैनल,
हिन्दी की साहित्यिक ई—पत्रिकाएँ, गैर साहित्यिक हिन्दी की वेबसाइट)
- संचार माध्यम और रोजगार की संभावनाएँ
- प्रिन्ट मीडिया और इलेक्ट्रॉनिक मीडिया का विकास, कठिनाइयाँ और उपयोगिता

इकाई III

- भारत में डिजिटलाइज़ेशन का विकास, कठिनाइयाँ और उपयोगिता
- सूचना प्रौद्योगिकी की जीवन में सकारात्मक एवं नकारात्मक भूमिका।
- सूचना प्रौद्योगिकी हिन्दी भाषा, देवनागरी लिपि की विशेषताएँ और वैश्विक प्रसार और प्रयोग।

इकाई IV

- सूचना प्रौद्योगिकी का शिक्षा के क्षेत्र में योगदान
- सूचना प्रौद्योगिकी का महत्त्व, आवश्यकता और उपयोगिता
- सूचना प्रौद्योगिकी समस्याएँ, सीमाएँ और चुनौतियाँ।

सूचना : पाठ्यक्रम से संबंधित किसी भी विषय पर 15 से 20 पृष्ठों का प्रकल्प तैयार करना अपेक्षित है।

प्रकल्प — 15

प्रस्तुतीकरण — 05

संदर्भ ग्रंथ :

1. आधुनिक जनसंचार और हिन्दी — हरिमोहन
2. कंप्यूटर के भाषिक अनुप्रयोग — विजय कुमार मल्होत्रा
3. कंप्यूटर और हिन्दी — हरिमोहन
4. पत्रकारिता से मीडिया तक — मनोज कुमार
5. इन्टरनेट — शशि शुक्ला
6. प्रयोजनमूलक हिन्दी — डॉ. पी. लता
7. प्रयोजनमूलक हिन्दी — रमेश जैन
8. जनसंचार और हिन्दी पत्रकारिता — डॉ. अर्जुन तिवारी
9. प्रयोजनमूलक हिन्दी — डॉ. विनोद गोदरे
10. प्रयोजनमूलक हिन्दी के विविध आयाम — डॉ. माया सिंह और डॉ. विद्वेश्वर कश्यप
11. वर्चुअल रिएलिटी और इन्टरनेट — जगदीश्वर चतुर्वेदी
12. मीडिया भूमंडलीकरण और समाज — संपादक : संजय द्विवेदी
13. जनसंचार और मीडिया लेखन — डॉ. दत्तात्रय मुरुमकर

नमूना प्रश्न पत्र

Semester – V

Course – VI

अवधि : 02½ घंटे

पूर्णांक : 80

सूचना: 1. सभी प्रश्न अनिवार्य हैं।

2. सभी प्रश्नों के लिए समान अंक हैं।

3. नियमित विद्यार्थी पहले चार प्रश्नों में से तीन के उत्तर लिखें।

4. IDOL के विद्यार्थियों के लिए सभी प्रश्न अनिवार्य हैं।

प्रश्न 1 कंप्यूटर में हिंदी फॉन्ट परिवर्तन को बताते हुए हिंदी टाइपिंग टूल पर प्रकाश डालिए। 20

अथवा

गूगल अनुवाद की समस्याओं एवं उपयोगिताओं पर लेख लिखिए।

प्रश्न 2 इंटरनेट पर हिंदी विज्ञापनों के महत्त्व और उसके उपयोगिता की चर्चा कीजिए। 20

अथवा

संचार माध्यम में रोजगार की सम्भावनाओं पर प्रकाश डालिए।

प्रश्न 3 सूचना प्रौद्योगिकी में हिंदी भाषा के प्रसार एवं प्रयोग पर प्रकाश डालिए। 20

अथवा

भारत में जिज़िलाइजेशन के विकास को बताते हुए उसकी उपयोगिता सिद्ध करें।

प्रश्न 4 सूचना प्रौद्योगिकी के शिक्षा के क्षेत्र में योगदान पर युक्तियुक्त उत्तर दीजिए। 20

अथवा

सूचना प्रौद्योगिकी की समस्याएँ एवं चुनौतियों पर अपने विचार अभिव्यक्त कीजिए।

प्रश्न 5 किन्हीं दो पर टिप्पणियाँ लिखिए :— 20

क) हिंदी में ई—मेल।

ख) गैर साहित्यिक हिंदी की वेबसाइट।

ग) संचार माध्यमों में रोज़गार।

घ) सूचना प्रौद्योगिकी की समस्याएँ।

T.Y.B.A. HINDI COURSE - VI
(Social Media)
Course Code - UAHIN - 603

कुल व्याख्यान - 45

SEMESTER - VI

Credit - 4

प्रश्न पत्र — VI

सोशल मीडिया

इकाई I

- सोशल मीडिया का स्वरूप, प्रकार और विकास
- फेसबुक, व्हाट्सअप, ट्विटर, मैसेन्जर, इन्स्टाग्राम में हिंदी, ब्लॉगिंग और हिंदी, सोशल नेटवर्किंग साइट और विज्ञापन, एफ.एम.रेडियो और हिंदी

इकाई II

- सोशल मीडिया के प्रभाव
राजनीतिक, सामाजिक, धार्मिक, युवाओं पर, बच्चों पर, महिलाओं और वृद्धों पर प्रभाव
- मुक्त अभिव्यक्ति और सोशल मीडिया
- सोशल मीडिया की प्रचलित भाषा, समाज और संस्कृति के अंतर्प्रभाव

इकाई III

- सोशल मीडिया और कानून
- सोशल मीडिया और बदलता हुआ भारतीय परिवेश
- सोशल मीडिया की उपयोगिता एवं उपलब्धियाँ

इकाई IV

- सोशल मीडिया में हिंदी का प्रसार और प्रयोग
- सोशल मीडिया समस्याएँ, चुनौतियाँ और सीमाएँ

संदर्भ ग्रंथ :

1. सोशल नेटवर्किंग : नए समय का संवाद — संपादक : संजय द्विवेदी
2. नए जमाने की पत्रकारिता — सौरभ शुक्ला
3. सोशल मीडिया — योगेश पटेल
4. उत्तर आधुनिक मीडिया तकनीक — हर्षदेव
5. नयी संचार प्रौद्योगिकी पत्रकारिता — कृष्ण कुमार रतू

6. हिन्दी भाषा का प्रयोजनमूलक स्वरूप — डॉ. कैलाश चन्द्र भाटिया
7. इन्टरनेट — शशि शुक्ला

नमूना प्रश्न पत्र
Semester - VI
Course - VI

अवधि : 02½ घंटे

पूर्णांक : 80

सूचना: 1. अंतिम प्रश्न अनिवार्य है।

2. सभी प्रश्नों के लिए समान अंक है।

3. नियमित विद्यार्थी पहले चार प्रश्नों में से तीन के उत्तर लिखे।

4. IDOL के विद्यार्थियों के लिए सभी प्रश्न अनिवार्य है।

प्रश्न 1 सोशल मीडिया के स्वरूप को स्पष्ट करते हुए उसके विका को 20 समझाइए।

अथवा

सोशल नेटवर्किंग साइट के विज्ञापनों की चर्चा करते हुए उसकी उपयोगिता सिद्ध कीजिए।

प्रश्न 2 सोशल मीडिया का बच्चों एवं युवाओं पर पड़ने वाले प्रभाव की 20 चर्चा कीजिए।

अथवा

सोशल मीडिया में मुक्त अभिव्यक्ति की स्वतंत्रता पर अपने विचार प्रकट कीजिए।

प्रश्न 3 बदलते भारतीय परिवेश में सोशल मीडिया के प्रभाव को 20 समझाइए।

अथवा

सोशल मीडिया में कानून की भूमिका पर प्रकाश डालिए।

प्रश्न 4 सोशल मीडिया में हिन्दी के बढ़ते प्रभाव पर अपने विचार 20 अभिव्यक्त करें।

अथवा

सोशल मीडिया की समस्याएँ एवं सीमाएँ बताइए।

प्रश्न 5 किन्हीं दो पर टिप्पणी लिखिए :— 20

क) ब्लॉगिंग और हिन्दी।

ख) सोशल मीडिया और राजनीतिक प्रभाव।

ग) सोशल मीडिया का भारतीय परिवेश पर प्रभाव।

घ) सोशल मीडिया की भाषा।

T.Y.B.A. Course – VII
Semester – V
Credits – 4
कुल व्याख्यान — 60
Course code – UAHIN – 504
कला, तृतीय वर्ष (हिंदी)
प्रश्न पत्र — VII
साहित्य समीक्षा : छंद एवं अलंकार
(T.Y.B.A. Hindi Paper - VII)
(Literary Criticism: Prosody & Rhetorics)

साहित्य समीक्षा : स्वरूप एवं सामान्य परिचय

इकाई I समीक्षा : —

- साहित्य की परिभाषा और स्वरूप (भारतीय एवं पाश्चात्य)
- साहित्य के तत्त्व
- साहित्य के हेतु
- साहित्य के प्रयोजन (केवल भारतीय)

इकाई II कला : —

- परिभाषा और वर्गीकरण
- कला और साहित्य का संबंध

इकाई III काव्य के रूप : —

- महाकाव्य : भारतीय एवं पाश्चात्य मान्यताओं का परिचय
- खंडकाव्य : स्वरूप और विशेषताएँ
- मुक्तक काव्य : स्वरूप और विशेषताएँ
- गीत : स्वरूप और विशेषताएँ
- गज़ल का सामान्य परिचय

इकाई IV छंद : —

सामान्य परिचय, लक्षण एवं उदाहरण

- मात्रिक छंद : i) चौपाई, ii) रोला, iii) दोहा, iv) बरवै,

v) हरिगीतिका, vi) गीतिका, vii) छप्पय,
viii) कुंडलिया

- वर्णिक छंद :
 - i) इन्द्रवज्रा, ii) शार्दूलविक्रीडित,
 - iii) भुजंगप्रयात, iv) द्रुतविलंबित,
 - v) मालिनी, vi) मंदाक्रांत, vii) सवैया, viii) कवित्त

नमूना प्रश्न पत्र
Semester – V
Course - VII

अवधि : 03 घंटे

पूर्णांक : 100

सूचना : 1. सभी प्रश्न अनिवार्य हैं।

2. सभी प्रश्नों के लिए समान अंक हैं।

प्रश्न 1 साहित्य के स्वरूप को स्पष्ट करते हुए उसके हेतुओं पर प्रकाश डालिए। 20

अथवा

साहित्य के तत्त्वों का परिचय देते हुए साहित्य के भारतीय प्रयोजनों को स्पष्ट कीजिए।

प्रश्न 2 कला की परिभाषा देते हुए उसके वर्गीकरण को स्पष्ट कीजिए। 20

अथवा

कला का साहित्य के साथ क्या संबंध है? समझाइए।

प्रश्न 3 महाकाव्य सम्बन्धी भारतीय एवं पाश्चात्य मान्यताओं का परिचय दीजिए। 20

अथवा

गीतिकाव्य का स्वरूप स्पष्ट करते हुए उसकी विशेषताओं पर प्रकाश डालिए।

प्रश्न 4 चौपाई तथा हरिगीतिका छन्दों का लक्षण तथा उदाहरण सहित सामान्य परिचय दीजिए। 20

अथवा

मालिनी तथा सवैया छन्दों के लक्षणों का परिचय देते हुए उनके उदाहरण दीजिए।

प्रश्न 5 किन्हीं दो विषयों पर टिप्पणियाँ लिखिए :— 20

क) साहित्य की परिभाषा

ख) कला के भेद

ग) खण्डकाव्य की विशेषताएँ

घ) दोहा छन्द लक्षण एवं उदाहरण।

T.Y.B.A. Course – VII
Semester – VI
Credits – 4
कुल व्याख्यान — 60
Course code – UAHIN – 604
कला, तृतीय वर्ष (हिंदी)
प्रश्न पत्र — VII
साहित्य समीक्षा : छंद एवं अलंकार
(T.Y.B.A. Hindi Paper - VII)
(Literary Criticism: Prosody & Rhetorics)

साहित्य समीक्षा :

इकाई I शब्द शक्ति : —

- शब्द शक्ति : अर्थ, परिभाषा और स्वरूप
- शब्द शक्ति के प्रकार :
(अभिधा, लक्षणा एवं व्यंजना का सामान्य परिचय)

इकाई II रस : —

- अर्थ एवं स्वरूप
- विविध अंग
- रस के भेद सामान्य परिचय

इकाई III गद्य के विविध रूप : —

- नाटक के तत्त्व (पाश्चात्य मान्यताओं के आधार पर)
- उपन्यास : परिभाषा, स्वरूप एवं प्रमुख तत्त्व
- कहानी : परिभाषा, स्वरूप एवं प्रमुख तत्त्व
- निबंध : स्वरूप तथा सामान्य विशेषताएँ
- आत्मकथा, जीवनी, संस्मरण और रेखाचित्र का तात्त्विक विवेचन

इकाई IV अलंकार :—

अलंकारों का लक्षण तथा उदाहरण सहित सामान्य परिचय : —

- शब्दालंकार : i) अनुप्रास, ii) यमक, iii) श्लेष,

- iv) पुनरुक्तिप्रकाश, v) वीप्सा, vi) वक्रोक्ति
- अर्थालंकार : i) उपमा, ii) रूपक, iii) अतिशयोक्ति,
iv) विभावना, v) उत्प्रेक्षा, vi) प्रतीप,
vii) व्याजस्तुति, viii) भ्रांतिमान, ix) दृष्टांत

संदर्भ ग्रंथ :

1. काव्य के रूप — बाबू गुलाबराय
2. भारतीय काव्यशास्त्र की परंपरा — डॉ. नगेन्द्र
3. सिद्धांत और अध्ययन — बाबू गुलाबराय
4. काव्यशास्त्र — डॉ. भगीरथ मिश्र
5. काव्य प्रदीप — श्री. रामबहोरी शुक्ल
6. छंद प्रकाश — श्री. रघुनंदन शास्त्री
7. साहित्य सहचर — आचार्य हजारी प्रसाद द्विवेदी
8. साहित्य विवेचन — सुमन एवं मलिक
9. हिंदी आलोचना के बीज शब्द — डॉ. बच्चन सिंह
10. हिंदी साहित्य कोश — ज्ञानमंडल प्रकाशन वाराणसी
11. हिंदी नाटक — डॉ. बच्चन सिंह
12. मोहन राकेश के रात बितने तक तथा अन्य ध्वनि नाटक में अन्तर्द्वंद्व — डॉ. गौतम सोनकांबले
13. साहित्य विधाओं की प्रकृति — सं. देवीशंकर अवस्थी
14. कला — हंस कुमार तिवारी
15. आधुनिक साहित्य चिंतन — डॉ. हरिश आरोड़ा, डॉ. गुंजनकुमार झा
16. भारतीय कला का इतिहास — डॉ. भागवत शरण उपाध्याय
17. भारतीय काव्यशास्त्र के सिद्धांत — डॉ. कृष्णदेव झारी
18. भारतीय काव्यशास्त्र — डॉ. मानवेंद्र पाठक
19. आधुनिक गीतिकाव्य — डॉ. उमाशंकर तिवारी
20. भारतीय साहित्य शास्त्र — डॉ. बलदेव उपाध्याय
21. भारतीय काव्यशास्त्र — डॉ. योगेंद्र प्रताप सिंह

नमूना प्रश्न पत्र
Semester – VI
Course – VII

अवधि : 03 घंटे

पूर्णांक : 100

सूचना : 1. सभी प्रश्न अनिवार्य हैं।

2. सभी प्रश्नों के लिए समान अंक हैं।

प्रश्न 1 शब्द शक्ति का अर्थ समझाते हुए उनके भेदों की चर्चा कीजिए। 20

अथवा

शब्द शक्ति की परिभाषा देते हुए उनके प्रकारों का सोदाहरण परिचय दीजिए।

प्रश्न 2 रस किसे कहते हैं? रस के स्वरूप पर प्रकाश डालिए। 20

अथवा

रसे के प्रमुख भेदों का सामान्य परिचय दीजिए।

प्रश्न 3 पाश्चात्य मान्यताओं के आधार पर नाटक के तत्त्वों की चर्चा कीजिए। 20

अथवा

निबंध के स्वरूप को स्पष्ट करते हुए उसकी सामान्य विशेषताओं पर प्रकाश डालिए।

प्रश्न 4 यमक तथा वक्रोक्ति अलंकारों के लक्षण स्पष्ट करते हुए उनके उदाहरण लिखिए। 20

अथवा

रूपक तथा उत्प्रेक्षा अलंकारों के लक्षणों को समझाते हुए उनके उदाहरण दीजिए।

प्रश्न 5 किन्हीं दो विषयों पर टिप्पणियाँ लिखिए :— 20

क) लक्षणा शब्दशक्ति

ख) रस के अंग

ग) कहानी के तत्त्व

घ) उपमा अलंकार

T.Y.B.A. Course – VIII
Semester – V
Credits – 4
कुल व्याख्यान — 60
Course code – UAHIN – 505
कला, तृतीय वर्ष (हिंदी)
प्रश्न पत्र — VIII
भाषा विज्ञान: हिंदी भाषा और व्याकरण
(T.Y.B.A. Hindi paper - VIII)
(Linguistics: Hindi Language and Grammar)

भाषा विज्ञान

- इकाई I
- भाषा की परिभाषा एवं उसकी विशेषताएँ
 - भाषा के विविध रूप
(बोली, राष्ट्रभाषा, राजभाषा, संपर्क भाषा)
 - भाषा परिवर्तन के प्रमुख कारण
- इकाई II
- भाषा विज्ञान : परिभाषा और उपयोगिता
 - भाषा विज्ञान की प्रमुख शाखाएँ सामान्य परिचय :
(वाक्य विज्ञान, रूप विज्ञान, शब्द विज्ञान, ध्वनि विज्ञान तथा अर्थ विज्ञान, अनुवाद विज्ञान)
- इकाई III हिंदी व्याकरण
- वर्णविचार : उच्चारण की दृष्टि से हिंदी ध्वनियों का वर्गीकरण
 - कारक के भेद एवं उनकी विभक्तियाँ

इकाई IV शब्द साधन (रूपांतर)

- संज्ञा : रूपांतर के आधार
- सर्वनाम : कारक रचना
- विशेषण : रूपांतर के आधार
- क्रिया में रूपांतर के आधार
(वाच्य, काल, पुरुष और वचन)

नमूना प्रश्न पत्र
Semester - V
Course - VIII

अवधि : 03 घंटे

पूर्णांक : 100

सूचना : 1. सभी प्रश्न अनिवार्य हैं।

2. सभी प्रश्नों के समान अंक हैं।

प्रश्न 1 भाषा की परिभाषा देते हुए उसकी विशेषताओं को स्पष्ट कीजिए। 20

अथवा

भाषा परिवर्तन के प्रमुख कारणों पर प्रकाश डालिए।

प्रश्न 2 भाषा विज्ञान किसे कहते हैं? भाषा विज्ञान की उपयोगिता पर प्रकाश डालिए। 20

अथवा

भाषा विज्ञान की प्रमुख शाखाओं का सामान्य परिचय दीजिए।

प्रश्न 3 उच्चारण की दृष्टि से हिन्दी व्यंजनों के वर्गीकरण को सोदाहरण समझाइए। 20

अथवा

कारक के भेदों पर प्रकाश डालते हुए उनकी विभक्तियों को सोदाहरण लिखिए।

प्रश्न 4 संज्ञा में रूपांतर किन कारणों से होता है? सोदाहरण समझाइए। 20

अथवा

क्रिया में वाच्य, काल, पुरुष और वचन के आधार पर किसप्रकार रूपांतर होता है, सोदाहरण समझाइए।

प्रश्न 5 किन्हीं दो विषयों पर टिप्पणियाँ लिखिए :— 20

क) राजभाषा

ख) अर्थविज्ञान

ग) उच्चारण की दृष्टि से स्वरों का वर्गीकरण

घ) सर्वनाम की कारक रचना।

T.Y.B.A. Course - VIII
Semester - VI
Credits - 4
कुल व्याख्यान — 60
Course code - UAHIN - 605
कला, तृतीय वर्ष (हिंदी)
प्रश्न पत्र — VIII
भाषा विज्ञान: हिंदी भाषा और व्याकरण
(T.Y.B.A. Hindi Paper - VIII)
(Linguistics : Hindi Language and Grammar)

हिंदी भाषा का स्वरूप और विकास

इकाई I

- प्राचीन एवं मध्यकालीन भारतीय आर्य भाषाओं का सामान्य परिचय —
 - क) वैदिक, ख) लौकिक संस्कृत,
 - ग) पाली, घ) प्राकृत, ङ) अपभ्रंश
- हिंदी भाषा की उत्पत्ति और विकास

इकाई II

- हिंदी की प्रमुख बोलियों का सामान्य परिचय —
 - क) ब्रज, ख) अवधी, ग) भोजपुरी, घ) खड़ी बोली,
- खड़ी बोली हिंदी के विविध रूप —
 - क) हिंदी, ख) हिंदुस्तानी, ग) उर्दू, घ) दक्खिनी

इकाई III

- हिंदी का शब्द समूह
- देवनागरी लिपि : विशेषताएँ एवं महत्त्व

इकाई IV हिंदी व्याकरण —

- वाक्य रचना —
 - क) वाक्य की परिभाषा, अर्थ और रचना की दृष्टि से प्रकार
 - ख) हिंदी वाक्य रचना में पदक्रम अध्याहार संबंधी सामान्य नियम
- समास एवं संधि —
 - क) समास : अर्थ, स्वरूप तथा प्रमुख भेदों का सामान्य परिचय
 - ख) संधि : अर्थ, स्वरूप तथा प्रमुख भेदों का सामान्य परिचय

संदर्भ ग्रंथ :

1. हिंदी भाषा और लिपी — डॉ. धीरेंद्र वर्मा
2. हिंदी भाषा का इतिहास — डॉ. भोलानाथ तिवारी
3. भाषा विज्ञान — डॉ. भोलानाथ तिवारी
4. हिंदी ध्वनियों का विकास — डॉ. भोलानाथ तिवारी
5. हिंदी व्याकरण — प. कामता प्रसाद गुरू
6. हिंदी शब्दानुशासन — आचार्य किशोरीदास वाजपेयी
7. भाषा विज्ञान की भूमिका — डॉ. देवेन्द्रनाथ शर्मा
8. भाषा विज्ञान एवं भाषाशास्त्र — डॉ. कपिलदेव द्विवेदी
9. हिंदी व्याकरण और रचना — वासुदेवनंदन प्रसाद
10. हिंदी व्याकरण मीमांसा — काशीराम शर्मा
11. भाषा शास्त्र के सिद्धांत — डॉ. उदय नारायण तिवारी
12. आधुनिक भाषा विज्ञान के सिद्धांत — डॉ. राम किशोर शर्मा
13. व्यवहारिक हिंदी — डॉ. मानवेंद्र पाठक
14. हिंदी भाषा का ऐतिहासिक परिप्रेक्ष्य — डॉ. राम किशोर शर्मा

नमूना प्रश्न पत्र
Semester – VI
Course – VIII

अवधि : 03 घंटे

पूर्णांक : 100

सूचना : 1. सभी प्रश्न अनिवार्य हैं।

2. सभी प्रश्नों के लिए समान अंक हैं।

प्रश्न 1 मध्यकालीन भारतीय आर्य भाषाओं की विशेषताओं का सामान्य परिचय दीजिए। 20

अथवा

हिन्दी भाषा की उत्पत्ति और विकास पर प्रकाश डालिए।

प्रश्न 2 हिन्दी की प्रमुख बोलियों का सामान्य परिचय दीजिए। 20

अथवा

खड़ी बोली हिन्दी के विविध रूपों — हिन्दी, हिन्दुस्तानी, उर्दू तथा दक्खिनी का सामान्य परिचय दीजिए।

प्रश्न 3 हिन्दी के शब्द समूह पर प्रकाश डालिए। 20

अथवा

देवनागरी लिपि की विशेषताओं को स्पष्ट कीजिए।

प्रश्न 4 वाक्य की परिभाषा देते हुए रचना की दृष्टि से वाक्यों के प्रकारों को सोपान समझाइए। 20

अथवा

संधि का स्वरूप स्पष्ट करते हुए उसके प्रमुख भेदों का सामान्य परिचय दीजिए।

प्रश्न 5 किन्हीं दो विषयों पर टिप्पणियाँ लिखिए :— 20

क) प्राचीन भारतीय आर्य भाषाएँ

ख) अवधी

ग) देवनागरी लिपि का महत्त्व

घ) पदक्रम।

T.Y.B.A. Course - IX
Semester - V
Credits - 4
कुल व्याख्यान — 60
Course Code - UAHIN - 506
कला, तृतीय वर्ष (हिंदी)
प्रश्न पत्र — IX
आधुनिक हिंदी साहित्य की वैचारिक पृष्ठभूमि
(T.Y.B.A. Hindi Paper - IX)
(Ideological Background of Modern Hindi Literature)

- इकाई I भारतीय नव जागरण आंदोलन और हिंदी साहित्य पर उसका प्रभाव (सामाजिक दृष्टि से होने वाले वैचारिक एवं व्यावहारिक बदलाव के विशेष संदर्भ में)
- भारतीय नव जागरण आंदोलन
(ब्रह्म समाज, प्रार्थना समाज, रामकृष्ण मिशन, थियोसोफिकल सोसाइटी सत्यशोधक समाज का सामान्य परिचय एवं मान्यताएँ)
 - आर्य समाज के सामाजिक दार्शनिक सिद्धांतों का हिंदी कविता और उपन्यास पर प्रभाव
- इकाई II गांधीवादी चिंतन का हिंदी कविता और उपन्यास पर प्रभाव
- इकाई III मार्क्सवाद : हिंदी कविता और हिंदी कथा साहित्य पर प्रभाव
- इकाई IV राष्ट्रीय चेतना के विकास में हिंदी पत्र—पत्रिकाओं का योगदान —
(हरिश्चंद्र मैगजीन, हिंदुस्तान, हिंदी प्रदीप, सरस्वती, स्वराज, कर्मवीर, चांद ओर मतवाला के विशेष संदर्भ में)

संदर्भ ग्रंथ :

1. बंगाल में स्वदेशी आंदोलन — सुमित सरकार
2. आज का भारत — रजनी पामदत्त
3. सत्य के प्रयोग — मोहनदास करमचंद गांधी
4. गुलामी — ज्योतिराव फुले
5. हिंदी साहित्य में प्रतिबंधित चिंतन प्रवाह — सुधाकर गोकाकर और गो. रा. कुलकर्णी
6. हिंदी साहित्य पर गांधीवादी प्रभाव — डॉ. अरविंद जोशी
7. मार्क्सवाद — यशपाल
8. दलित देवो भव — किशोर कुणाल
9. मनोविश्लेषण — सिगमंड फ्राइड
10. हिंदी पत्रकारिता — डॉ. कृष्ण बिहारी मिश्र
11. समाचार पत्रों का इतिहास — अंबिका प्रसाद वाजपेयी
12. भारतीय पत्रकारिता कोश — विजय दत्त श्रीधर
13. मार्क्सवादी साहित्य चिंतन — शिवकुमार मिश्र
14. दलित साहित्य का समाजशास्त्र — ओमप्रकाश वाल्मीकि
15. आधुनिकता के आइने में दलित — अभय कुमार दुबे
16. भारतीय समाज में नारी — निरा देसाई
17. आधुनिक हिंदी कविता में मनोविज्ञान — डॉ. उर्वशी ज. सुरती
18. भारतीय दलित आंदोलन का इतिहास — मोहनदास नैमिशराय
19. आधुनिक हिंदी कथा साहित्य और मनोविज्ञान — डॉ. देवराज उपाध्याय
20. मनोविज्ञान का इतिहास — डॉ. सप्रसाद पांडे
21. दलित वैचारिकी की दिशाएँ — सं. बद्रीनारायण
22. हिंदी उपन्यास में दलित वर्ग — कुसुम मेघवाल
23. दलित चेतना और समकालीन हिंदी उपन्यास — डॉ. मुन्ना तिवारी
24. आदिवासी शौर्य और विद्रोह — सं. रमणिका गुप्ता
25. आदिवासी साहित्य यात्रा — सं. रमणिका गुप्ता

नमूना प्रश्न पत्र
Semester – V
Course – IX

अवधि : 02 ½ घंटे

पूर्णांक : 80

सूचना : 1. सभी प्रश्न अनिवार्य हैं।

2. सभी प्रश्नों के लिए समान अंक हैं।

3. नियमित विद्यार्थी पहले चार प्रश्नों में से तीन के उत्तर लिखें।

4. IDOL के विद्यार्थियों के लिए सभी प्रश्न अनिवार्य हैं।

प्रश्न 1 ब्रह्म समाज तथा प्रार्थना समाज का सामान्य परिचय देते हुए उनकी मान्यताओं पर प्रकाश डालिए। 20

अथवा

आर्य समाज के सामाजिक एवं दार्शनिक सिद्धान्त का हिन्दी कविता पर किस प्रकार प्रभाव हुआ, सोदाहरण लिखिए।

प्रश्न 2 गांधीवादी चिंतन के हिन्दी कविता पर हुए प्रभाव को सोदाहरण समझाइए। 20

अथवा

गांधीवादी चिंतन की हिन्दी उपन्यास में किस प्रकार अभिव्यक्ति हुई है? चर्चा कीजिए।

प्रश्न 3 मार्क्सवाद के हिन्दी कविता पर हुए प्रभाव को सोदाहरण लिखिए। 20

अथवा

मार्क्सवाद से प्रभावित हिन्दी कथा साहित्य पर प्रकाश डालिए।

प्रश्न 4 राष्ट्रीय चेतना के विकास में सरस्वती और मतवाला पत्रिकाओं के योगदान को रेखांकित कीजिए। 20

अथवा

हरिश्चंद्र मैगजीन और कर्मवीर पत्रिकाओं ने राष्ट्रीय चेतना के विकास में अपनी महत्वपूर्ण योगदान दिया है, स्पष्ट कीजिए।

प्रश्न 5 किन्हीं दो विषयों पर टिप्पणियाँ लिखिए :— 20

क) सत्यशोधक समाज

ख) गांधीवादी चिंतन का स्वरूप

ग) मार्क्सवाद का स्वरूप

घ) हिन्दी प्रदीप।

T.Y.B.A. Course - IX
Semester - VI
Credits - 4
कुल व्याख्यान — 60
Course Code - UAHIN - 606
कला, तृतीय वर्ष (हिंदी)
प्रश्न पत्र — IX
आधुनिक हिंदी साहित्य की वैचारिक पृष्ठभूमि
(T.Y.B.A. Hindi Paper - IX)
(Ideological Background of Modern Hindi Literature)

- इकाई I मनोविश्लेषणवाद : सामान्य परिचय और हिंदी उपन्यास पर उसका प्रभाव
- इकाई II दलित चेतना : हिंदी कविता तथा कथा साहित्य पर प्रभाव
- इकाई III समकालीन कथा साहित्य में आदिवासी विमर्श
- इकाई IV स्वातन्त्रोत्तर जन चेतना और हिंदी पत्रकारिता :
धर्मयुग, आलोचना, हंस, कथादेश, इंडिया टुडे, आज और
नवभारत टाइम्स (अभिव्यक्ति के विशेष संदर्भ में)

सूचना : प्रकल्प — 20 अंक

संदर्भ ग्रंथ :

1. बंगाल में स्वदेशी आंदोलन — सुमित सरकार
2. आज का भारत — रजनी पामदत्त
3. सत्य के प्रयोग — मोहनदास करमचंद गांधी
4. गुलामी — ज्योतिराव फुले
5. हिंदी साहित्य में प्रतिबंधित चिंतन प्रवाह — सुधाकर गोकाकर और गो. रा. कुलकर्णी
6. हिंदी साहित्य पर गांधीवादी प्रभाव — डॉ. अरविंद जोशी
7. मार्क्सवाद — यशपाल
8. दलित देवो भव — किशोर कुणाल
9. मनोविश्लेषण — सिगमंड फ्राइड

10. हिंदी पत्रकारिता — डॉ. कृष्ण बिहारी मिश्र
11. समाचार पत्रों का इतिहास — अंबिका प्रसाद वाजपेयी
12. भारतीय पत्रकारिता कोश — विजय दत्त श्रीधर
13. मार्क्सवादी साहित्य चिंतन — शिवकुमार मिश्र
14. दलित साहित्य का समाजशास्त्र — ओमप्रकाश वाल्मीकि
15. आधुनिकता के आइने में दलित — अभय कुमार दुबे
16. भारतीय समाज में नारी — निरा देसाई
17. आधुनिक हिंदी कविता में मनोविज्ञान — डॉ. उर्वशी ज. सुरती
18. भारतीय दलित आंदोलन का इतिहास — मोहनदास नैमिशराय
19. आधुनिक हिंदी कथा साहित्य और मनोविज्ञान — डॉ. देवराज उपाध्याय
20. मनोविज्ञान का इतिहास — डॉ. सप्रसाद पांडे
21. दलित वैचारिकी की दिशाएँ — सं. बद्रीनारायण
22. हिंदी उपन्यास में दलित वर्ग — कुसुम मेघवाल
23. दलित चेतना ओर समकालीन हिंदी उपन्यास — डॉ. मुन्ना तिवारी
24. आदिवासी शौर्य और विद्रोह — सं. रमणिका गुप्ता
25. आदिवासी साहित्य यात्रा — सं. रमणिका गुप्ता
26. बीसवीं शताब्दी की अंतिम द्वादशक की हिंदी कहानी में दलित जीवन — डॉ. गौतम सोनकांबले

नमूना प्रश्न पत्र
Semester – VI
Course – IX

अवधि : 02 ½ घंटे

पूर्णांक : 80

सूचना : 1. सभी प्रश्न अनिवार्य हैं।

2. सभी प्रश्नों के लिए समान अंक हैं।

3. नियमित विद्यार्थी पहले चार प्रश्नों में से तीन के उत्तर लिखें।

4. IDOL के विद्यार्थियों के लिए सभी प्रश्न अनिवार्य हैं।

प्रश्न 1 मनोविश्लेषणवाद के स्वरूप को स्पष्ट करते हुए हिन्दी कहानी पर हुए उसके प्रभाव को रेखांकित कीजिए। 20

अथवा

मनोविश्लेषणवाद का हिन्दी उपन्यास पर किस प्रकार प्रभाव हुआ है, स्पष्ट कीजिए।

प्रश्न 2 दलित चेतना के हिन्दी कविता पर हुए प्रभाव को सोदाहरण समझाइए। 20

अथवा

दलित चेतना ने हिन्दी कथा साहित्य को किस प्रकार प्रभावित किया है, स्पष्ट कीजिए।

प्रश्न 3 समकालीन हिन्दी उपन्यासों में आदिवासी विमर्श की अभिव्यक्ति किस प्रकार हुयी है, स्पष्ट कीजिए। 20

अथवा

समकालीन हिन्दी कहानियों में चित्रित आदिवासी विमर्श पर प्रकाश डालिए।

प्रश्न 4 'धर्मयुग' में स्वातंत्र्योत्तर जन-चेतना को किस प्रकार वाणी मिली है, स्पष्ट कीजिए। 20

अथवा

'हंस' तथा 'कथादेश'; पत्रिकाओं में स्वातंत्र्योत्तर जन चेतना को अभिव्यक्त करने में अपनी महत्वपूर्ण भूमिका निभाई है, स्पष्ट कीजिए।

प्रश्न 5 किन्हीं दो विषयों पर टिप्पणियाँ लिखिए :— 20

क) मनोविश्लेषणवाद

ख) दलित चेतना का स्वरूप

ग) आदिवासी विमर्श

घ) आलोचना।

T.Y.B.A. Course - IX
Semester - V
Credits - 4
कुल व्याख्यान — 60
Course Code - UAHIN - 506
कला, तृतीय वर्ष (हिंदी)
प्रश्न पत्र — IX
संचार माध्यम
(T.Y.B.A. Hindi Paper - IX)
(Mass Media)

- इकाई I जन संचार माध्यम
- अवधारणा एवं स्वरूप
 - जनसंचार के तत्त्व
 - जनसंचार की प्रक्रिया, उपयोगिता
- इकाई II प्रमुख संचार माध्यमों का सामान्य परिचय
- पारंपरिक जनसंचार माध्यम
(तमाशा, लावणी, कठपुतली, रासलीला तथा नौटंकी)
 - आधुनिक संचार माध्यम
(समाचार पत्र, रेडियो, सिनेमा, दूरदर्शन एवं मोबाईल)
- इकाई III संचार माध्यमों का विकास एवं उपयोगिता
- समाचार पत्र
 - रेडियो
 - सिनेमा
 - दूरदर्शन
 - मोबाइल
- इकाई IV जन संचार माध्यमोपयोगी लेखन का सामान्य परिचय
- समाचार
 - रेडियो वार्ता
 - साक्षात्कार

- संवाद
- फीचर

संदर्भ ग्रंथ :

1. जनसंचार माध्यम और पत्रकारिता सर्वांग — जीतेन्द्र वत्स
2. जनसंचार माध्यम और हिन्दी पत्रकारिता — डॉ. अर्जुन तिवारी
3. जनसंचार माध्यम — हरिश अरोडा
4. प्रयोजनमूलक तथा व्यावहारिक हिन्दी — डॉ. अम्बादास देशमुख
5. प्रयोजनमूलक हिन्दी — डॉ. माधव सोनटक्के
6. हिन्दी सिनेमा — डॉ. चन्द्रकांत मिसाळ
7. हिंदी पत्रकारिता — डॉ. कृष्ण बिहारी मिश्र
8. समाचार पत्रों का इतिहास — अंबिका प्रसाद वाजपेयी
9. भारतीय पत्रकारिता कोश — विजय दत्त श्रीधर
10. जनसंचार और मीडिया लेखन — डॉ. दत्तात्रय मरुमकर
11. आधुनिक विज्ञापन और नारी — डॉ. विद्या शिंदे

नमूना प्रश्न पत्र

Semester – V

Course – IX

अवधि : 02 ½ घंटे

(संचार माध्यम)

पूर्णांक : 80

सूचना : 1. सभी प्रश्न अनिवार्य हैं।

2. सभी प्रश्नों के लिए समान अंक हैं।

3. नियमित विद्यार्थी पहले चार प्रश्नों में से तीन के उत्तर लिखें।

4. IDOL के विद्यार्थियों के लिए सभी प्रश्न अनिवार्य हैं।

प्रश्न 1 जनसंचार की अवधारणा एवं स्वरूप पर प्रकाश डालिए। 20
अथवा

जनसंचार की प्रक्रिया को स्पष्ट कीजिए।

प्रश्न 2 पारंपरिक जनसंचार माध्यमों का सामान्य परिचय दीजिए। 20
अथवा

दूरदर्शन का सामान्य परिचय देते हुए उसके महत्त्व पर प्रकाश डालिए।

प्रश्न 3 समाचार पत्र के विकास पर प्रकाश डालते हुए उसकी उपयोगिता 20
को स्पष्ट कीजिए।
अथवा

मोबाईल के विकास को स्पष्ट करते हुए उसकी उपयोगिता पर प्रकाश डालिए।

प्रश्न 4 रेडियों वार्ता लेखन का सामान्य परिचय दीजिए। 20
अथवा

संवाद एवं फीचर लेखन का सामान्य परिचय दीजिए।

प्रश्न 5 किन्हीं दो विषयों पर टिप्पणियाँ लिखिए :— 20
क) जनसंचार के तत्त्व
ख) सिनेमा : आधुनिक प्रमुख संचार माध्यम
ग) रेडियो की उपयोगिता
घ) साक्षात्कार लेखन।

T.Y.B.A. Course – IX
Semester – VI
Credits – 4
कुल व्याख्यान — 60
Course Code – UAHIN – 606
कला, तृतीय वर्ष (हिंदी)
प्रश्न पत्र — IX
संचार माध्यम
(T.Y.B.A. Hindi Paper - IX)
(Mass Media)

इकाई I संचार माध्यमों की भाषा

- मुद्रित माध्यम
- रेडियो
- सिनेमा
- दूरदर्शन

इकाई II विज्ञापन

- परिभाषा एवं स्वरूप
- मुद्रित विज्ञापन
- रेडियो विज्ञापन
- दूरदर्शन विज्ञापन
- वेब मीडिया और विज्ञापन
- विज्ञापन की भाषा
- विज्ञापन और नैतिकता
- विज्ञापन और कानून

इकाई III वृत्तचित्र

- वृत्तचित्र : अर्थ एवं स्वरूप
- वृत्तचित्र : सामान्य परिचय
- वृत्तचित्र की उपयोगिता एवं महत्व

इकाई IV लघुफिल्म

- लघुफिल्म का अर्थ एवं स्वरूप
- लघु फिल्मों की उपयोगिता एवं महत्त्व
- फिल्म प्रभाग का सामान्य परिचय
- भारतीय फिल्म संस्थान पुणे का सामान्य परिचय एवं योगदान

संदर्भ ग्रंथ :

1. जनसंचार माध्यम और पत्रकारिता सर्वांग — जीतेन्द्र वत्स
2. जनसंचार माध्यम और हिन्दी पत्रकारिता — डॉ. अर्जुन तिवारी
3. जनसंचार माध्यम — हरिश अरोड़ा
4. प्रयोजनमूलक तथा व्यावहारिक हिन्दी — डॉ. अम्बादास देशमुख
5. प्रयोजनमूलक हिन्दी — डॉ. माधव सोनटक्के
6. हिन्दी सिनेमा — डॉ. चन्द्रकांत मिसाळ
7. हिन्दी पत्रकारिता — डॉ. कृष्ण बिहारी मिश्र
8. समाचार पत्रों का इतिहास — अंबिका प्रसाद वाजपेयी
9. भारतीय पत्रकारिता कोश — विजय दत्त श्रीधर
10. जनसंचार और मीडिया लेखन — डॉ. दत्तात्रय मरुमकर
11. आधुनिक विज्ञापन और नारी — डॉ. विद्या शिंदे

नमूना प्रश्न पत्र

Semester – VI

Course – IX

अवधि : 02 ½ घंटे

(संचार माध्यम)

पूर्णांक : 80

सूचना : 1. सभी प्रश्न अनिवार्य हैं।

2. सभी प्रश्नों के लिए समान अंक हैं।

3. नियमित विद्यार्थी पहले चार प्रश्नों में से तीन के उत्तर लिखें।

4. IDOL के विद्यार्थियों के लिए सभी प्रश्न अनिवार्य हैं।

प्रश्न 1 मुद्रित माध्यमों की भाषा का सामान्य परिचय दीजिए। 20

अथवा

दूरदर्शन की भाषा को सोदाहरण समझाइए।

प्रश्न 2 विज्ञापन की परिभाषा एवं स्वरूप पर प्रकाश डालिए। 20

अथवा

विज्ञापन और कानून का सामान्य परिचय दीजिए।

प्रश्न 3 वृत्तचित्र का अर्थ स्पष्ट करते हुए उसके स्वरूप पर प्रकाश डालिए। 20

अथवा

वृत्तचित्र की उपयोगिता एवं महत्त्व को रेखांकित कीजिए।

प्रश्न 4 लघु फिल्मों की उपयोगिता एवं महत्त्व पर प्रकाश डालिए। 20

अथवा

भारतीय फिल्म संस्थान पूणे का सामान्य परिचय देते हुए भारतीय फिल्म जगत को उसके योगदान की चर्चा कीजिए।

प्रश्न 5 किन्हीं दो विषयों पर टिप्पणियाँ लिखिए :— 20

क) सिनेमा की भाषा

ख) वेब मीडिया और विज्ञापन

ग) वृत्तचित्र का सामान्य परिचय

घ) लघु फिल्म का अर्थ एवं स्वरूप।

मराठी विभाग
प्रथम वर्ष कला
अनिवार्य मराठी (Compulsory Marathi)

प्रथमसत्र -

अभ्यासक्रम -

प्रथमवर्ष बी.एमराठी अनिवार्य या विषयासाठी २०१९ - २०२० या शैक्षणिक वर्षापामून नेमलेला अभ्यासक्रम

एकूण व्याख्याने - ४०, श्रेयांकने - ०२ गुण

घटक :-I वडीलधारी माणसे - लेखिका शांताशेळके, सुरेश एजन्सी, पुणे-०२ .

घटक - १

- १) गुरुवर्य माटे
- २) जोगसर
- ३) साहेब
- ४) मामा वरेरकर
- ५) आशा
- ६) वसंत पवार
- ७) दुर्गाबाई
- ८) हृदयनाथ
- ९) कोठावळे
- १०) लताबाई

घटक - २

- १) मराठी लेखनाचे नियम व विराम चिन्हे
- २) वर्तमान पत्रासाठी वृत्त आणि वृत्तांत
- ३) अर्जलेखन
- ४) भाषांतर (इंग्रजीतून मराठीत)

द्वितीय सत्र
अभ्यासक्रम

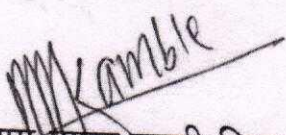
एकूण व्याख्याने ४०, श्रेयांकने ०२ गुण :-
❖ नापास मुलांची गोष्ट - संपादन अरुण शेवते - ऋतुरंग प्रकाशन

घटक - १

- १) महात्मा गांधी
- २) कुसुमाग्रज
- ३) दया पवार
- ४) ना. सी फडके
- ५) सी. रामचंद्र
- ६) शांता शेळके
- ७) यशवंतराव गडाख
- ८) सुशीलकुमार शिंदे
- ९) चंद्रशेखर धर्माधिकारी
- १०) वाय. सी. पवार

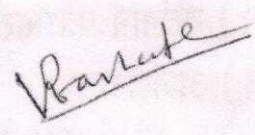
घटक - २

- १) इतिवृत्त लेखन
- २) वर्तमानपत्रासाठी जाहिरातलेखन
- ३) उता-यावरील प्रश्न
- ४) सारांशलेखन


विभाग प्रमुख, मराठी विभाग

चांगू काना ठाकूर कला, वाणिज्य आणि
विज्ञान महाविद्यालय, नवीन पनवेल




प्राचार्य

चांगू काना ठाकूर कला, वाणिज्य आणि
विज्ञान महाविद्यालय, नवीन पनवेल



॥ विद्या विनयेन शोभते ॥

Janardan Bhagat Shikshan Prasarak Sanstha's

**CHANGU KANA THAKUR
ARTS, COMMERCE & SCIENCE COLLEGE,
NEW PANVEL (AUTONOMOUS)**

Re-accredited 'A+' Grade by NAAC

'College with Potential for Excellence' Status Awarded by UGC

'Best College Award' by University of Mumbai

Program: B.A.

Revised Syllabus of T.Y.B. A. Geography

Paper No. IV to IX

for

Semester V and VI

Choice Based Credit & Grading System (75:25)

T.Y.B.A. Geography(Semester - V)
Paper – IX: GEOSPATIAL TECHNOLOGY

Course Code: UAR5GE9

Credit- 3.5

UNIT - I	Remote Sensing – I	No. of Lectures
1.1	Geospatial Technology: Concept, Components and Importance	09
1.2	Remote Sensing: Concept, Types, Process and Geographical Applications	
1.3	Electromagnetic Energy, EMR and EMS – Effects of Atmosphere on EMR, Spectral Reflectance and Spectral Signature or Curve - Platforms, Sensors and Resolution	
1.4	Elements of Visual Image Interpretation - Mapping of Thematic Layers and Visual Image Interpretation of Physical and Manmade Features	
UNIT - II	Remote Sensing – II	09
2.1	Concept of DEM, Digital image analysis: landuse and landform classification, 3D view of DEM	
2.2	Aerial Photographs: Concept, Process and Types	
2.3	Interpretation of Aerial Photographs	
2.4	Advanced Remote Sensing Technology - Use of Bhuvan website	
UNIT - III	Global Positioning System	09
3.1	GPS : Concept, Segments, Applications	
3.2	Types of GPS – GPS Data Accuracy and Errors	
3.3	Factors Affecting GPS Data - Global Navigation System	
3.4	Ground Survey and Demarcation of Point, Line and Polygon Features with GPS Device – Transfer GPS Data to Computer with Software’s like Easy GPS	
UNIT - IV	Geographic Information System – I	09
4.1	GIS : Concept, Components and Applications - Map Projection and Coordinate System	
4.2	GIS Data Sources and Types	
4.3	Use of Image/map into GIS Software and Geo-referencing	
4.4	Creating Layers by Digitization of Point, Line and Polygon Features	
UNIT V	Geographic Information System – II	09
5.1	Functions of Database Creation – Input, Editing and Linking	
5.2	Spatial Database Analysis: Overlay, Merge, Query	
5.3	Map compositions for Map Layout and Design	
5.4	Preparation of Thematic Maps	



JanardanBhagatShikshanPrasarakSanstha's
CHANGU KANA THAKUR
ARTS, COMMERCE & SCIENCE COLLEGE, NEW
PANVEL (AUTONOMOUS)

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'College with Potential for Excellence' Status Awarded by UGC
'Best College Award' by University of Mumbai

Program: B.A

Revised Syllabus of S.Y.B.A. Rural Development
Choice Based Credit & Grading System (75:25)
w.e.f. Academic Year 2020-2021

S. Y. B.A. Rural Development

For the subject of Rural Development there shall be Two papers for 45 lectures each .

Semester-III

Paper-III :Rural Society

1. Unit-I: Indian Rural Society
2. Unit-II: Rural Institutional System
3. Unit-III: Social Change
4. Unit-IV: Concept Related to Social Change

Paper-IV: Rural Administration

1. Unit-I: District Administration
2. Unit-II: Revenue Administration
3. Unit-III: Law and Order Administration and Judicial Machinery
4. Unit-IV : Planning for Rural Development

Semester - IV

Paper V : Development Strategies

1. Unit-I: Agricultural Development
2. Unit-II: Sources of Rural Employment
3. Unit-III: Tourism Development
4. Unit-IV : Areas of Rural Upliftment

Paper VI : Laws Related to Rural Development

1. Unit-I: Law Related to Panchayat Raj in Maharashtra
2. Unit-II: Land Reform legislations
3. Unit-III: Law Related to Rural Area
4. Unit-IV : Law Related to Tribal Area

Choice Based Credit Grading and Semester System (CBCGS)
S.Y.B.A. Rural Development Syllabus
To be implemented from the Academic year 2020-2021
SEMESTER III

Paper No III

Course Code	Unit	Topics	Credits	L / Week
UAR1RD-III	I	Indian Rural Society	3	3
	II	Rural Institutional System		
	III	Social Change		
	IV	Concept Related to Social Change		

Paper No IV

Course Code	Unit	Topics	Credits	L/Week
UAR1RD-IV	I	District Administration	3	3
	II	Revenue Administration		
	III	Law & Order Administration and Judicial Machinery		
	IV	Planning for Rural Development		

Semester – IV

Paper No V

Course Code	Unit	Topics	Credits	L/Week
UAR1RD-V	I	Study of Agricultural Development	3	3
	II	Sources of Rural Employment		
	III	Tourism Development		
	IV	Areas of Rural Upliftments		

Paper NO VI

Course Code	Unit	Topics	Credits	L/Week
UAR1RD-VI	I	Law Related to Panchayat Raj in Maharashtra	3	3
	II	Land Reforms Legislations		
	III	Law related to Rural Area		
	IV	Law related to Tribal Area		

**S.Y.B.A – RURAL DEVELOPMENT
SEMESTER III PAPER NO. III
RURAL SOCIETY**

Code BARD - 03

1. Indian Rural Society

a. Components of Indian Rural Society

- Tribal Community : Definition and Characteristics
- Rural Community : Definition and Characteristics
- Urban Community : Definition and Characteristics
-

b. Rural Urban Continuum

- Concept , Examples , Impact of Rural Community on Urban Community

c. Problems of Weaker Section

- Scheduled Caste : Problems , Remedial Measures and Constitutional Provisions
- Scheduled Tribes : Problems , Remedial Measures
- Problems Of Women : Responsible Factor , Remedial Measures

2. Rural Institutional System

a. Religion: Concept, Features, Functions , Importance , Elements of Religion

b. Education: Concept, Objectives, Function and Importance in Rural Development

c. Co-operation: Concept, Features, Merits and Demerits, Importance in Rural Development

3. Social Change

a. Concept Of Social Change

b. Reasons Of Social Change

c. Types Of Social Change

d. Barriers in Social Change

e . Change in Society

4. Concept Related to Social Change

a. Sanskritization: Concept, Features, Factors Responsible For Sanskritization Limitation of Sanskritization

b. Westernization

Concept, Features, Nature, Impact of Westernization on Indian Society

c. Modernization

Concept, Nature, causes, Impact of Modernization on Rural Society

NOTE: For Semester III question paper will carry 100 marks as per University Norms.

S Y B A - RURAL DEVELOPMENT
SEMESTER – III PAER NO. IV

Code B.A.R.D - 04

Rural Administration

- Ch- No. 1 District Administration**
- a) Basic concept of District Administration.
 - b) Objectives and Principles of District Administration
 - c) Post independence developments of District Administration
 - d) Components of District Administration.
- Ch- No. 2 Revenue Administration**
- a) Historical Background
 - b) Scope of Revenue Administration.
 - c) Components of Revenue Administration.
 - d) Functions & Functionaries of Revenue Administration
- Ch- No. 3 Law & Order Administration & Judicial Machinery.**
- a) Law and order in District and Taluka level
 - b) Judicial Machinery in district
 - c) Civil and Criminal Judicial
 - d) Lok Nyayalaya
- Ch- No. 4 Planning for Rural Development.**
- a) Concept, types and importance of planning.
 - b) District planning Machinery.
 - c) Need of people participation in rural planning.
 - d) Role of NGOs in Rural Planning

Note - For Semester III question Paper Will Copy 100 Marks as per university Norms.

S Y B A - RURAL DEVELOPMENT
SEMESTER – IV PAER NO. V
DEVELOPMENT STRATEGIES

Code B.A.R.D - 05

1. Agricultural Development

- a. National Agricultural Policy 2007 and Food Security
 - Concept
 - Objectives
 - Features
 - Provision and Drawbacks
- b. Irrigation and Water Management
 - Importance Of Irrigation In Agriculture
 - Sources Of Irrigation
 - Methods Of Irrigation - Modern And Conventional
- c. Agricultural Universities and KVK
 - Establishment
 - Importance And Need
 - Function

2 Sources of Rural Employment

- a Self Help Group
 - Concept
 - Features
 - Importance in Rural Development

Syllabus S.Y.B.A. Rural Development

- b. **Agro Based Industries**
 - Concept, Types, Function, Importance in employment Generation
 - Problems Of Agro Based Industries
- d. **Commerce and Trade**
 - Rural Marketing and Finance
 - APMC

3. Tourism Development

- **Concept, Factors**
- **Merits and Demerits In Tourism**

a. Rural Tourism

- **Concept, Nature, Importance, Limitation**

b. Agro Tourism

- **Concept, Nature, Importance, Merits and Demerits**

c. Environmental Tourism

- **Concept, Nature, Need and Importance**

4. Areas of Rural Upliftment

- Agriculture Development
- Rural Housing
- Rural Education
- Rural Health
- Tribal Development

Question Paper will carry 75 marks for Semester- IV

University of Mumbai



**Revised Syllabus
and
Question Paper Pattern
of Courses of
Bachelor of Commerce (B.Com.)
Programme
First Year
*Semester I and II***

**Under Choice Based Credit, Grading
and Semester System**

(To be implemented from Academic Year- 2019-2020)

Faculty of Commerce

Bachelor of Commerce (B.Com.) Programme

Under Choice Based Credit, Grading and Semester System

Course Structure

F.Y.B.Com.

(To be implemented from Academic Year- 2019-2020)

No. of Courses	Semester I	Credits	No. of Courses	Semester II	Credits
1	Elective Courses (EC)		1	Elective Courses (EC)	
1A	Discipline Specific Elective(DSE)Courses		1A	Discipline Specific Elective(DSE)Courses	
1	Accountancy and Financial Management - I	03	1	Accountancy and Financial Management - II	03
1B	Discipline Related Elective(DRE)Courses		1B	Discipline Related Elective(DRE)Courses	
2	Commerce - I	03	2	Commerce - II	03
3	Business Economics - I	03	3	Business Economics - II	03
2	Ability Enhancement Courses (AEC)		2	Ability Enhancement Courses (AEC)	
2A	Ability Enhancement Compulsory Courses (AECC)		2A	Ability Enhancement Compulsory Courses (AECC)	
4	Business Communication - I	03	4	Business Communication - II	03
5	Environmental Studies - I	03	5	Environmental Studies - II	03
2B	*Skill Enhancement Courses (SEC)		2B	**Skill Enhancement Courses (SEC)	
6	Any one course from the following list of the courses	02	6	Any one course from the following list of the courses	02
3	Core Courses (CC)		3	Core Courses (CC)	
7	Mathematical and Statistical Techniques - I	03	7	Mathematical and Statistical Techniques - II	03
Total Credits		20	Total Credits		20

*List of Skill Enhancement Courses (SEC) for Semester I (Any One)		**List of Skill Enhancement Courses (SEC) for Semester II (Any One)	
1	Foundation Course - I	1	Foundation Course - II
2	Foundation Course in NSS - I	2	Foundation Course in NSS - II
3	Foundation Course in NCC - I	3	Foundation Course in NCC - II
4	Foundation Course in Physical Education - I	4	Foundation Course in Physical Education - II
Note: Course selected in Semester I will continue in Semester II			

Bachelor of Commerce (B.Com.) Programme

Under Choice Based Credit, Grading and Semester System

Course Structure

(To be implemented from Academic Year- 2019-2020)

Semester I

No. of Courses	Semester I	Credits
1	<i>Elective Courses (EC)</i>	
1A	<i>Discipline Specific Elective(DSE)Courses</i>	
1	Accountancy and Financial Management - I	03
1B	<i>Discipline Related Elective(DRE)Courses</i>	
2	Commerce - I	03
3	Business Economics - I	03
2	<i>Ability Enhancement Courses (AEC)</i>	
2A	<i>Ability Enhancement Compulsory Courses (AECC)</i>	
4	Business Communication - I	03
5	Environmental Studies - I	03
2B	<i>*Skill Enhancement Courses (SEC)</i>	
6	Any one course from the following list of the courses	02
3	<i>Core Courses (CC)</i>	
7	Mathematical and Statistical Techniques - I	03
Total Credits		20

<i>*List of Skill Enhancement Courses (SEC) for Semester I (Any One)</i>	
1	Foundation Course - I
2	Foundation Course in NSS - I
3	Foundation Course in NCC - I
4	Foundation Course in Physical Education - I

Bachelor of Commerce (B.Com.) Programme

Under Choice Based Credit, Grading and Semester System

Course Structure

(To be implemented from Academic Year- 2019-2020)

Semester II

No. of Courses	Semester II	Credits
1	<i>Elective Courses (EC)</i>	
1A	<i>Discipline Specific Elective(DSE)Courses</i>	
1	Accountancy and Financial Management - II	03
1B	<i>Discipline Related Elective(DRE)Courses</i>	
2	Commerce - II	03
3	Business Economics - II	03
2	<i>Ability Enhancement Courses (AEC)</i>	
2A	<i>Ability Enhancement Compulsory Courses (AECC)</i>	
4	Business Communication - II	03
5	Environmental Studies - II	03
2B	<i>**Skill Enhancement Courses (SEC)</i>	
6	Any one course from the following list of the courses	02
3	<i>Core Courses (CC)</i>	
7	Mathematical and Statistical Techniques - II	03
Total Credits		20

*List of Skill Enhancement Courses (SEC) for Semester II (Any One)

1	Foundation Course - II
2	Foundation Course in NSS - II
3	Foundation Course in NCC - II
4	Foundation Course in Physical Education - II

***Revised Syllabus of Courses of B.Com. Programme at Semester II
with Effect from the Academic Year 2019-2020***

***Elective Courses (EC)-
Discipline Related Elective(DRE) Courses***

2. Commerce II

Modules at a Glance

Sr. No.	Modules	No. of Lectures
1	Concept of Services	12
2	Retailing	12
3	Recent Trends in Service Sector	10
4	E-Commerce	11
Total		45

Sr. No.	Modules / Units
1	Concept of Services
	<p>Introduction: Meaning, Characteristics, Scope and Classification of Services – Importance of service sector in the Indian</p> <p>Marketing Mix Services: Consumer expectations, Services Mix, - Product, Place, Price, Promotion, Process of Services delivery, Physical evidence and people</p> <p>Service Strategies: Market research and Service development cycle, Managing demand and capacity, opportunities and challenges in service sector.</p>
2	Retailing
	<p>Introduction: Concept of organized and unorganized retailing , Trends in retailing, growth of organized retailing in India, Survival strategies for unorganized Retailers</p> <p>Retail Format: Store format, Non – Store format, Store Planning, design and layout</p> <p>Retail Scenario: Retail Scenario in India and Global context – Prospects and Challenges in India. Mall Management – Retail Franchising. FDI in Retailing, Careers in Retailing</p>
3	Recent Trends in Service Sector
	<p>ITES Sector: Concept and scope of BPO, KPO, LPO and ERP.</p> <p>Banking Sector: Methods of E-Payment (Debit & Credit Cards, Smart Cards, E-Wallets ,NEFT ,RTGS) Payment Gateways , online banking and M- Banking (Importance and risk involved), FDI and its impact on Banking in India</p> <p>Logistics: Net working – Importance – Challenges</p>
4	E-Commerce
	<p>Introduction: Meaning, Features, Functions and Scope of E-Commerce- Importance and Limitations of E-Commerce</p> <p>Types of E-Commerce: Basic ideas and Major activities of B2C,B2B, C2C.</p> <p>Present status of E-Commerce in India: Transition to E-Commerce in India, E-Transition Challenges for Indian Corporates , Government E-Market place</p>

University of Mumbai



**Revised Syllabus
and
Question Paper Pattern
of Courses of
Bachelor of Commerce Programme
Second Year
Semester III and IV**

**Under Choice Based Credit, Grading and
Semester System**

To be implemented from Academic Year 2020-2021

Faculty of Commerce

S.Y.B.Com

(To be implemented from Academic Year- 2020-2021)

No. of Courses	Semester III	Credits	No. of Courses	Semester IV	Credits
1	Elective Courses (EC)		1	Elective Courses (EC)	
1A	Discipline Specific Elective(DSE) Courses		1A	Discipline Specific Elective(DSE) Courses	
1Aa	Discipline Specific Elective(DSE) Courses		1Aa	Discipline Specific Elective(DSE) Courses	
1	Accountancy and Financial Management III	03	1	Accountancy and Financial Management IV	03
1Ab	Discipline Specific Elective(DSE) Courses		1Ab	Discipline Specific Elective(DSE) Courses	
2	Financial Accounting and Auditing - Introduction to Management Accounting	03	2	Financial Accounting and Auditing - Auditing	03
1B	Discipline Related Elective(DRE) Courses		1B	Discipline Related Elective(DRE) Courses	
3	Commerce III	03	3	Commerce IV	03
4	Business Economics III	03	4	Business Economics IV	03
2	Ability Enhancement Courses (AEC)		2	Ability Enhancement Courses (AEC)	
2A	*Skill Enhancement Courses (SEC) Group A		2A	**Skill Enhancement Courses (SEC) Group A	
5	Advertising I/ Computer Programming I	03	5	Advertising II/ Computer Programming II	03
2B	*Skill Enhancement Courses (SEC) Group B		2B	**Skill Enhancement Courses (SEC) Group B	
6	Any one course from the following list of the courses	02	6	Any one course from the following list of the courses	02
3	Core Courses (CC)		3	Core Courses (CC)	
7	Business Law I	03	7	Business Law II	03
Total Credits		20	Total Credits		20

*List of Skill Enhancement Courses (SEC) Group B for Semester III (Any One)		** List of Skill Enhancement Courses (SEC) Group B for Semester IV (Any One)	
1	Foundation Course- Contemporary Issues – III	1	Foundation Course- Contemporary Issues – IV
2	Foundation Course in NSS – III	2	Foundation Course in NSS – IV
3	Foundation Course in NCC – III	3	Foundation Course in NCC – IV
4	Foundation Course in Physical Education – III	4	Foundation Course in Physical Education – IV
Note: Course selected in Semester III will continue in Semester IV			

B.Com. Programme
Under Choice Based Credit, Grading and Semester System
Course Structure

(To be implemented from Academic Year- 2020-2021)

Semester III

<i>Sr.No.</i>	<i>Course Code</i>	<i>Course Name</i>	<i>Credits</i>
<i>1</i>	<i>UCM3CM3</i>	<i>Commerce III</i>	<i>03</i>
<i>2</i>	<i>UCM3AD1</i>	<i>Advertising I</i>	<i>03</i>
<i>3</i>	<i>UCM3BL1</i>	<i>Business Law I</i>	<i>03</i>

***Revised Syllabus of Courses of B.Com. Programme at Semester III
with Effect from the Academic Year 2020-2021***

***Elective Courses (EC)-
1B Discipline Related Elective (DRE) Courses***

Commerce –III

(Management: Functions and Challenges)

Subject Code – UCM3CM3

Course Objectives:

- 1) To make the learners aware about conceptual knowledge and evolution of management.
- 2) To familiarize the learners with the functions of management.
- 3) To develop the skill of decision making.
- 4) To enable learners to understand organizing as a function of management.
- 5) To develop understanding of learners about controlling techniques.

• **Course Outcomes:**

- 1) Understanding about conceptual knowledge and evolution of management.
- 2) Awareness about the functions of management.
- 3) Better knowledge towards planning and decision making.
- 4) Better understanding about various aspect of organizing.
- 5) Developing the skills of controlling.

***Revised Syllabus of Courses of B.Com. Programme at Semester III
with Effect from the Academic Year 2020-2021***

***Elective Courses (EC)-
1B Discipline Related Elective (DRE) Courses***

Commerce –III

(Management: Functions and Challenges)

Subject Code – UCM3CM3

Sr. No.	Modules	No. of Lectures
1	Introduction To Management	11
2	Planning & Decision Making	10
3	Organising	12
4	Directing And Controlling	12
Total		45

Sr. No.	Modules
1	Introduction To Management (11)
	<ul style="list-style-type: none"> • Management- Concept, Nature, Functions, Managerial Skills & Competencies • Evolution of Management Thoughts Classical Approach: Scientific Management – F.W.Taylor’s Contribution Classical Organisation Theory: Henri Fayol’s Principles Neo Classical: Human Relations Approach – Elton Mayo’s Hawthorne experiments • Modern Management Approach- Peter Drucker’s Dimensions of Management, Indian Management Thoughts: Origin & Significance of Indian Ethos to Management.
2	Planning & Decision Making (10)
	<ul style="list-style-type: none"> • Planning – Steps, Importance, Components, Problems in Planning • M.B.O – Process, Advantages, Management By Exception- Advantages; Management Information System- Concept, Components • Decision Making – Techniques, Essentials of a Sound Decision Making, Impact of Technology on Decision Making.
3	Organising (12)
	<ul style="list-style-type: none"> • Organising-Steps, Organisation Structures – Features of Line & Staff Organisation, Matrix Organisation, Virtual Organisation, Formal v/s Informal Organisation. • Departmentation –Meaning –Bases, Span of Management- Factors Influencing Span of Management, Tall and Flat Organisation. • Delegation of Authority- Process, Barriers to Delegation, Principles of Effective Delegation. Decentralisation: Factors Influencing Decentralisation, Centralization v/s Decentralisation
4	Directing and Controlling (12)
	<ul style="list-style-type: none"> • Motivation – Concept, Importance, Influencing factors. Importance of Communication, Barriers to effective Communication • Leadership- Concept, Functions, Styles, Qualities of a good leader. Importance of Coordination, Principles of Coordination • Controlling – Concept, Steps, Techniques of Controlling –PERT, CPM, Budgetary Control, Management Audit.

***Revised Syllabus of Courses of B.Com. Programme at Semester III
with Effect from the Academic Year 2020-2021***

***2 Ability Enhancement Courses (AEC)
2A * Skill Enhancement Courses (SEC) Group A***

5. Advertising – I

Subject Code -UCM3AD1

Course Objective:

- 1) To introduce the student to the concept of Advertising.
- 2) To make the students understand about the carrier options in advertising.
- 3) To introduce the economic & social aspects of advertising.
- 4) To make the student aware about brand building, special purpose of advertising.

Course Outcomes:

- 1) Understanding of evaluation and classification of advertising.
- 2) Developed skills required for carrier in advertising.
- 3) Understanding economic & social aspects of advertising.
- 4) Understanding of Brand building & Special purpose & trends in advertising.

Sr. No.	Modules	No. of Lectures
1	Introduction to Advertising	12
2	Advertising Agency	11
3	Economic & Social Aspects of Advertising	11
4	Brand Building and Spécial Purpose Advertising	11
Total		45

Sr. No.	Modules
1	Introduction to Advertising
	<ul style="list-style-type: none"> • Integrated Marketing Communications (IMC)- Concept, Features, Elements, Role of advertising in IMC • Advertising: Concept, Features, Evolution of Advertising, Active Participants, Benefits of advertising to Business firms and consumers. Functions of Advertising. • Classification of advertising: Geographic, Media, Target audience and Functions.
2	Advertising Agency
	<ul style="list-style-type: none"> • Ad Agency: Features, Structure and services offered, Types of advertising agencies , Agency selection criteria • Agency and Client: Maintaining Agency–Client relationship, Reasons and ways of avoiding Client Turnover, Creative Pitch, Agency compensation • Careers in advertising: Skills required for a career in advertising, Various Career Options, Freelancing Career Options – Graphics, Animation, Modeling, Dubbing.
3	Economic & Social Aspects of Advertising
	<ul style="list-style-type: none"> • Economic Aspects: Effect of advertising on consumer demand, monopoly and competition, Price. • Social aspects: Ethical and social issues in advertising, positive and negative influence of advertising on Indian values and culture. • Pro Bono/Social advertising: Pro Bono Advertising, Social Advertising by Indian Government through Directorate of Advertising and Visual Publicity (DAVP), Self-Regulatory body- Role of ASCI (Advertising Standard Council of India)
4	Brand Building and Special Purpose Advertising
	<ul style="list-style-type: none"> • Brand Building: The Communication Process, AIDA Model, Role of advertising in developing Brand Image and Brand Equity, and managing Brand Crises. • Special purpose advertising: Rural advertising, Political advertising-, Advocacy advertising, Corporate Image advertising, Green Advertising – Features of all the above special purpose advertising, Financial Advertising. • Trends in Advertising: Media, Execution of advertisements

B.Com. Programme
Under Choice Based Credit, Grading and Semester System
Course Structure

(To be implemented from Academic Year- 2020-2021)

Semester IV

<i>Sr.No.</i>	<i>Course Code</i>	<i>Course Name</i>	<i>Credits</i>
<i>1</i>	<i>UCM4CM4</i>	<i>Commerce IV</i>	<i>03</i>
<i>2</i>	<i>UCM4AD2</i>	<i>Advertising IV</i>	<i>03</i>
<i>3</i>	<i>UCM4BL2</i>	<i>Business Law IV</i>	<i>03</i>

***Revised Syllabus of Courses of B.Com. Programme at Semester IV
with Effect from the Academic Year 2020-2021***

***Elective Courses (EC)-
1B Discipline Related Elective (DRE) Courses***

**3. Commerce – IV
(Management: Production & Finance)**

UCM4CM4

- **Course objectives:**

- 1) To overview learners about Production and Finance as a part of management.
- 2) To acquaint learners with the basic concept of production management, Inventory management.
- 3) To understand different aspects of Quality management.
- 4) To provide basic knowledge about Indian Financial System.
- 5) To update the learners with the recent trends in Finance.

- **Course Outcomes:**

- 1) Understanding about conceptual knowledge of production and Finance.
- 2) Awareness about the production management and Inventory management.
- 3) Better knowledge towards Quality management.
- 4) Better understanding about various aspect of Financial System.
- 5) Developing the skills of trading with Financial market.

***Revised Syllabus of Courses of B.Com. Programme at Semester IV
with Effect from the Academic Year 2020-2021***

***Elective Courses (EC)-
1B Discipline Related Elective (DRE) Courses***

**3. Commerce – IV
(Management: Production & Finance)**

UCM4CM4

Sr. No.	Modules	No. of Lectures
1	Production & Inventory Management	11
2	Quality Management	10
3	Indian Financial System	12
4	Recent Trends In Finance	12
Total		45

Sr. No.	Modules
1	Production & Inventory Management
	<ul style="list-style-type: none"> • Production Management: Objectives, Scope Production Planning & Control : Steps, Importance • Production Systems: Concept, Types - Continuous and Intermittent. Productivity: Concept, Factors Influencing Productivity, Measures for improving Productivity. • Inventory Management- Objectives, Inventory Control- Techniques. Scientific Inventory Control System - Importance
2	Quality Management
	<ul style="list-style-type: none"> • Introduction to Quality: Dimensions of Quality, Cost of Quality: Types – Internal Failure Cost, External Failure Cost, Appraisal Cost, Prevention Cost, Quality Circle: Features. • Quality Management Tools: TQM – Importance, Six Sigma – Process, ISO 9000 – Certification Procedure, Kaizen – Process • Service Quality Management: Importance, SERVQUAL Model, Measures to improve service quality.
3	Indian Financial System
	<ul style="list-style-type: none"> • Indian Financial Market: Structure, Primary Market – IPO Procedure Dematerialisation: Process, Role of Depositories : NSDL and CDSL • SEBI: Functions of SEBI, Investors protection measures of SEBI. Stock Exchange – Functions, Speculators. • Credit Rating: Advantages, Credit Rating Agencies in India - CRISIL, CARE, and ICRA.
4	Recent Trends In Finance
	<ul style="list-style-type: none"> • Mutual Funds- Advantages and Limitations, Types, Factors responsible for growth of mutual funds – Systematic Investment Plan. • Commodity Market: Categories, Derivatives Market: Types, Participants, Types of Derivative Instruments. • Start-up Ventures – Concept, Sources of Funding, Micro Finance – Importance, Role of Self Help Groups. Managing Personal Finance during Pandemic

***Revised Syllabus of Courses of B.Com. Programme at Semester IV
with Effect from the Academic Year 2020-2021***

3. Core Courses (CC)

7. Business Law II

UCM4BL2

Sr. No.	Modules	No. of Lectures
1	Indian Companies Act – 2013 Par T –I	12
2	Indian Companies Act – 2013, Par T –II	12
3	Indian Partnership Act – 1932	12
4	Consumer Protection Act, 1986 & Competition Act 2002	12
5	Intellectual Property Rights	12
Total		60

Sr. No.	Modules
1	Indian Companies Act – 2013 Par T –I
	<ul style="list-style-type: none"> • Company –Concept, Features, Role of Promoters (S. 2(69) S. 92), Duties and liabilities of the Promoter Effects of Pre-Incorporation contracts, Consequences of non-registration, and Lifting of Corporate Veil. • Classification of Companies Distinction between Private Company and Public Company, Advantages and disadvantages of Private company and Public Company. –Common Procedure for Incorporation of Company, • Memorandum of Association (MOA) & Article of Association(AOA) – Concept , Clauses of MOA, AOA- Contents, Doctrine of constructive notice, Doctrine of Ultra Vires, Doctrine of Indoor Management. • Prospectus – Concept, Kinds, Contents, Private Placement
2	Indian Companies Act – 2013, Par T –II
	<ul style="list-style-type: none"> • Member of a Company –Concept, Who can become a member, Modes of acquiring membership, Cessation of membership, Right & Liabilities of Members. • Director – Qualifications& Disqualification, Classification, Director Identification Number (DIN), Legal Position of Directors. • Meetings – Types, Legal Provisions of Statutory Meeting, Annual General Meeting, Extra-Ordinary Meeting, Board Meeting.
3	Indian Partnership Act – 1932
	<ul style="list-style-type: none"> • Partnership – Concept, Essentials, True Test of Partnership, Partnership Deed, Types of Partnership, Rights and Duties of Partners, Distinguish between Partnership & Hindu Undivided Family (HUF). • Dissolution – Concept, Modes of Dissolution, Consequences of Dissolution. • Limited Liability Partnership (LLP) 2008 – Concept, Characteristics, Advantages & Disadvantages, Procedure for Incorporation. • Extent of L.L.P.- Conversion of LLP, Mutual rights & duties of partners, Winding up of LLP, Distinction between LLP and Partnership.
4	Competition act 2002 & Information and Technology Act,2000
	<ul style="list-style-type: none"> • Competition Act 2002 – Concept, Salient Features, Objectives & Advantages. • Abuse of Dominant Position, Competition Commission of India, Anti-Competition Agreements • Development of IT act in India. • Cyber Law & Cyber Crime - Types of Cyber Crime. • Cyber Security – Measures to overcome cyber-crime.

Sr. No.	Modules
5	INTELLECTUAL PROPERTY RIGHTS 12
	<ul style="list-style-type: none"> • Intellectual Property Right (IPR) – Concept, Nature, Introduction & background of IPR in India. • IPR relating to Patents – Concepts of Invention and discovery, Comparison (S2 (j)), Concept of Patents, General principles applicable to working of patented inventions, Term of Patent. Infringement of Patent Rights & Remedies. (Ss. 104-115) • IPR relating to Copyrights- Concept of Copyright (Ss. 14, 16, 54,) Concept of author and authorised acts, (S.2) Ownership of Copy right (S.17) Duration or term of Copy right. (S. 22-27), Original work and fair use, Rights of Copyright holder, Infringement of Copyrights & Remedies. (Ss. 51, 52) • IPR relating to Trademarks –Concept, Functions of Trade Mark, types, trademarks that cannot be registered, Registration of Trade Marks and rights of the proprietor of Trade Marks. Procedure for registration of Trade Marks., Infringement of Trademarks & Remedies.

Janardan Bhagat Shikshan Prasarak Sanstha's
CHANGU KANA THAKUR
ARTS, COMMERCE & SCIENCE COLLEGE, NEW PANVEL
(AUTONOMOUS)

Re-accredited 'A+' Grade by NAAC
'College with Potential for Excellence' Status Awarded by UGC
'Best College Award' by University of Mumbai

Program: B.Com

Syllabus of T.Y.B.Com. Commerce
Choice Based Credit & Grading System (75:25)
w.e.f. Academic Year 2021-22

***Syllabus of Courses of B.Com. Programme at Semester V with effect
from the Academic Year 2020-2021***

Elective Courses (EC)

1 B. Discipline Related Elective(DRE) Courses

3.

**Commerce-V
Marketing**

- **Course objectives:**

- 1) To teach the students the concepts of marketing
- 2) To understand the various aspects and importance of marketing decision making
- 3) To understand the importance of marketing mix in decision making
- 4) To explain the various key marketing dimensions
- 5) To understand the skill sets required for effective marketing
- 6) To explain marketing ethics

- **Course Outcomes:**

- 1) Enable the student to comprehend the concepts of marketing
- 2) Be familiar with the basic elements of marketing mix
- 3) Evaluate the key marketing dimensions for decision making
- 4) Prepare the skill sets required for a career in marketing
- 5) Understanding the importance of ethics in marketing

Modules at a Glance

Sr. No.	Modules	No. of Lectures
1	Introduction to Marketing	12
2	Marketing Decisions I	11
3	Marketing Decisions	11
4	Key Marketing Dimensions	11
Total		45

Modules at a Glance

Sr. No.	Modules / Units
1	Introduction to Marketing
	<ul style="list-style-type: none"> Marketing, Concept, Features, Importance, Functions, Evolution, Strategic v/s Traditional Marketing Marketing Research - Concept, Features, Process Marketing Information System-Concept, Components Data Mining- Concept, Importance Consumer Behaviour- Concept, Factors influencing Consumer Behaviour Market Segmentation- Concept, Benefits, Bases of market segmentation Customer Relationship Management-Concept, Techniques, Customer engagement- Tools Market Targeting- Concept, Five patterns of Target market Selection
2	Marketing Decisions I
	<ul style="list-style-type: none"> Marketing Mix- Concept, Product- Product Decision Areas Product Life Cycle- Concept, Managing stages of PLC Branding- Concept , Components Brand Equity- Concept , Factors influencing Brand Equity Packaging- Concept , Essentials of a good package Product Positioning- Concept, Strategies of Product Positioning Service Positioning- Importance & Challenges Pricing- Concept, Objectives, Factors influencing Pricing, Pricing Strategies
3	Marketing Decisions
	<ul style="list-style-type: none"> Physical Distribution- Concept, Factors influencing Physical Distribution, Marketing Channels (Traditional & Contemporary Channels) Supply Chain Management-Concept, Components of SCM Promotion- Concept, Importance, Elements of Promotion mix Integrated Marketing Communication (IMC)- Concept, Scope ,Importance Sales Management- Concept, Components, Emerging trends in selling Personal Selling- Concept , Process of personal selling, Skill Sets required for Effective Selling
4	Key Marketing Dimensions
	<ul style="list-style-type: none"> Marketing Ethics: Concept, Unethical practices in marketing, Marketing Myths Competitive Strategies for Market Leader, Market Challenger, Market Follower, and Market Nicher. Rural Marketing- Concept, Features of Indian Rural Market, Strategies for Effective Rural Marketing Digital Marketing-Concept, trends in Digital Marketing Green Marketing- concept, importance

	<ul style="list-style-type: none">Challenges faced by Marketing Managers in 21st Century <p>Careers in Marketing – Skill sets required for effective marketing</p> <p>Factors contributing to Success of brands in India with suitable examples,</p> <p>Marketing During a Pandemic</p>
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***Revised Syllabus of Courses of B.Com. Programme at Semester
V with effect from the Academic Year 2018-2019***

Elective Courses (EC)

2. Ability Enhancement Courses (AEC)

3. Export Marketing Paper - I

- **Course objectives:**

1. To give outline about the Export Marketing.
2. To aware student about global framework for export marketing.
3. To make students aware about India's foreign trade Policy.
4. To aware students regarding Export incentives and Assistance.

- **Course Outcomes:**

1. Understand importance of Export Marketing.
2. Understand various Economic Grouping of the world, and trade barriers.
3. Understand New Foreign trade Policy 2015-20 and benefits to status holder.
4. Understand financial incentives available to Indian Exporter.

Modules at a Glance

Sr. No.	Modules	No. of Lectures
1	Introduction to Export Marketing	12
2	Global Framework for Export Marketing	11
3	India's Foreign Trade Policy	11
4	Export Incentives and Assistance	11
Total		45

Sr. No.	Modules / Units
1	Introduction to Export Marketing
	<ul style="list-style-type: none"> a) Concept and features of Export Marketing; Importance of Exports for a Nation and a Firm; Distinction between Domestic Marketing and Export Marketing b) Factors influencing Export Marketing; Risks involved in Export Marketing; Problems of India's Export Sector c) Major merchandise/commodities exports of India (since 2015); Services exports of India (since 2015); Region-wise India's Export Trade (since 2015)
2	Global Framework for Export Marketing
	<ul style="list-style-type: none"> a) Trade barriers; Types of Tariff Barriers and Non-Tariff barriers; Distinction between Tariff and Non-Tariff barriers b) Major Economic Groupings of the World (EU (European Union), ASEAN (The Association of Southeast Asian Nations), SAARC (The South Asian Association of Regional Cooperation), NAFTA (The North American Free Trade Agreement) BRICS (Brazil, Russia, India, China, South Africa) APEC (Asia -Pacific Economic Cooperation)); Positive and Negative Impact of Regional Economic Groupings; Agreements of World Trade Organization (WTO) c) Need for Overseas Market Research; Market Selection Process, Determinants of Foreign Market Selection E- Exporting
3	India's Foreign Trade Policy
	<ul style="list-style-type: none"> a) Foreign Trade Policy (FTP) 2015-20 - Highlights and Implications, Export Trade facilitations and ease of doing business as per the new FTP b) Role of Directorate General of Foreign Trade (DGFT), Negative list of Exports, Deemed Exports c) Benefits to Status Holders & Towns of Excellence; Common benefits for EHTP, BTP and STP; Benefits enjoyed by (IIAs) Integrated Industrial Areas(SEZ), EOU, AEZ Production Link Incentive Scheme (PLI)
4	Export Incentives and Assistance
	<ul style="list-style-type: none"> a. Financial Incentives available to Indian Exporters - Marketing Development Assistance (MDA), Market Access Initiative (MAI), Assistance to States for Infrastructure Development for Exports (ASIDE), Industrial Raw Material Assistance Centre(IRMAC), b. Institutional Assistance to Indian Exporters - Federation of Indian Export Organisations (FIEO), India Trade Promotion Organisation (ITPO), The Federation of Indian Chambers of Commerce and Industry (FICCI), Export Promotion Councils (EPCs) & Commodity Boards (CBs), Indian Institute of Foreign Trade (IIFT), Indian Institute of Packaging (IIP) c. Schemes - Export Promotion Capital Goods (EPCG) Scheme, Duty Exemption and Remission Schemes, Export Advance Authorisation Scheme; Duty Drawback (DBK); IGST Refund for Exporters

***Revised Syllabus of Courses of B.Com. Programme at Semester V
with effect from the Academic Year 2020-2021***

Elective Courses (EC)

2. Ability Enhancement Courses (AEC)

4. Marketing Research Paper – I

- **Course objectives:**

- 1) To introduce the concepts of marketing research
- 2) To understand the various steps and stages in planning marketing research
- 3) To make learners familiar with the sources of data collection
- 4) To provide analytical framework of data processing and analysis
- 5) To facilitate students to integrate technology in data collection and introduction to statistical tools in data analysis
- 6) To enable students to understand the significance of good report writing

- **Course Outcomes:**

- 1) Comprehend the concepts of marketing research
- 2) Enable the student to undertake marketing research
- 3) Evaluate the various sources of data collection
- 4) Familiar with data processing, analysis and reporting
- 5) Integrating the use of technology in data collection and analysis

Modules at a Glance

Sr. No.	Modules	No. of Lectures
1	Introduction to Marketing Research	12
2	Planning Research	11
3	Data Collection	11
4	Data Processing, Analysis, Reporting	11
Total		45

Sr. No.	Modules / Units
1	Introduction to Marketing Research
	a. Marketing Research- Definition, features, functions, significance of Marketing Research in marketing decision making, limitations of Marketing Research, b. Steps in Marketing Research, Ethics in Marketing Research, Career options in Marketing Research , Qualities of a good Marketing Research professional c. Marketing Information System- Definition, components, essentials of a good MIS, Key Performance Indicator (KPI) Dashboards- concept and examples, Concept of Decision Support System- Components , importance Data Mining- concept, importance
2	Planning Research
	a. Research Design- concept, importance, types Hypothesis- concept, types, importance b. Questionnaire- concept, types of questions, steps in the preparation of questionnaire, essentials of a good questionnaire c. Sampling- concept, terms in sampling, techniques of sampling, essentials of good sampling
3	Data Collection
	a. Primary data-concept, merits, demerits, methods b. Secondary data- concept, merits, demerits, sources c. Qualitative and Quantitative research- concept, features, Qualitative v/s Quantitative research Integrating technology in data collection, methods- (online surveys, hand held devices, text messages, social networking), importance
4	Data Processing, Analysis, Reporting
	a. Stages in Data processing Editing- meaning, objectives, types Coding- meaning, guidelines Classification- meaning, methods Tabulation- meaning, methods b. Data Analysis & Interpretation Data Analysis- meaning, steps, use of statistical tools (SPSS, SAS, MS EXCEL, MINITAB) Data Interpretation- meaning, importance, stages c. Report Writing- concept, types, contents, essentials, use of visual aids in research report

B.Com. Programme
Under Choice Based Credit, Grading and Semester System
Course Structure

(To be implemented from Academic Year- 2020-2021)

Semester VI

Syllabus of Courses of B.Com. Programme at Semester VI
with effect from the Academic Year 2020-2021

Elective Courses (EC)

1 B. Discipline Related Elective(DRE) Courses

3. Commerce-VI

Human Resource Management

- **Course objectives:**

- 1) To teach the students the concepts of **Human Resource Management**
- 2) To understand the various aspects and importance of **Human Resource Development**
- 3) To understand the importance of human relations and employee welfare
- 4) To explain the recent trends in **Human Resource Management**
- 5) To understand the challenges in human resource management
- 6) To explain the importance of human resources and their effective management in organizations

- **Course Outcomes:**

- 1) Develop the understanding of the concepts of **Human Resource Management**
- 2) Be familiar with the various aspects of **Human Resource Development**
- 3) Develop an understanding of the importance of Human relations
- 4) Evaluate and understand the various aspects of leadership, motivation, employee morale, employee grievance and their effective management in organizations
- 5) To integrate the knowledge of the concepts of **Human Resource Management to take correct business decisions.**

Modules at a Glance

Sr. No.	Modules	No. of Lectures
01	Human Resource Management	12
02	Human Resource Development	11
03	Human Relations	11
04	Trends In Human Resource Management	11
Total		45

Modules at a Glance

Sr. No.	Modules / Units
1	Human Resource Management
	<ul style="list-style-type: none"> Human Resource Management – Concept, Functions, Importance, Traditional v/s Strategic Human Resource Management Human Resource Planning- Concept Steps in Human Resource Planning Job Analysis-Concept, Components, Job design- Concept, Techniques Recruitment- Concept, Sources of Recruitment Selection - Concept , process , Techniques of E-selection,
2	Human Resource Development
	<ul style="list-style-type: none"> Human Resource Development- Concept, functions Training- Concept, Process of identifying training and development needs, Methods of Training & Development (Apprenticeship, understudy, job rotation, vestibule training, case study, role playing, sensitivity training, In-basket, management games, E- Training) Evaluating training effectiveness- Concept, Methods Performance Appraisal- Concept, Benefits, Limitations, Methods Potential Appraisal-Concept, Importance Career Planning- Concept, Importance Succession Planning- Concept, Need Mentoring- Concept, Importance Counselling- Concept, Techniques.
3	Human Relations
	<ul style="list-style-type: none"> Human Relations- Concept, Significance Leadership –Concept, Transactional & Transformational Leadership Motivation- Concept, Theories of Motivation,(Maslow’s Need Hierarchy Theory, Vroom’s Expectancy Theory, McGregor’s Theory X and Theory Y, Pink’s Theory of Motivation) Employees Morale- Concept, Factors affecting Morale, Measurement of Employees Morale Emotional Quotient and Spiritual Quotient- Concept, Factors affecting EQ & SQ Employee Grievance- Causes, Procedure for Grievance redressal Employee welfare measures and Healthy & Safety Measures.
4	Trends In Human Resource Management
	<ul style="list-style-type: none"> HR in changing environment: Competencies- concept, classification Learning organizations- Concept, Creating an innovative organization, Innovation culture- Concept, Need, Managerial role. Trends in Human Resource Management,; Employee Engagement- Concept, Types Human resource Information System (HRIS) – Concept, Importance, Changing patterns of employment. Challenges in Human Resource Management: Employee Empowerment,

	Workforce Diversity. Inclusion in the workplace, Attrition, Downsizing, Employee Absenteeism, Work life Balance, Sexual Harassment at work place, Domestic and International HR Practices, Millennial (Gen Y), Competency Mapping, Human Resource Management during a Pandemic.
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Revised Syllabus of Courses of B.Com. Programme at Semester VI with effect from the Academic Year 2020-2021

Elective Courses (EC)

2. Ability Enhancement Courses (AEC)

3. Export Marketing Paper - II

• **Course objectives:**

1. Introduction about product planning and pricing decisions for export marketing.
2. To aware student regarding export distribution and promotion.
3. To make students aware about export finance.
4. To aware students regarding Export procedure and documentation

Course Outcomes:

1. Understand factors determining export price .Need for labelling and export marketing.
2. Understand factors influencing distribution channels, components of logistics and sales [promotion techniques.
3. Understand methods of payment in export marketing. Role of commercial bank, EXIM, SIDBI in financing exporters, ECGC.
4. Understand registration with different authorities, shipping and custom stage formalities

Modules at a Glance

Sr. No.	Modules	No. of Lectures
1	Product Planning and Pricing Decisions for Export Marketing	12
2	Export Distribution and Promotion	11
3	Export Finance	11
4	Export Procedure and Documentation	11
Total		45

Sr. No.	Modules / Units
1	Product Planning and Pricing Decisions for Export Marketing
	<ul style="list-style-type: none"> a) Planning for Export Marketing with regards to Product, Branding, Packaging ROHS (Restriction of Hazardous Substances, Recycling) b) Need for Labelling and Marking in Exports, Factors determining Export Price; Objectives of Export Pricing c) International Commercial (INCO) Terms; Export Pricing Quotations – Free on Board (FOB), Cost Insurance and Freight (CIF) and Cost and Freight (C&F); Problems on FOB quotation
2	Export Distribution and Promotion
	<ul style="list-style-type: none"> a) Factors influencing Distribution Channels; Direct and Indirect Exporting Channels; Distinction between Direct and Indirect Exporting Channels b) Components of Logistics in Export marketing; Selection criteria of Modes of Transport; Need for Insurance in Export Marketing, Warehousing c) Sales Promotion Techniques used in Export Marketing; Importance of Trade Fairs and Exhibitions; Benefits of Personal Selling; Essentials of Advertising in Export Marketing; Grey Marketing
3	Export Finance
	<ul style="list-style-type: none"> a) Methods of Payment In export marketing; Procedure to open Letter of Credit, Types and Benefits of Countertrade b) Features of Pre-Shipment and Post-shipment finance; Procedure to obtain Export Finance; Distinction between Pre-shipment Finance and Post Shipment Finance. c) Role of Commercial Banks, EXIM Bank, SIDBI in financing exporters; Role of ECGC
4	Export Procedure and Documentation
	<ul style="list-style-type: none"> a. Registration with different authorities; Pre-shipment Procedure involved in Exports; Procedure of Quality Control and Pre-shipment Inspection; (HSN Harmonized System of Nomenclature) b. Shipping and Custom Stage Formalities; Role of Clearing & Forwarding Agent; Post-shipment Procedure for Realization of Export Proceeds; Procedure of Export under Bond and Letter of Undertaking. (LUT) c. Importance of - Commercial Invoice cum Packing list, Bill of Lading/ Airway Bill, Shipping Bill/Bill of Export, Consular Invoice, Certificate of Origin. Performa of Bills

University of Mumbai



Master of Commerce (M.Com) Programme Two Year Integrated Programme - Four Semesters *Course Structure*

**Under Choice Based Credit, Grading and
Semester System**

***To be implemented from Academic Year- 2019-2020
Progressively***

Faculty of Commerce, University of Mumbai

Master of Commerce (M.Com) Programme

Under Choice Based Credit, Grading and Semester System

Course Structure

M.Com I

(To be implemented from Academic Year- 2019-2020)

No. of Courses	Semester I	Credits	No. of Courses	Semester II	Credits
1	Core Courses (CC)		1	Core Courses (CC)	
1	Strategic Management	06	1	Research Methodology for Business	06
2	Economics for Business Decisions	06	2	Macro Economics concepts and Applications	06
3	Cost and Management Accounting	06	3	Corporate Finance	06
4	Business Ethics and Corporate Social Responsibility	06	4	E-Commerce	06
Total Credits		24	Total Credits		24

University of Mumbai



**Revised Syllabus
and
Question Paper Pattern
of Courses
of
Master of Commerce (M.Com)
Programme
at
Two Year
*Semester I and II***

**Under Choice Based Credit, Grading and
Semester System**

(To be implemented from Academic Year- 2019-2020)

Faculty of Commerce, University of Mumbai

Master of Commerce (M.Com) Programme

Under Choice Based Credit, Grading and Semester System

Course Structure

M.Com I

(To be implemented from Academic Year- 2019-2020)

No. of Courses	Semester I	Credits	No. of Courses	Semester II	Credits
1	Core Courses (CC)		1	Core Courses (CC)	
1	Strategic Management	06	1	Research Methodology for Business	06
2	Economics for Business Decisions	06	2	Macro Economics concepts and Applications	06
3	Cost and Management Accounting	06	3	Corporate Finance	06
4	Business Ethics and Corporate Social Responsibility	06	4	E-Commerce	06
Total Credits		24	Total Credits		24

Master of Commerce (M.Com) Programme
Under Choice Based Credit, Grading and Semester System
Course Structure

(To be implemented from Academic Year- 2019-2020)

Semester I

No. of Courses	Semester I	Credits
1	<i>Core Courses (CC)</i>	
1	Strategic Management	06
2	Economics for Business Decisions	06
3	Cost and Management Accounting	06
4	Business Ethics and Corporate Social Responsibility	06
Total Credits		24

Revised Syllabus of Courses of
Master of Commerce (M.Com) Programme at Semester I

(To be implemented from Academic Year- 2019-2020)

Core Courses (CC)

1. Strategic Management

Modules at a Glance

SN	Modules	No. of Lectures
1	Introduction to Strategic Management	15
2	Strategy Formulation, Implementation and Evaluation	15
3	Business, Corporate and Global Strategies	15
4	Emerging Strategic Trends	15
Total		60

1	Introduction to Strategic Management
	<ul style="list-style-type: none"> • Concept of Strategic Management, Strategic Management Process, Vision, Mission and Goals, Benefits and Risks of Strategic Management. • Levels of Strategies: Corporate, Business and Operational Level Strategy • Functional Strategies: Human Resource Strategy, Marketing Strategy, Financial Strategy , Operational Strategy • Business Environment: Components of Environment- Micro and Macro and Environmental Scanning
2	Strategy Formulation, Implementation and Evaluation
	<ul style="list-style-type: none"> • Strategic Formulation: Stages and Importance, Formulation of Alternative Strategies: Mergers, Acquisitions, Takeovers, Joint Ventures, Diversification, Turnaround, Divestment and Liquidation. • Strategic Analysis and Choice: Issues and Structures, Corporate Portfolio Analysis- SWOT Analysis, BCG Matrix, GE Nine Cell Matrix, Hofer's Matrix, • ETOP- Environmental Threat and Opportunity Profile, Strategic Choice- Factors and Importance. • Strategic Implementation: Steps, Importance and Problems, Resource Allocation- Importance & Challenges • Strategic Evaluation and Control: Importance, Limitations and Techniques • Budgetary Control: Advantages, Limitations
3	Business, Corporate and Global Strategies
	<ul style="list-style-type: none"> • Corporate Restructuring Strategies: Concept, Need and Forms, Corporate Renewal Strategies: Concept, Internal and External factors and Causes. • Strategic Alliance: Concept, Types, Importance, Problems of Indian Strategic Alliances and International Businesses • Public Private Participation: Importance, Problems and Governing Strategies of PPP Model. • Information Technology Driven Strategies: Importance, Limitations and contribution of IT sector in Indian Business
4	Emerging Strategic Trends
	<ul style="list-style-type: none"> • Business Process Outsourcing and Knowledge Process Outsourcing in India: Concept and Strategies. Reasons for growing BPO and KPO businesses in India. • Reengineering Business Processes- Business Reengineering, Process Reengineering and Operational Reengineering • Disaster Management: Concept, Problems and Consequences of Disasters, Strategies for Managing and Preventing disasters and Cope up Strategies. • Start-up Business Strategies and Make in India Model: Process of business start ups and its Challenges, Growth Prospects and government initiatives in Make in India Model with reference to National manufacturing, Contribution of Make in India Policy in overcoming industrial sickness

***Revised Syllabus of Courses of
Master of Commerce (M.Com) Programme at Semester II
(To be implemented from Academic Year- 2019-2020)***

Core Courses (CC)

4. E-Commerce

Modules at a Glance

SN	Modules	No. of Lectures
1	Introduction to Electronic Commerce –Evolution and Models	15
2	World Wide Web and E-enterprise	15
3	E-marketing and Electronic Payment System	15
4	Legal and Regulatory Environment and Security issues of E-commerce	15
Total		60

SN	Modules/ Units
1	Introduction to Electronic Commerce –Evolution and Models
	<ul style="list-style-type: none"> • Evolution of E-Commerce-Introduction, History/Evolution of Electronic Commerce, Roadmap of E-Commerce in India, Main activities, Functions and Scope of E-Commerce. • Benefits and Challenges of E-Commerce, Reverse logistics , E-Commerce Business Strategies for Marketing, Sales and Promotions. • Business Models of E-Commerce- Characteristics of Business to Business(B2B), Business to Consumers (B2C), Business to Government (B2G) • Concepts of other models of E-commerce. • Business to Consumer E-Commerce process, Business to Business E-Commerce- Need and Importance, alternative models of B2B E-Commerce. • E-Commerce Sales Product Life Cycle (ESLC) Model
2	World Wide Web and E-enterprise
	<ul style="list-style-type: none"> • World Wide Web-Reasons for building own website, Benefits of Website, Registering a Domain Name, Role of web site in B2C E-commerce; push and pull approaches; Web site design principles. • EDI and paperless trading; Pros & Cons of EDI; Related new technologies use in E-commerce. • Applications of E-commerce and E-enterprise - Applications to Customer Relationship Management- Types of E-CRM, Functional Components of E-CRM. • Managing the E-enterprise- Introduction, Managing the • E-enterprise, Comparison between Conventional and • E-organisation, Organisation of Business in an E-enterprise, Benefits and Limitations of E- enterprise
3	E-marketing and Electronic Payment System
	<ul style="list-style-type: none"> • E-Marketing- Scope and Techniques of E-Marketing, Traditional web promotion; Web counters; Web advertisements, Role of Social media. • E-Commerce Customer Strategies for Purchasing and support activities, Planning for Electronic Commerce and its initiatives, Justify an Internet business. • Electronic Payment System-Characteristics of E-payment system, SET Protocol for credit card payment, prepaid e-payment service, post-paid E-payment system, Types of payment systems. • Operational, credit and legal risks of E-payment system, Risk management options for E-payment systems, Set standards / principles for E-payment

SN	Modules/ Units
4	Legal and Regulatory Environment and Security issues of E-commerce
	<ul style="list-style-type: none"> • Introduction to Cyber Laws-World Scenario, Cyber-crime& Laws in India and their limitations, Hacking, Web Vandals, E-mail Abuse, Software Piracy and Patents. • Taxation Issues, Protection of Cyber Consumers in India and CPA 1986, Importance of Electronic Records as Evidence. • Security Issues in E-Commerce- Risk management approach to Ecommerce Security - Types and sources of threats, Protecting electronic commerce assets and intellectual property. • Security Tools, Client server network security, Electronic signature, Encryption and concepts of public and private key infrastructure

***Revised Syllabus of Courses of B.Com. Programme at Semester II
with Effect from the Academic Year 2016-2017***

***Elective Courses (EC)-
Discipline Specific Elective(DSE) Courses***

1. Accountancy and Financial Management II

Modules at a Glance

Sr. No.	Modules	No. of Lectures
1	Accounting from Incomplete Records	15
2	Consignment Accounts	15
3	Branch Accounts	15
4	Accounting In Computerized Environment	15
Total		60

Sr. No.	Modules / Units
1	Accounting from Incomplete Records
	Introduction Problems on preparation of final accounts of Proprietary Trading Concern (conversion method)
2	Consignment Accounts
	Accounting for consignment transactions Valuation of stock Invoicing of goods at higher price(excluding overriding commission, normal/abnormal losses)
3	Branch Accounts
	Meaning/ Classification of branch Accounting for Dependent Branch not maintaining full books: Debtors method Stock and debtors method
4	Accounting In Computerized Environment
	Manual vs Computerized Accounting System Tally ERP 9 1.Creation of company 2.Group 3.Ledger



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Program: B.Com.

**Revised Syllabus of
S.Y.B.Com.**

**Accountancy and Financial Management
Financial Accounting and Auditing
Choice Based Credit & Grading System (75:25)
w.e.f. Academic Year 2020-21**

**Revised Syllabus of Courses of B.Com. Programme at Semester IV
with Effect from the Academic Year 2020-2021**

Elective Courses (EC)

Discipline Specific Elective (DSE) Courses

Accountancy and Financial Management IV

Modules at a Glance Sr. No.	Modules	No. of Lectures
1	Introduction to Company Accounts	15
2	Redemption of Preference Shares	15
3	Ascertainment and Treatment of Profit Prior to Incorporation	15
4	Accounting with the use of Accounting Software	15
Total		60

Sr. No.	Modules / Units
1	Introduction to Company Accounts
	<p>Introduction of basic terms: Types of companies, nature and formation of companies, Shares, Debentures, Share Capital, Reserves and surplus, types of assets and liabilities, dividend, format of Balance Sheet</p> <p>Issue of shares: Different modes IPO, Private Placements, Preferential, Rights, ESO, SWEAT and ESCROW account, Issue of shares at par, premium and discount, Under subscription and Over subscription of shares, forfeiture and reissue of forfeited shares, issue of shares for consideration other than cash. (Practical problem)</p> <p>Issue of Debenture and Redemption ; At par, Premium, discount types of Debentures (no practical problems on redemption of debentures)</p>
2	Redemption of Preference Shares
	<p>Redemption of Preference:</p> <p>Provision of the Companies Act for redemption of Preference Shares (Sec 55 of the Companies Act, 2013), Companies (Share and Debentures) Rules.</p> <p>Methods of Redemption of fully paid up Preference Shares as per Companies Act, 2013: The proceed of a fresh issue of shares, the capitalisation of undistributed profits and a combination of both, calculation of minimum fresh issue to provide the fund for redemption, (Question on journal entries and/or Balance Sheet)</p> <p>Note: Companies governed by Section 133 of the Companies Act, 2013 and comply with the accounting standards prescribed for them. Hence, the balance in security premium account not to be utilised for premium payable on redemption of preference shares.</p>
3	Ascertainment and Treatment of Profit Prior to Incorporation
	<p>(i) Principles for ascertainment</p> <p>Preparation of separate combined, columnar Profit and Loss A/c including different basis of allocation of expenses and income and Balance sheet</p>
4	Accounting with the use of Accounting Software
	<p>Advance accounting & Inventory Voucher: Purchase and Sales order, reorder , delivery notes , Budgeting Control, Invoice product invoice and service invoice</p> <p>Shortcut keys : special combination, special functional key combination.</p> <p>Management Information System (MIS)</p>

Reference Text :

1. Introduction to Accountancy T.S. Grewal S. Chand and Co. (P) Ltd., New Delhi
2. Advanced Accounts Shukla and Grewal S. Chand and Co. (P) Ltd., New Delhi
3. Advanced accountancy R.L. Gupta and M. Radhaswamy S. Chand and Co. (P) Ltd., New Delhi
4. Modern Accountancy Mukerjee and Hanif Tata Mc. Grow Hill and Co. Ltd., Mumbai
5. Financial Accountancy LesileChandWichkPretice Hall of India AdinBakley (P) Ltd.



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Program: B.Com.

Revised Syllabus of T.Y.B.Com. – Semester Vth and VIth
Direct and Indirect Tax
Paper I and II

Choice Based Credit & Grading System (75:25)
w.e.f. Academic Year 2021-22

		OR Short Notes out of 5 any 315 M
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**Choice Based Credit Grading and Semester System (CBCGS)
T.Y.B. Com. Direct and Indirect Tax Syllabus
To be implemented from the Academic year 2021-2022
SEMESTER V**

Course Code	Unit	Topics	Credits	L / Week
UCM5TX1	I	Basic Terms	3	04
	II	Scope of Total Income & Residential Status		04
	III	Heads of Income		24
	IV	Deduction from Total Income		04
	V	Computation of Total Income for Individual and filling ITR-1 Form		09

**Choice Based Credit Grading and Semester System (CBCGS)
T.Y.B. Com. Direct and Indirect Tax- Goods and Service Tax Act
Syllabus to be implemented from the Academic year 2021-2022
SEMESTER VI**

Course Code	Unit	Topics	Credits	L / Week
UCM6DX2	I	Introduction	3	09
	II	Levy and Collection of Tax		09
	III	Time, Place and Value of Supply		09
	IV	Input Tax Credit & Payment of Tax		09
	V	Registration under GST Law		09

Semester - V– Direct and Indirect Tax - I

Sr. No.	Modules / Units
1	Basic Terms
	Assessee, Assessment, Assessment Year, Annual value, Business, Capital Assets, Income, Person, Previous Year, Transfer
2	Scope of Total Income & Residential Status
	Scope of Total Income (S: 5) Residential Status (S: 6) for Individual assessee
3	Heads of Income (S: 14)
	<ul style="list-style-type: none"> • Salary (S: 15 to 17) • Income from House Properties (S: 22 to 27) • Profit and Gain From Business (S:28, 30, 31, 32, 35, 35D, 36, 37, 40, 40A 43B. • Capital Gains (S: 45, 48, 49, 50, 54, 54 EC) restricted to computation of Capital gain on transfer of residential house property only • Income from Other Sources (S: 56 to S: 59) • Exclusions From Total Income (S: 10) Exclusion related to specified heads to be covered with relevant head.eg. Salary, Business Income, Capital Gain, Income from Other Sources
4	Deduction from Total Income
	S 80 A, S 80C, 80CCC, 80D, 80DD, 80E, 80 U, 80 TTA (revised deduction)
5	Computation of Total Income for Individual and filling ITR-1 Form Sahaj

Semester –VI- Direct and Indirect Tax - II Goods and Service Tax Act

Sr. No.	Modules / Units
1	Introduction
	<ul style="list-style-type: none"> What is GST Need for GST Dual GST Model Definitions <ul style="list-style-type: none"> Section 2(17) Business Section 2(13) Consideration Section 2(45) Electronic Commerce Operator Section 2(52) Goods Section 2(56) India Section 2(78) Non taxable Supply Section 2(84) Person Section 2(90) Principal Supply Section 2(93) Recipient Section 2(98) Reverse charge Section 2(102) Services Section 2(105) Supplier Section 2(107) Taxable Person Section 2(108) Taxable Supply Goods & Services Tax Network (GSTN)
2	Levy and Collection of Tax
	<ul style="list-style-type: none"> Scope of Supply Non taxable Supplies Composite and Mixed Supplies Composition Levy Levy and Collection of tax Exemption from tax
3	Time, Place and Value of Supply
	<ul style="list-style-type: none"> Time of Supply Place of Supply Value of Supply
4	Input Tax Credit & Payment of Tax
	<ul style="list-style-type: none"> Eligibility for taking Input Tax Credit Input Tax Credit in Special Circumstances Computation of Tax Liability and payment of tax (Recent tax Rate)
5	Registration under GST Law
	<ul style="list-style-type: none"> Persons not liable registration Compulsory registration Procedure for registration Deemed registration Cancellation of registration



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Revised Syllabus of T.Y.B.Com. – Semester Vth and VIth
FINANCIAL ACCOUNTING AND AUDITING

Paper VII and IX

Choice Based Credit & Grading System (75:25)

w.e.f. Academic Year 2021-22

Choice Based Credit Grading and Semester System (CBCGS)
T.Y.B. Com. Financial Accounting and Auditing-VII
Syllabus To be implemented from the Academic year 2021-2022
SEMESTER V

Course Code	Unit	Topics	Credits	L / Week
UCM5FA7	I	Preparation of Final Accounts of Companies	4	15
	II	Internal Reconstruction		15
	III	Buy Back of Shares		10
	IV	Investment Accounting (w.r.t. Accounting Standard- 13)		12
	V	Implications for Accounting with Application of Excel in Business for Accounting		8

Choice Based Credit Grading and Semester System (CBCGS)
T.Y.B. Com. Financial Accounting and Auditing-IX Syllabus
To be implemented from the Academic year 2021-2022
SEMESTER VI

Course Code	Unit	Topics	Credits	L / Week
UCM6FA9	I	AS – 14 - Amalgamation, Absorption & External Reconstruction	4	15
	II	Accounting of Transactions of Foreign Currency		15
	III	Underwriting of Shares & Debentures		10
	IV	Accounting for Limited Liability Partnership		10
	V	Recent Trends in Accounting with ERP SAP R3.		10

Sr. No.	Modules / Units
4	Investment Accounting (w.r.t. Accounting Standard- 13)
	For shares (variable income bearing securities) For debentures/Preference. shares (fixed income bearing securities) Accounting for transactions of purchase and sale of investments with ex and cum interest prices and finding cost of investment sold and carrying cost as per weighted average method (Excl. brokerage). Columnar format for investment account.
5	Implications for Accounting with Application of Excel in Business for Accounting
	Practical use of the following excel formulas for Business for Accounting AGGREGATE, ROUND, EOMONTH, EDATE, WORKDAY, TRIM , 3DFORMULAS, VLOOKUP, HLOOKUP, IF, SUMIFS.

Financial Accounting and Auditing-IX

Sr. No.	Modules / Units
1	AS – 14 - Amalgamation, Absorption & External Reconstruction (excluding inter-company holdings)
	In the nature of merger and purchase with corresponding accounting treatments of pooling of interests and purchase method respectively. Meaning and Computation of purchase consideration. Problems based on purchase method only.
2	Accounting of Transactions of Foreign Currency
	In relation to purchase and sale of goods, services and assets and loan and credit transactions. Computation and treatment of exchange rate differences
3	Underwriting of Shares & Debentures
	Introduction, Underwriting, Underwriting Commission Provision of Companies Act with respect to Payment of underwriting commission Underwriters, Sub-Underwriters, Brokers and Manager to issues Types of underwriting, Abatement Clause Marked, Unmarked and Firm-underwriting applications, Liability of the underwriters in respect of underwriting contract Practical problems

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Department of Business Economics

Mapping of Syllabus

(Activities/ Content with a direct bearing on Employability/ Entrepreneurship/ Skill Development of Courses during the Year 2020-21)

1. F.Y.B.COM Semester –I

Business Economics-Paper- I, Course Code- UCM1BE1

Module-I: - Introduction: 10 L

Scope and importance of business economics- Basic tools, opportunity cost principle- Basic economic relations- functional relations- equations- total, average and marginal relations- use of marginal analysis in decision making.

The basics of market demand, market supply and equilibrium price- shifts in demand and supply curves and equilibrium.

Module-II: - Demand Analysis: 15L

Demand function: Nature of Demand curve under different markets. Meaning, significance and types of elasticity of demand -Price elasticity of demand, income elasticity of demand, cross elasticity of demand and promotional elasticity of demand.

Demand estimation and forecasting- meaning and significance- methods of demand estimation- survey and statistical methods (numerical illustrations on trend analysis).

Module-III: - Supply and Production Decisions: 10L

Production function- short run analysis with law of variable proportions- production function with two variable inputs-isoquants -ridge lines and least cost combination of inputs- long run production function and laws of returns to scale, Expansion path.

Module-IV: - Cost of production: 15L

Cost concepts: accounting and economic costs, explicit and implicit costs, Social and private costs, fixed and variable costs- total, average and marginal costs- cost-output relationship in short and long run (hypothetical numerical problems to be discussed)

Extension of cost analysis: cost reduction through experience, LAC and learning curve- Break even analysis (with business applications)

2. F.Y.B.COM - Semester –II

Business Economics-II - Course Code- UCM2BE2

Module-I: - Market structure: Perfect competition and Monopoly: 10L

Perfect competition and monopoly: Perfect competition and monopoly models are two extreme cases- short run and long run equilibrium of a firm and of industry. Monopoly: sources of monopoly power- short run and long run equilibrium of a firm under monopoly.

Module-II: - Pricing and output decisions under imperfect competition: 15L

Monopolistic competition market: Competitive and monopolistic elements of monopolistic competition- equilibrium of a firm under monopolistic competition- monopolistic completion verses perfect competition- excess capacity and inefficiency- debate over role of advertising (topics to be taught using case studies from real life examples)

Oligopolistic markets: Key attributes of oligopoly- price rigidity, collusive and non- collusive oligopoly market-price leadership models (with practical examples)

Module-III: -Pricing practices: 10L

Cost oriented pricing methods: cost-plus (full cost) pricing, marginal cost pricing, mark up pricing, multiple product pricing- discriminating pricing- transfer pricing. (Case studies on how pricing methods are used in business world)

Module-IV: - Evaluating capital projects: 10L

Meaning and importance of capital budgeting, steps in capital budgeting- Techniques of investment appraisal: Payback period method, net present value method, internal rate of return method (with numerical examples)

3. F.Y.B.COM (Accounting and Finance) Semester-I

Business Economics- Paper-I, Course Code- UAF1BE1

Module I- Introduction: 10L

Scope and Importance of Business Economics - basic tools- Opportunity Cost principle- Incremental and Marginal Concepts. Basic economic relations – functional relations: equations-Total, Average and Marginal relations-use of Marginal analysis in decision making.

Module II-Demand Analysis:- 10L

Demand Function - nature of demand curve under different markets

Meaning, significance, types and measurement of elasticity of demand (Price, income cross and promotional)

The basics of Market Demand & Supply and Equilibrium Price – shifts in the demand and supply curves and equilibrium

Demand Estimation and forecasting: Meaning and significance-methods of demand estimation :survey and statistical methods

(numerical illustrations on trend analysis and simple linear regression)

Module III- Production function: 15L

Short run analysis with Law of Variable proportion-isoquants, ridgelines, and least cost combination of inputs-Long run production function and Law of return to Scale-Expansion path

Cost Concepts: Accounting cost and economic cost, implicit and explicit cost, fixed and variable cost- total, average and marginal cost, cost output relationship in the short run and long run (hypothetical numerical problems to be discussed) Break even analysis (with business applications)

Module IV-Market Structure: 15L

Perfect competition and monopoly and pricing and output decisions under imperfect competition :- Short run and long run equilibrium of a competitive firm and of industry-Monopoly- Short run and long run equilibrium of a firm under monopoly.

Monopolistic Competition: Equilibrium of a firm under monopolistic competition.

Oligopolistic markets: Key attributes of oligopoly –price rigidity

Module V -Pricing Practices:- 10L

Cost oriented pricing methods: Cost plus (full cost)pricing, marginal cost pricing , mark up pricing, discriminating pricing, multiple product pricing, transfer pricing (case studies on how pricing methods are used in business world)

4. F Y B M S- Semester-I

Business Economics- Paper-I, Course Code- UMS1BE1

Module I- Introduction: 10L

Scope and Importance of Business Economics - basic tools- Opportunity Cost principle- Incremental and Marginal Concepts. Basic economic relations – functional relations: equations-Total, Average and Marginal relations-use of Marginal analysis in decision making.

Module II-Demand Analysis:- 10L

Demand Function - nature of demand curve under different markets

Meaning, significance, types and measurement of elasticity of demand (Price, income cross and promotional)

The basics of Market Demand & Supply and Equilibrium Price – shifts in the demand and supply curves and equilibrium

Demand Estimation and forecasting: Meaning and significance-methods of demand estimation :survey and statistical methods

(numerical illustrations on trend analysis and simple linear regression)

Module III- Production function: 15L

Short run analysis with Law of Variable proportion-isoquants, ridgelines, and least cost combination of inputs-Long run production function and Law of return to Scale-Expansion path

Cost Concepts: Accounting cost and economic cost, implicit and explicit cost, fixed and variable cost- total, average and marginal cost, cost output relationship in the short run and long run (hypothetical numerical problems to be discussed) Break even analysis (with business applications)

Module IV-Market Structure: 15L

Perfect competition and monopoly and pricing and output decisions under imperfect competition :- Short run and long run equilibrium of a competitive firm and of industry-Monopoly- Short run and long run equilibrium of a firm under monopoly.

Monopolistic Competition: Equilibrium of a firm under monopolistic competition.

Oligopolistic markets: Key attributes of oligopoly –price rigidity

Module V -Pricing Practices:- 10L

Cost oriented pricing methods: Cost plus (full cost)pricing, marginal cost pricing , mark up pricing, discriminating pricing, multiple product pricing, transfer pricing (case studies on how pricing methods are used in business world)

5. S.Y.B.COM Semester –III
Business Economics- Paper- III- Course Code- UCM3BE3
Introduction to Macroeconomics

Module-I: Introduction: 10L

- **Macroeconomics:** Meaning, Scope and Importance.
- **Circular flow of aggregate income and expenditure** and its Importance- closed and open economy models
- **Green GNP and NNP concepts-** Importance and Measurement
- **Trade Cycles:** Features and Phases
- **Classical Macro economics: Say's law of Markets** - Features, Implications and Criticism

Module-II: - Basic Concepts of Keynesian Economics: 15L

- **The Principle of Effective Demand:** Aggregate Demand and Aggregate Supply
- **Consumption Function:** Properties, Assumptions and Implications
- **Investment function and Marginal Efficiency of capital**
- **Investment Multiplier effect on Income and Output:** Assumptions, Working, Leakages, Criticism and Importance - paradox of thrift
- **Relevance of Keynesian theory tools to the developing countries**

Module-III: POST Keynesian Developments In Macro Economics: 10L

- **The IS-LM model** of integration of commodity and money markets
- **Inflation and unemployment:** Philips curve
- **Stagflation:** meaning, causes, and consequences
- **Supply side economics:** Basic propositions and critical appraisal

Module-IV - Money, Prices and Inflation- 10L

- **Money Supply:** Determinants of Money Supply - Factors influencing Velocity of Circulation of Money
- **Demand for Money:** Classical and Keynesian approaches and Keynes' liquidity preference theory of interest - Friedman's restatement of Demand for money
- **Inflation:** Demand Pull Inflation and Cost Push Inflation - Effects of Inflation- Nature of inflation in a developing economy - policy measures to curb inflation- monetary policy and inflation targeting

6. S.Y.B.COM, Semester –IV Business Economics – IV

Public Finance Paper, Course Code- UCM4BE4

Model No. I - The Role of Government in an Economy: 10L

- **Meaning and Scope of Public finance.**
- **Major fiscal functions:** allocation function, distribution function & stabilization function
- **Principle of Maximum Social Advantage:** Dalton and Musgrave Views - the Principle in Practice, Limitations.
- **Relation between Efficiency, Markets and Governments**
- **The concept of Public Goods and the role of Government**

Module-II- Public Revenue: 15

- **Sources of Public Revenue:** tax and non-tax revenues
- **Objectives of taxation** - Canons of taxation
- **Direct taxes- Merits and demerits- Indirect taxes- Merits and demerits**
- **Shifting of tax burden:** Impact and incidence of taxation - Processes- factors influencing incidence of taxation
- **Economic Effects of taxation:** on Income and Wealth, Consumption, Savings, Investments and Production.
- **Redistributive and Anti – Inflationary nature of taxation** and their implications

Module –III- Public Expenditure and Public Debt: 10L

- **Public Expenditure:** Canons - classification - economic effects of public spending - on production, consumption, distribution, employment and stabilization - Theories of Public Expenditure: Wagner's Hypothesis and Wiseman Peacock Hypothesis - Causes for Public Expenditure Growth - Significance of Public Expenditure: Low Income Support and Social Insurance Programmes.
- **Public Debt:** Classification - Burden of Debt Finance: Internal and External- Public Debt and Fiscal Solvency

Module- IV- Fiscal Policy and Management: 10L

- **Fiscal Policy:** Meaning, Objectives, constituents and Limitations.
- **Budget-** Meaning objectives and types - Structure of Union budget - Deficit concepts
- **Study of current year budget**
- **Intergovernmental Fiscal Relations:** fiscal federalism and fiscal decentralization - central-state financial relations

7. S. Y. B. COM. (Accounting and Finance)

Semester-IV, Paper –II,

Course code- UAF4BE2

1. Introduction to Macroeconomic Data and Theory - 15L

Macroeconomics: Meaning, Scope and Importance.

Circular flow of aggregate income and expenditure: closed and open economy models

The Measurement of national product: Meaning and Importance - conventional and Green GNP and NNP concepts

Short run economic fluctuations : Features and Phases of Trade Cycles

The Keynesian Principle of Effective Demand: Aggregate Demand and Aggregate Supply

- Consumption Function - Investment function - effects of Investment Multiplier on Changes in Income and Output.

Introduction to the Great Depression and Euro Zone Crisis – Brexit

2. Money, Inflation and Monetary Policy - 15L

Money Supply: Determinants of Money Supply - Factors influencing Velocity of Circulation of Money

Demand for Money : Classical and Keynesian approaches and Keynes' liquidity preference theory of interest

Money and prices : Quantity theory of money - Fisher's equation of exchange - Cambridge cash balance approach

Inflation: Demand Pull Inflation and Cost Push Inflation - Effects of Inflation- Nature of inflation in a developing economy.

Monetary policy : Meaning, objectives and instruments, inflation targeting

3. Constituents of Fiscal Policy - 15L

Role of a Government to provide Public goods- Principles of Sound and Functional Finance

Fiscal Policy: Meaning and Objectives

Instruments of Fiscal policy : Canons of taxation - Factors influencing incidence of taxation - Effects of taxation Significance of Public Expenditure - Social security contributions- Low Income Support and Social Insurance Programmes - Public Debt - Types, Public Debt and Fiscal Solvency, Burden of debt finance

Union budget -Structure- Deficit concepts-Fiscal Responsibility and Budget Management Act.

4. Open Economy : Theory and Issues of International Trade - 15L

The basis of international trade : Ricardo's Theory of comparative cost advantage - The Heckscher – Ohlin theory of factor endowments- terms of trade - meaning and types

Factors determining terms of trade - Gains from trade - Free trade versus protection

Foreign Investment : Foreign Portfolio investment- Benefits of Portfolio capital flows- Foreign Direct Investment - Merits of Foreign Direct Investment - Role of Multinational corporations

Balance of Payments: Structure -Types of Disequilibrium - Measures to correct disequilibrium in BOP.

Foreign Exchange and foreign exchange market : Spot and Forward rate of Exchange - Hedging, Speculation and Arbitrage -Fixed and Flexible exchange rates- Managed flexibility

8 SY BMS Semester-IV, Paper –II,

Course code- UMS4BE2

1. Introduction to Macroeconomic Data and Theory - 15L

Macroeconomics: Meaning, Scope and Importance.

Circular flow of aggregate income and expenditure: closed and open economy models

The Measurement of national product: Meaning and Importance - conventional and Green GNP and NNP concepts

Short run economic fluctuations : Features and Phases of Trade Cycles

The Keynesian Principle of Effective Demand: Aggregate Demand and Aggregate Supply

- Consumption Function - Investment function - effects of Investment Multiplier on Changes in Income and Output.

Introduction to the Great Depression and Euro Zone Crisis – Brexit

2. Money, Inflation and Monetary Policy - 15L

Money Supply: Determinants of Money Supply - Factors influencing Velocity of Circulation of Money

Demand for Money : Classical and Keynesian approaches and Keynes' liquidity preference theory of interest

Money and prices : Quantity theory of money - Fisher's equation of exchange - Cambridge cash balance approach

Inflation: Demand Pull Inflation and Cost Push Inflation - Effects of Inflation- Nature of inflation in a developing economy.

Monetary policy : Meaning, objectives and instruments, inflation targeting

3. Constituents of Fiscal Policy - 15L

Role of a Government to provide Public goods- Principles of Sound and Functional Finance

Fiscal Policy: Meaning and Objectives

Instruments of Fiscal policy : Canons of taxation - Factors influencing incidence of taxation - Effects of taxation Significance of Public Expenditure - Social security contributions- Low Income Support and Social Insurance Programmes - Public Debt - Types, Public Debt and Fiscal Solvency, Burden of debt finance

Union budget -Structure- Deficit concepts-Fiscal Responsibility and Budget Management Act.

4. Open Economy : Theory and Issues of International Trade - 15L

The basis of international trade : Ricardo's Theory of comparative cost advantage - The Heckscher – Ohlin theory of factor endowments- terms of trade - meaning and types

Factors determining terms of trade - Gains from trade - Free trade versus protection

Foreign Investment : Foreign Portfolio investment- Benefits of Portfolio capital flows- Foreign Direct Investment - Merits of Foreign Direct Investment - Role of Multinational corporations

Balance of Payments: Structure -Types of Disequilibrium - Measures to correct disequilibrium in BOP.

Foreign Exchange and foreign exchange market : Spot and Forward rate of Exchange - Hedging, Speculation and Arbitrage -Fixed and Flexible exchange rates- Managed flexibility

9. T Y B Com Semester -V

Business Economics Paper-V Course Code-UCM5BE5

1. Macro Economic Overview of India

- **Overview of New Economic Policy 1991:** Role of Social Infrastructure with reference to Education, Health and Family Welfare.
- **Sustainable Development Goals and Policy Measures:** Make in India, Invest in India, and Skill Development and Training Programmes.
- **Foreign Investment Policy Measures in India:** Foreign Investment Promotion Board, FDI, MNCs and their role.

2. Agriculture During Post Reform Period

- **National Agriculture Policy 2000:** Objectives, Features and Implications.
- **Agricultural Pricing and Agricultural Finance**
- **Agricultural Marketing Development:** Agricultural Market Infrastructure – Market Information – Marketing Training – Enabling Environments – Recent Developments.

3. The Industry and Service Sector during Post-reform Period

- **Policy Measures:** Competition Act, 2003, Disinvestment Policy, Micro, Small and Medium Enterprises [MSME Sector] since 2007.
- **Industrial Pollution in India:** Meaning, Type, Effects and Control.
- **Service Sector:** Recent Trends, Role and Growth in Healthcare and Tourism Industry.

4. Banking and Financial Market

- **Banking Sector:** Recent Trends, Issues and Challenges in Banking and Insurance Industry.
- **Money Market:** Structure, Limitations and Reforms.
- **Capital Market:** Structure, Growth and Reforms.

10. T Y B Com Semester- VI
Business Economics Paper-VI, Course Code-UCM6BE6

1. Introduction to International Trade

- **Theories of International Trade** – Ricardo's Theory of Comparative Costs and the Heckscher – Ohlin Theory.
- **Terms of Trade** – Types and Limitations.
- **Gains from International Trade** – Offer Curves and Reciprocal Demand.

2. Commercial Policy

- **Commercial Trade Policy** – Free Trade and Protection – Pros and Cons.
- **Tariff and Non-Tariff Barriers**: Meaning, Types and Effects.
- **International Economic Integration** – Types and Objectives: EU and Brexit, ASAEN

3. Balance of Payments and International Economic Organization

- **Balance of Payment**: Meaning, Structure, Types of Disequilibrium.
- **Causes and Measures to correct the disequilibrium in Balance of Payments.**
- **WTO** – Recent Developments in TRIPS, TRIMS and GATS.

4. Foreign Exchange Market

- **Foreign Exchange Market**: Meaning, Functions, Determination of Equilibrium Rate of Exchange.
- **Purchasing Power Parity Theory, Spot and Forward Rates, Arbitrage.**
- **Role of Central Bank in Foreign exchange rate management, Managed Flexible exchange rate system of India.**

11. M.Com. Part I Semester I- Business Economics-I , Course Code- PCM1BE1
“Economics for Business Decisions”

1. Basic Principles in Business Economics- 15L

Meaning and Scope of Business Economics – twin principles of scarcity- Meaning and Scope or and efficiency, incremental and Marginal principle; profit maximization principle; market economy and invisible hand; production possibility frontier; Opportunity cost – accounting profit and economic profit; market failure, externality, public goods and economic role of government

2. Demand and Supply Analysis- 15L

Determinants of demand – market demand function – theory of attributes, snob appeal, band wagon and Veblen effect and demand function.

Applications of elasticity of demand and supply to economic issues: Paradox of bumper harvest- tax on price and quantity – minimum floor and maximum ceilings: minimum wages controversy- Effects of elasticity of demand and supply on incidence of tax.

The theory of consumer choice – Consumer preference and budget constraint – equilibrium position of tangency with the help of Indifference analysis – effect of changes in price and Income on consumer –equilibrium

3. Production Decisions and Cost Analysis- 15L

Production function – short run and long run – Law of variable proportion, returns to scale, scale economies, scope economies- least cost factor combination for a given output- Expansion path and Multi product firm cost reduction through experience – learning curve

Economic analysis of Cost: Classification of costs, short run and long run cost functions. Break even analysis.

4. Market Structure Analysis -15L

Difference between perfectly and imperfectly competitive markets- Perfect competition and Monopoly as limiting cases of market imperfections – Sources of market power – profit maximization of simple and discriminating monopolist – methods of measuring monopoly power and discriminating monopolist – Public policy towards monopoly power.

Different forms of imperfect competition – Monopolistic competition and Oligopoly – Strategic decision making in oligopoly markets- collusive and non-collusive oligopoly- collusive oligopoly models of price leadership and cartel – basic concepts of game theory – Using Game theory to analyse strategic decisions – application of model of prisoner’s dilemma in market decisions. Advanced Nash equation.

12. M.Com. Part I, Semester II, Business Economics-II, Course Code- PCM2BE2
“Macro Economics: Concepts and Applications”

1. Aggregate income and its Dimensions- 15L

Aggregate Income and its dimensions: National income aggregates – and measurement; - GNP, GDP, NDP, Real and nominal income concepts, measures of inflation and price indices – GDP deflator – Nominal and real Interest rates -PPP Income and HDI , National income as a measure of economic welfare.

2. Keynesian Concepts of Aggregate Demand (ADF), Aggregate Supply (ASF)- 15L

Keynesian concepts of Aggregate Demand (ADF), Aggregate Supply (ASF), Interaction of ADF and ASF and determination of real Income. Marginal efficiency of capital, Inflationary gap.

Policy trade – off between Inflation and unemployment - Phillips’ curve – short run and long run.

3. Economic Policy Implications in the IS-LM Framework- 15L

The IS-LM mode: Equilibrium in goods and money market; Monetary and real influences on IS-LM curves, Economic fluctuations and Stabilization policies in IS-LM framework Transmission mechanism and the crowding out effect; composition of output and policy mix, IS-LM in India

4. International Aspects of Macroeconomic Policy- 15L

International aspects of Macroeconomic policy: Balance of payments disequilibrium of an open economy – corrective policy measures – Expenditure changing policies and Expenditure switching policies BOP adjustments through monetary and fiscal policies – The Mundell–Fleming model. Devaluation, revaluation as expenditure switching policies effectiveness of devaluation and J curve effect

	13. T Y B Com (Accounting and Finance)
	Economics Paper – III Course Code- UAF6BE3 (Indian Economy)
Sr. No.	Modules / Units
1	Introduction Agricultural Sector
	Introduction Demographic features- Poverty, Income inequality and Unemployment Urbanization and its effects Agricultural Sector Institutional Structure- Land reforms in India Technological changes in agriculture Agricultural pricing and agricultural finance Agricultural marketing National agricultural policy
2	Industrial Sector
	Growth and pattern of industrialization Industrial Policy of 1991. Public sector enterprises and disinvestment policy Small scale sector- problems and prospects
3	Service Sector and External Sector
	Service Sector Nature and scope of service industry Recent trends in Banking industry, Insurance Industry, Healthcare Industry and Tourism Industry External Sector Structure and directions of foreign trade India's Balance of payments since 1991 FDI, foreign capital and transnational companies in India. Role and impact of SAARC, ASEAN and WTO
4	Money and Banking
	Money market and its features Monetary policy of RBI Progress of commercial banking in India Development of capital markets SEBI and its functions

1.1.3 Q_nM	<i>Number of courses focusing on employability/entrepreneurship/ skill development offered by the Institution during the year:</i>	
	Year	2020-21
	Number	14

Name of the Course	Course Code	Activities/Content with a direct bearing on Employability/ Entrepreneurship/ Skill development	Link to the relevant document
Financial Accounting - III	UAF3FA3	Partnership Final Accounts based on Adjustment of Admission or Retirement / Death of a Partner during the Year	
Cost Accounting - II	UAF3CA3	Contract Costing	
Taxation - II (Direct Tax - I)	UAF3TX1	Computation of Total Income & Tax liability	
Information Technology in Accountancy - I	UAF3IT1	Electronic Commerce	
FC (Financial Market Operations) - III	UAF3FC3	Financial Services	
Business Law - II	UAF3BL2	Employee State Insurance Act 1948	
Business Economics - II	UAF4BE2	Money, Inflation and Monetary Policy	
Financial Accounting - IV	UAF4FA4	Redemption of Preference Shares and Redemption of Debentures	
Management Accounting	UAF4MAC	Working Capital	

		Management	
Taxation - III (Direct Tax - II)	UAF4TX2	Tax Deduction at Source & Tax collected at Source	
Information Technology in Accountancy - II	UAF4IT2	IT and Auditing	
FC (Introduction to Management) - IV	UAF4FC4	Introduction to Basic Management Concepts	
Business Law (Company Law) - III	UAF4BL3	National Company Law Tribunal.	
Research Methodology in Accounting and Finance	UAF3RMA	Statistical Analysis	

Choice Based Credit Grading and Semester System (CBCGS)

S.Y.B.Com. Accounting & Finance Semester –III Syllabus

To be implemented from the Academic year 2020-2021

1. Elective Courses (EC)

1. Financial Accounting (Special Accounting Areas)– III

1	Preamble of the syllabus
	<p>B.Com. in Accounting & Finance is an under graduation course of the Department of B.Com. (Accounting & Finance), Changu Kana Thakur Arts, Commerce & Science College, New Panvel, Affiliated to University of Mumbai (MH). The Choice Based Credit, Grading, and Semester System to be implemented through this curriculum would allow students to develop a strong footing in the fundamentals and specialize in the disciplines of his/her liking and abilities. The students pursuing this course would have to develop an understanding of various aspects of the Accounting & Finance. The conceptual understanding, development of experimental skills, developing the aptitude for academic and professional skills, acquiring basic concepts and understanding of hyphenated techniques, understanding the fundamental Accounting & Finance processes and rationale towards the application of Accounting & Finance knowledge is among such important aspects. The performance of the learners shall be evaluated into two components i.e. internal and external. The learner's performance shall be assessed by Internal Assessment with 40 marks and external assessment with 60 marks.</p>

2	Objectives of the course
•	The main objective is to describe the pattern of final accounts
•	It also describes the process of liquidation which is included in the company account
•	To provide the knowledge of amalgamation of the partnership firms
•	To give practical knowledge of accounts
•	To understand the conversion of foreign currency into reporting currency

3	Outcomes of the course
•	Learners understand the dissolution of firms
•	Got the knowledge of the piecemeal distribution of cash for settlement of liabilities
•	Understanding conversion of a firm into a ltd company
•	Learners learned to maintain accounts in the books of purchasing firm
•	Helps to understand the application of rate for foreign currency into reporting

4	Detailed Syllabus	
	Financial Accounting - Elements of Financial Accounting - Paper I	
Sr. No.	Modules / Units	No. Of Lectures
1	Partnership Final Accounts based on Adjustment of Admission or Retirement / Death of a Partner during the Year	15
	Simple final accounts questions to demonstrate the effect on the final Accounts when a partner is admitted during the year or when partner Retires / dies during the year Allocation of gross profit prior to and after admission/retirement / death when stock on the date of admission/retirement is not given and apportionment of other expenses based on time / Sales/other given basis Ascertainment of gross profit prior to and after admission/retirement / death when stock on the date of admission / retirement is given and apportionment of other expenses based on time / Sales / other given basis	
2	Piecemeal Distribution of Cash	10
	Excess Capital Method & Maximum Loss Method Asset took over by a partner Treatment of past profits or past losses in the Balance sheet Contingent liabilities / Realization expenses/amount kept aside for expenses and adjustment of actual, Treatment of secured liabilities Treatment of preferential liabilities like Govt. dues/labour dues etc Excluding: Insolvency of partner and Maximum Loss Method	
3	Amalgamation of Firms	15
	Realization method only Calculation of purchase consideration Journal/ledger accounts of old firms, Preparing a Balance sheet of a new firm Adjustment of goodwill in the new firm Realignment of capitals in the new firm by current accounts / cash or a combination thereof	
4	Conversion / Sale of a Partnership Firm into a Ltd. Company	10
	Realization method only Calculation of New Purchase consideration, Journal / Ledger Accounts of old firms. Preparing Balance sheet of new company	
5	Ascertainment and Treatment of Profit Prior to Incorporation	10
	Principles for ascertainment Preparation of separate, combined and columnar Profit and Loss Account including different basis of allocation of expenses/ incomes	

Choice Based Credit Grading and Semester System (CBCGS)

S.Y.B.Com. Accounting & Finance Semester –III Syllabus

To be implemented from the Academic year 2020-2021

1. Elective Courses (EC)

2. Cost Accounting (Methods of Costing) – II

1	Preamble of the syllabus
	<p>B.Com. in Accounting & Finance is an under graduation course of Department of B.Com. (Accounting & Finance), Changu Kana Thakur Arts, Commerce & Science College, New Panvel. Affiliated to University of Mumbai (MH) The Choice Based on Credit, Grading, and Semester System to be implemented through this curriculum, would allow students to develop a strong footing in the fundamentals and specialize in the disciplines of his/her liking and abilities. The students pursuing this course would have to develop an understanding of various aspects of Accounting & Finance. It helps for the ascertainment of cost, fixation of selling price, proper recording and presentation of cost data to management for measuring efficiency and for cost control and cost reduction, ascertaining the profit of each activity, assisting management in decision making. The performance of the learners shall be evaluated into two components i.e. internal and external. The learner's performance shall be assessed by Internal Assessment with 40 marks and external assessment with 60 marks.</p>

2.	Objectives of the course
•	To make students aware of cost structures & elements
•	To understand various techniques & methods of cost accounting
•	To understand various aspects of material control & wastages
•	To understand the reasons for the difference in two sets of books
•	To let them know about the cost sheet & tender price
•	To make them aware of the different process of costing

3	Course Outcome
•	Define various components of the total cost [Direct/Indirect/Fixed/Variable]
•	Determine the various types of centers i.e. cost centers
•	Use cost sheet for computing per unit cost & total cost
•	Determine the basis for computing tender price of contract

4	Detailed Syllabus	
	Cost Accounting (Methods of Costing) – II	
Sr. No.	Modules / Units	No. Of Lectures
1	Classification of Costs and Cost Sheet	10
	Classification of costs, Cost of Sales, Cost Centre, Cost Unit, Profit Centre and Investment Centre Cost Sheet, Total Costs and Unit Costs, Different Costs for different purpose Problems on the preparation of cost sheet& Estimated Cost sheet	
2	Unit costing, Job Costing & batch costing	15
	Unit Costing – introduction, Unit costing method, Prepare & calculate cost under Unit costing method Job Costing-Introduction, accounting entries for cost elements, calculate cost per job Batch costing –introduction, batch costing methods, accounting entries for cost elements, calculate the cost for a batch Practical Problems	.
3	Contract Costing	15
	Meaning of Contract Costing, Recording of contract cost, Progress payments, Retention money, Contract accounts, Accounting for material, Accounting for Tax deducted at source by the contractee, Accounting for plant used in a contract, treatment of profit on incomplete contracts, Contract profit, and Balance sheet entries. Escalation clause Practical Problems	
4	Process Costing	10
	Meaning of Process Costing, Costing procedure, Treatment of Normal loss, Abnormal gains, and losses. Excluding Equivalent units, Inter-process profit Practical Problems Process Costing	
5	Joint products & by-product costing	10
	Meaning of Joint products & by-product costing Differentiate between Joint products & by-product costing Methods of apportionment of joint costs to joint products and to by-products Treatment of by-products cost in cost accounting Practical Problems	

Choice Based Credit Grading and Semester System (CBCGS)
S.Y.B.Com. Accounting & Finance Semester –III Syllabus
To be implemented from the Academic year 2020-2021

1. Elective Courses (EC)

4. Taxation - I (Direct Taxes Paper- I)

1	Preamble of the syllabus
	<p>B.Com. in Accounting & Finance is a under graduate course of Changu Kana Thakur Arts, Commerce & Science College, New Panvel affiliated to University of Mumbai. There is Choice Based Credit, Grading and Semester System to be implemented through this curriculum, developing learners towards basic fundamentals in the area of direct taxes. Learners who will pursue this course will understand the provisions and procedure to compute total income under different heads of income. The conceptual understanding will help in developing real-life situations involving taxation & to equip them with techniques for taking tax-sensitive decisions. The performance of the learners shall be evaluated into two components i.e. internal and external. The learner's performance shall be assessed by Internal Assessment with 40 marks and external assessment with 60 marks.</p>

2	Objectives of the course
•	To acquaint the students with basic principles underlying the provisions of direct & indirect taxes laws & to develop a broad understanding of the tax laws & accepted tax practices
•	To give an understanding of the relevant provisions of direct tax code
•	To introduce practical aspects of tax planning as an important managerial decision-making process.
•	Expose the participants to real-life situations involving taxation & to equip them with techniques for taking tax sensitive decisions
•	To understand the provisions and procedure to compute total income under five heads of income i.e. Salaries, house property, profit & gains from business & profession, capital gains, and other sources.

3	Course Outcome
•	By the end of the course students will able to describe how the provisions of direct tax laws and to develop a broad understanding of the tax laws & accepted tax practices
•	Students of the course will be able to explain different types of incomes & their taxability & expenses & their deductibility
•	Students who complete this course will be able to learn various direct taxes & their implication in practical situations
•	Students of the course will able to state the use of various deductions to reduce the taxable income.

4	Detailed Syllabus	
	Taxation-II (Direct Taxes Paper- I)	
Sr. No.	Modules / Units	No. of Lectures
1	Basic Concepts , Residential Status, Scope of Total Income and Income which do not part of total income	10
	Basic Concepts- Basic related to Income Tax Definitions u/s – 2: Assessee, Assessment Year, Assessment, Annual value, Business, Capital asset, Income, Person, Previous Year, Transfer Basis of Charge : Section 3 – 9 – Previous Year, Residential Status, Scope Of Total Income, Deemed Income Income which does not part of total income: Section 10 Note -Exemptions related to specific Heads of Income to be covered with Relevant Provisions.	
2	Heads of Income	30
	Various Heads of Income Salary Income: Section 15 – 17, Including relief under section 89 Income From House Property : Section 22 – 27, Including Section 2 – Annual Value Profits & Gains From Business & Profession : Section 28-44D excluding section 35AD, 35 2(AA)35 (2AB),35CCA, 35CCC, 35CCD,35D,35DDA Capital Gains : Section 45- 55 Income from Other Sources: Section 56 – 59	
3	Deductions under Chapter VI – A	8
	80 A- Restriction on a claim in Chapter VI- A deductions Deductions under Chapter VI – A (related to individual and HUF)	
4	Computation of Total Income & Tax liability	12
	Computation of Total Income of Individual and HUF with respect to above heads and deductions	

Note: Relevant Law/Statute/Rules in force and relevant Standards in force on 1st April immediately preceding commencement of Academic Year is applicable for ensuring examination after relevant year.

Choice Based Credit Grading and Semester System (CBCGS)

S.Y.B.Com. Accounting & Finance Semester –III Syllabus

To be implemented from the Academic year 2020-2021

2A. Ability Enhancement Courses (AEC)

1. Information Technology in Accountancy - I

1	Preamble of the syllabus
	<p>B.Com. in Accounting & Finance is an under graduation course of Department of B.Com. (Accounting & Finance), Changu Kana Thakur Arts, Commerce & Science College, New Panvel. Affiliated to University of Mumbai (MH). The course is designed to guide students of B.Com accounting and finance with the knowledge of Indian business law. It helps to provide the brief idea about the legal framework of Indian Business Law and to know the role of law in an economic and business context. It also helps to acquaint knowledge of the legal environment of business and corporate laws. The performance of the learners shall be evaluated into two components i.e. internal and external. The learner's performance shall be assessed by Internal Assessment with 40 marks and external assessment with 60 marks.</p>

2	Objectives of the syllabus
•	To understand the basics of computer & communication system
•	To understand database management
•	To understand web & its uses
•	To understand how the network works

3	Course Outcome
•	To learn the basics of computer & communication system
•	To learn knowledge data delivery
•	To learn the concept of application in business
•	To learn database & storage management
•	To learn various types of memory

4	Detailed Syllabus	
	Information Technology in Accountancy - I	
Sr. No.	Modules / Units	No. of Lectures
1	Introduction to Computers	08
	History of Computers, Parts of Computers Hardware: Specifications and Data Storage Management Software: Concept of System Software and Applications Networking: Introduction and types of network topologies	
2	Office Productivity Tools	20
	MS Word: Creating, Editing, Formatting and Printing of Documents, Using Tools, Mail-merge and Print Review and Set-up MS Excel: Creating Worksheet, Creating Various Formulae, Creating Charts, Rename and Copy of Worksheets, Using Tools, Printing Review and Set-up PowerPoint: Create Project Report, Create Slides, Animation, Page Designing, Insert Image, View Page, and Print Review, and Set-up. Use of Tools In Accounting :- Preparation of vouchers, invoices, and reports, Calculation of Interest, Depreciation, TDS, Salary, Taxes, inventory, and reconciliation	
3	Web	08
	Use of Various Web Browser, Information Searching Tools Downloading, Create New email ID, Sending Data through email Search engine optimisation	
4	Introduction to Internet and other emerging technologies	08
	Introduction – Internet components – electronic commerce – e-commerce applications – Electronic Data Exchange – Extranet – Payment systems – Risks and security considerations – Legal issues Other emerging technologies – Cloud computing, Mobile computing, Artificial Intelligence & Machine learning	
5	Electronic Commerce	08
	Meaning, Advantages and Limitations of E-Commerce, The role of Strategy in E-Commerce, Value chains in E-Commerce, Infrastructure for Electronic Commerce Web-Based Tools for Electronic Commerce, Electronic Commerce software, Security Threats to electronic Commerce Implementing Security for Electronic Commerce, Electronic Payment Systems, Strategies for Marketing, Sales & Promotion Strategies for Purchasing Logistics & Support Activities, Electronic Markets & Communities, Business Plans for Implementing Electronic Commerce.	
6	Mobile Commerce	08

	Introduction, History, Concepts, Characteristics, components, supporting technology, Mobile security, mobile application, payment system.	
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Choice Based Credit Grading and Semester System (CBCGS)

S.Y.B.Com. Accounting & Finance Semester –III Syllabus

To be implemented from the Academic year 2020-2021

2B. Skill Enhancement Courses (SEC)

1. Foundation Course in Commerce (Financial Market Operations) - III

1	Preamble of the syllabus
	<p>B.Com. in Accounting & Finance is an under graduation course of Department of B.Com. (Accounting & Finance), Changu Kana Thakur Arts, Commerce & Science College, New Panvel. Affiliated to University of Mumbai (MH). The course is designed to guide students of B.Com accounting and finance to give them an outline about the participants in the Financial Markets. It helps to make them aware of the primary and secondary markets. It also make the students aware about the share and debt markets. The performance of the learners shall be evaluated into two components i.e. internal and external. The learner's performance shall be assessed by Internal Assessment with 40 marks and external assessment with 60 marks.</p>

2	Objectives of the Syllabus
•	To give them an outline about the participants in the Financial Markets.
•	To aware the students about share and debt markets and name their collective name
•	To aware the students about the instruments of the money & bond
•	To make them capable to distinguish between fixed-interest & interest-bearing markets
•	To make them aware of the primary and secondary markets

3	Course Outcome
•	Students will able to understand the Australian Banking system & describe the role of regulatory bodies in regulating how banks manage their capital
•	Students will able to apply different valuation techniques to determine share prices.
•	Students will able to describe the characteristic of different types of debt securities and be able to price them

4	Detailed Syllabus	
	Foundation Course in Commerce (Financial Market Operations) - III	
Sr. No.	Modules / Units	No. of Lectures
1	An Overview of the Financial System	05
	Saving and Investment Money, Inflation and Interest Banking and Non-Banking Financial Intermediaries	
2	Financial Markets	15
	Financial Markets: Introduction and meaning, Government Economic Philosophy and Financial Market, Structure of Financial Market in India Capital Market: Introduction and meaning, Concept, Role, Importance, Evolution in India, Primary Market System and Regulations in India, Secondary Market System Bond Market in India Debt Market in India	
3	Financial Instruments	10
	Meaning and types of Financial Instruments Characteristics of Financial Instruments: Liquidity, Maturity, Safety and Yield REPO, TBs, Equities, Bonds, Derivatives, others	
4	Financial Services	15
	Merchant Banking: Managing of Public Equity / Debenture Issues Mobilizing Fixed Deposits, Arranging Inter-corporate Loans, Raising term Finance and Loan Syndication. Other Financial Services: Consumer Finance, Credit Cards, Mutual Funds and Commercial Paper	

Choice Based Credit Grading and Semester System (CBCGS)

S.Y.B.Com. Accounting & Finance Semester –III Syllabus

To be implemented from the Academic year 2020-2021

3. Core Courses (CC)

1. Business Law (Business Regulatory Framework) – II

1	Preamble of the syllabus
	<p>B.Com. in Accounting & Finance is an under graduation course of Department of B.Com. (Accounting & Finance), Changu Kana Thakur Arts, Commerce & Science College, New Panvel. Affiliated to University of Mumbai (MH). The course is designed to guide students of B.Com accounting and finance with the knowledge of Indian business law. It helps to provide a brief idea about the legal framework of Indian Business Law and to know the role of law in an economic and business context. It also helps to acquaint knowledge of the legal environment of business and labour laws. The performance of the learners shall be evaluated into two components i.e. internal and external. The learner's performance shall be assessed by Internal Assessment with 40 marks and external assessment with 60 marks.</p>

2	Objectives of the Syllabus
•	To help the learner to understand the legal environment in a country.
•	To enable the learner to know the functioning of a different form of business like LLP and Partnership Act.
•	To provide the students with knowledge of legal principles.
•	To study the nature and scope of business economics.

3	Course Outcomes
•	It enable the learner to appreciate the relevance of business law to individuals and business.
•	Learners are able to identify the fundamental legal principles behind contractual agreements
•	Learner acquired problem solving techniques and to be able to present coherent, concise legal argument.

4	Detailed Syllabus	
	Business Law (Business Regulatory Framework) - II	
Sr. No.	Modules / Units	No. of Lectures
1	The Indian Partnership Act – 1932	10
	<ul style="list-style-type: none"> • Concept of Partnership, Kinds of partnership • Partnership and Company • Test for determination of existence for partnership • Registration and effects of non-registration of Partnership • Rights and Duties of Partners • Authority and Liability of partners • Admission, Retirement and Expulsion of Partner • Dissolution of Partnership 	
2	Limited Liability Partnership Act – 2008	08
	<ul style="list-style-type: none"> • Nature of Limited Liability Partnership • Incorporation of Limited Liability Partnership • Extent and Limitation of Liability of Limited Liability Partnership and Partners • Contributions • Conversion Into Limited Liability Partnership • Winding Up and Dissolution 	
3	Industrial Law	20
	<ul style="list-style-type: none"> • Industrial Disputes Act, 1947: Definition, Authorities, Awards, Settlements, Strikes Lockouts, Lay Offs, Retrenchment and Closure • The Trade Union Act, 1926: Objectives, Function, Formation, Regulation, Rights, and Liabilities • The Factory Act 1948: Definitions, Provisions pertaining to Health, Safety, and Welfare • Employee State Insurance Act 1948: Definition and Employees Provident Fund • The payment of Wages Act 1948: Objectives, Definition, Authorised Deductions 	
4	Intellectual Property Rights	12
	<ul style="list-style-type: none"> • IPR definition/objectives • Patent definition. What is patentable & not patentable? Invention And its Attributes, Inventors and Applications • Trademarks, definition, types of trademarks, infringement, and passing off. • Copy right definition and subject in which copyright exists, 	

	Originality, Meaning and Content, Authors and Owners, Rights, and Restrictions. <ul style="list-style-type: none">• Plagiarism	
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Choice Based Credit Grading and Semester System (CBCGS)

S.Y.B.Com. Accounting & Finance Semester –III Syllabus

To be implemented from the Academic year 2020-2021

3. Core Courses (CC)

2. Business Economics - II – (Macro Economics)

1	Preamble of the Syllabus
	B.Com. in Accounting & Finance is an under graduation course of Department of B.Com. (Accounting & Finance), Changu Kana Thakur Arts, Commerce & Science College, New Panvel. Affiliated to University of Mumbai (MH). The course is designed to guide students of B.Com accounting and finance with the main macroeconomics theories. It helps to provide a brief idea of the determinants of various macroeconomics such as output, inflation, productivity. The performance of the learners shall be evaluated into two components i.e. internal and external. The learner's performance shall be assessed by Internal Assessment with 40 marks and external assessment with 60 marks.

2	Objectives of the Syllabus
•	Students will be able to describe the main macroeconomics theories
•	Students will be able to critically evaluate the consequences of basic macroeconomics policy option
•	To identify the determinants of various macroeconomics such as output, inflation, productivity

3	Course Outcomes
•	Understand the basic of national income accounting.
•	Understand the cause and consequence of the business cycle.
•	Understand the role of fiscal and monetary policy.

4	Detailed Syllabus	
	Economics – II – (Macro Economics)	
Sr. No.	Modules / Units	NO. Of Lectures
1	Introduction to Macroeconomic Data and Theory	15
	<p>Macroeconomics: Meaning, Scope and Importance.</p> <p>Circular the flow of aggregate income and expenditure: closed and open economy models</p> <p>The Measurement of national product: Meaning and Importance - conventional and Green GNP and NNP concepts</p> <p>Short run economic fluctuations: Features and Phases of Trade Cycles</p> <p>The Keynesian Principle of Effective Demand: Aggregate Demand and Aggregate Supply - Consumption Function - Investment function - effects of Investment Multiplier on Changes in Income and Output</p> <p>Introduction to The Great Depression and Euro Zone Crisis - Brexit</p>	
2	Money, Inflation and Monetary Policy	15
	<p>Money Supply: Determinants of Money Supply - Factors influencing Velocity of Circulation of Money</p> <p>Demand for Money: Classical and Keynesian approaches and Keynes' liquidity preference theory of interest</p> <p>Money and prices : The quantity theory of money - Fisher's equation of exchange - Cambridge cash balance approach</p> <p>Inflation: Demand-Pull Inflation and Cost-Push Inflation - Effects of Inflation- Nature of inflation in a developing economy.</p> <p>Monetary policy: Meaning, objectives and instruments, inflation targeting</p>	
3	Constituents of Fiscal Policy	15
	<p>Role of a Government to provide Public goods- Principles of Sound and Functional Finance Policy: Meaning and Objectives</p> <p>Instruments of Fiscal policy: Canons of taxation - Factors influencing the incidence of taxation - Effects of taxation Significance of Public Expenditure - Social security contributions- Low-Income Support and Social Insurance Programmes - Public Debt - Types, Public Debt and Fiscal Solvency, Burden of debt finance; Union budget -Structure- Deficit concepts-Fiscal Responsibility and Budget Management Act.</p>	
4	Open Economy: Theory and Issues of International Trade	15
	<p>The basis of international trade: Ricardo's Theory of comparative cost advantage - The Heckscher – Ohlin theory of factor endowments- terms of trade - meaning and types Factors determining terms of trade - Gains from trade - Free trade versus protection</p> <p>Foreign Investment: Foreign Portfolio investment- Benefits of Portfolio capital flows-Foreign Direct Investment - Merits of Foreign Direct Investment - Role of Multinational corporations</p> <p>Balance of Payments: Structure -Types of Disequilibrium - Measures to</p>	

	correct disequilibrium in a BOP. Foreign Exchange and foreign exchange market: Spot and Forward rate of Exchange - Hedging, Speculation and Arbitrage -Fixed and Flexible exchange rates- Managed flexibility	
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Choice Based Credit Grading and Semester System (CBCGS)

S.Y.B.Com. Accounting & Finance Semester –IV Syllabus

To be implemented from the Academic year 2020-2021

1. Elective Courses (EC)

1. Financial Accounting (Special Accounting Areas) – IV

1	Preamble of the Syllabus
	B.Com. in Accounting & Finance is an under graduation course of Department of B.Com. (Accounting & Finance), Changu Kana Thakur Arts, Commerce & Science College, New Panvel. Affiliated to University of Mumbai (MH). The course is designed to guide students of B.Com accounting and finance with the pattern of the final account of the company. It helps to provide the knowledge of redemption of preference shares and debentures. It also helps to understand the conversion of foreign currency into reporting currency. The performance of the learners shall be evaluated into two components i.e. internal and external. The learner's performance shall be assessed by Internal Assessment with 40 marks and external assessment with 60 marks.

2	Objectives of the Syllabus
•	To describe the pattern of the final account of the company
•	It provides the knowledge of redemption of preference shares and debentures
•	To differentiate profit and loss prior to incorporation and post-incorporation
•	To understand the conversion of foreign currency into reporting currency

3	Course Outcomes
•	Learners understanding about final accounts of the companies
•	Learn about redemption provisions of preference shares and debentures
•	Work with profit prior to incorporation and post-incorporation profits

4	Detailed Syllabus	
	Financial Accounting (Special Accounting Areas) – IV	
Sr. No.	Modules / Units	No. of Lectures
1	Underwriting of shares & debentures	10
	Introduction, Underwriting, Underwriting Commission Provision of Companies Act with respect to Payment of underwriting commission Underwriters, Sub-Underwriters, Brokers and Manager to issues, Types of underwriting, Abatement Clause Marked, Unmarked and Firm-underwriting applications, Liability of the underwriters in respect of underwriting contracts . Practical problems	
2	Redemption of Preference Shares	12
	Provision of the Companies Act for redemption of Preference Shares (Sec 55 of the Companies Act, 2013), Companies (Share and Debentures) Rules., Methods of Redemption of fully paid up Preference Shares as per Companies Act, 2013: The proceed of a fresh issue of shares, the capitalisation of undistributed profits and a combination of both, calculation of minimum fresh issue to provide the fund for redemption, (Question on entries and/or Balance Sheet) Note: Companies governed by Section 133 of the Companies Act, 2013 and comply with the accounting standards prescribed for them. Hence, the balance in security premium account not to be utilised for the premium payable on redemption of preference shares.	
3	Buy Back of Shares	10
	Company Law / Legal provisions (including related restrictions, power, transfer to capital redemption reserve account and prohibitions). Compliance of conditions including sources, maximum limits and debt-equity ratio. Cancellation of Shares Bought back(Excluding Buy Back of minority shareholding) - Practical problems	
4	Redemption of Debentures	12
	Introduction: Provisions of Section 71 (1) and (4) of the Companies Act, 2013, Creation and investment of DRR including The Companies (Share Capital and Debentures) Rules, 2014, the methods of writing-off discount/loss on issue of debentures; Terms of issue of debentures Methods of redemption of debentures: By payment in lumpsum and by payment in installments (excluding from by purchase in open market), Conversion. (Question on entries. ledgers and/or Balance Sheet and /or redemption of debentures)	
5	Preparation of Final Accounts of Companies	16
	Relevant provisions of Companies Act related to the preparation of Final Account (excluding cash flow statement) Preparation of financial statements as per Companies Act.	

	AS 1 in relation to final accounts of companies (disclosure of accounting policies)	
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Choice Based Credit Grading and Semester System (CBCGS)

S.Y.B.Com. Accounting & Finance Semester –IV Syllabus

To be implemented from the Academic year 2020-2021

1. Elective Courses (EC)

2. Management Accounting (Introduction to Management Accounting)

1	Preamble of the Syllabus
	B.Com. in Accounting & Finance is an under graduation course of Department of B.Com. (Accounting & Finance), Changu Kana Thakur Arts, Commerce & Science College, New Panvel. Affiliated to University of Mumbai (MH). The course is designed to guide students of B.Com accounting and finance to introduce the concept of management Accounting. It helps to analyse and interprets the financial statements. It also helps to manage and calculate the working capital requirement of the firm. The performance of the learners shall be evaluated into two components i.e. internal and external. The learner's performance shall be assessed by Internal Assessment with 40 marks and external assessment with 60 marks.

2	Objectives of the Syllabus
•	To introduce the concept of management Accounting.
•	How to analyse and interprets financial statement.
•	How to analysis cash flow of business
•	How to manage and calculate the working capital requirement of the firm.

3	Course Outcomes
•	Understand the concept of management accounting
•	Analyses and interpret the financial statements.
•	Calculate various ratios from the financial statements.
•	Do cash flow analysis.
•	Manage working capital requirement estimations of the firm.

4	Detailed Syllabus	
	Management Accounting (Introduction to Management Accounting)	
Sr. No.	Modules / Units	No. of Lectures
1	Introduction to Management Accounting	05
	Meaning, Features, Scope, Importance, Functions, role of Management Accounting, Management Accounting Framework, Tools, Management Accounting and Financial Accounting	
2	Analysis and Interpretation of Accounts	10
	a) Vertical Forms of Balance Sheet and Profit and Loss Account suitable for analysis b) Trend Analysis. c) Comparative Statement. d) Common Size Statement. NOTE: Practical Problems based on the above (a) to (d)	
3	Financial Statement analysis: Ratio analysis	15
	Meaning of financial Statement Analysis, steps, Objective and types of Analysis. Ratio analysis: Meaning, classification, Du Point Chart, advantages and Limitations. Balance Sheet Ratios Revenue Statement Ratios Combined Ratio Practical problems on the Calculation of ratio and write comments on it.	
4	Cash Flow Statement	12
	Preparation of Cash Flow Statement with reference to Accounting Standard .3. (Indirect method) and Direct Method	
5	Working Capital Management	08
	Concept, Nature of Working Capital, Planning of Working Capital Estimation / Projection of Working Capital Requirement in case of Trading and Manufacturing Organization Operating Cycle Practical Problems	
6	Cash Budget	10
	Meaning, Objectives, importance & Advantages of cash budget Types of cash budget Practical problems	

Choice Based Credit Grading and Semester System (CBCGS)

S.Y.B.Com. Accounting & Finance Semester –IV Syllabus

To be implemented from the Academic year 2020-2021

1. Elective Courses (EC)

4. Taxation - II (Direct Taxes- II)

1	Preamble of the Syllabus
	<p>B.Com. in Accounting & Finance is an under graduation course of Department of B.Com. (Accounting & Finance), Changu Kana Thakur Arts, Commerce & Science College, New Panvel. Affiliated to University of Mumbai (MH). The course is designed to guide students of B.Com accounting and finance with the knowledge of Indian taxation law. It helps to provide a brief idea about the filing of the income tax returns. It also helps to acquaint knowledge of PAN, TDS and other different aspects of direct taxes. The performance of the learners shall be evaluated into two components i.e. internal and external. The learner's performance shall be assessed by Internal Assessment with 40 marks and external assessment with 60 marks.</p>

2	Objectives of the Syllabus
•	To study Clubbing of Income from assets transferred to a person for the benefit of spouse, income from assets transferred to a person for the benefit of a spouse attracts the provisions on clubbing of income.
•	To learn various provisions under heads of income for enabling assessee to carry forward & set-off in the previous year as well as in the future. Learn limitations for a number of years, for which losses can be carried forward and set-off.
•	To learn with these objectives, an investor needs to generate income from his investments
•	To learn basic concept & objective of Tax Deducted at Source is to collect taxes at the very source of income.

3	Course Outcomes
•	By the end of the course students will able to understand the Indian Income tax system.
•	Understood fundamental Concepts of Indian Income tax act 1961
•	Apply Income tax laws and solves the problems.
•	Analyses and evaluates tax information and issues.
•	Communicate effectively and orally income tax act information to income tax issues.

4	Detailed Syllabus	
	Taxation – II (Direct Taxes – II)	
Sr. No.	Modules/ Units	No. of Lectures
1	Clubbing of Income - Section 60 to 65	8
2	Set Off & Carry Forward of Losses – Section 70 to 74)	8
3	Computation of Income of Partnership Firm in Relation to Sec: 40(b) & Tax Thereon With Applicable Rate of Tax	8
4	Return of Income & Self-Assessment	6
5	Tax Deduction at Source & Tax collected at Source	10
	Basic Aspects of Deduction of Taxes at Source Sec. 191 – Direct payment; Sec. 192 – TDS on Salary; Sec. 194A – TDS on Interest; Sec. 194C – TDS on Contractor; Sec. 194H – TDS on Commission; Sec. 194I – TDS on Rent; Sec. 194J – TDS on Professional Fees; Sec. -194N – TDS on cash withdrawal; Sec. 195 A – Income payable net of tax; Sec. 197 Certificate of Tax at lower Rate; Sec. 197A Certificate of Tax at Nil Rate Sec. 200 – Duty of person deducting tax (Rule 30 & 31A) Sec. 201 – consequence of failure to deduct or pay Sec. 202 – deduction only one mode of recovery Sec. 203 – Certificate of tax deducted Sec. 203AA- Furnishing of statement of tax deducted Sec. 204 – Person responsible for paying TDS Sec 206- Tax collected at Source	
6	Advance Tax (Section 207 to section 211 and 219)	6
7	Interest & Penalties	8
	Interest Payable - (Sec 234A, Sec. 234B, Sec. 234C, Sec. 234D, Sec. 234E & Sec. 234F) Penalty – (Sec. 270A, Sec. 271C, Sec. 271CA & Sec. 273)	
8	Practical Income-Tax	6
	PAN, TAN, Payment of Income tax & TDS Filing of Income-Tax return & TDS Return Form 12BA, Form No. 16 & Form No. 16A	

Note:

1. Relevant Law / Statute in force on 1st April immediately preceding commencement of Academic Year is applicable for ensuing examinations after relevant year.
2. The syllabus is restricted to study of particular section/s, specifically mentioned rules and notifications only.

Choice Based Credit Grading and Semester System (CBCGS)

S.Y.B.Com. Accounting & Finance Semester –IV Syllabus

To be implemented from the Academic year 2020-2021

2A. Ability Enhancement Courses (AEC)

1. Information Technology in Accountancy - II

1	Preamble of the Syllabus
	<p>B.Com. in Accounting & Finance is an under graduation course of Department of B.Com. (Accounting & Finance), Changu Kana Thakur Arts, Commerce & Science College, New Panvel. Affiliated to University of Mumbai (MH). The course is designed to guide students of B.Com accounting and finance to study computerised accounting system software like TALLY ERP. It helps to study business process management. It also helps to acquaint knowledge of Management Information System which helps organizations like HR, Marketing, and Finance etc. The performance of the learners shall be evaluated into two components i.e. internal and external. The learner's performance shall be assessed by Internal Assessment with 40 marks and external assessment with 60 marks.</p>

2	Objectives of the Syllabus
•	To study business process management
•	To study automation of the business process
•	To study computerised accounting system software like TALLY ERP
•	To study Management Information System which helps organizations like HR, Marketing, Finance etc.
•	To study internal audits to evaluate the effectiveness of an operation's internal control

3	Course Outcomes
•	Learn need & importance of business process, business process management in IT, BPM life cycle
•	Learn practical knowledge of tally software
•	Learn importance & applications of information system in management, the role of computer in MIS
•	Learn different IT auditing techniques

4	Detailed Syllabus	
	Information Technology in Accountancy - II	
Sr. No.	Modules / Units	No. of Lectures
1	Business Process	10
	<p>Introduction, Definition and Meaning of business process The flow of business process for accounting, purchase, sales and finance, Classification of business processes Introduction, Definition and Meaning of Business Process Management, Principles and Practices of Business Process Management, Business Process Management life cycle Theories of Business Management Process Implementation of Business process Management – need, key factors and importance Automation of Business Processes – benefits, risks, challenges Accounting systems automation IT and Business Process Management</p>	
2	Computerized accounting system	20
	<p>Introduction and meaning, Uses and Benefits, Role Need and requirements of the computerized accounting Basic requirements of computerized accounting system Limitations of computerized accounting system Understand the development and design of a computerized accounting system; determining how the accounting data will be processed, i.e. what accounts and books are needed and what is the desired output i.e. financial reports and other reports. Accounting Software: Introduction and meaning, Advantages of accounting software, Uses of Accounting software, Various accounting software Accounting software – creation of company, Ledgers, Groups, voucher entry, Accounting and reports</p>	
3	Concept of MIS Reports in Computer Environment	10
	<p>Introduction, Concept of MIS, Need for MIS, Characteristic of MIS, Outputs of MIS, Role of MIS, Guidelines for Developing MIS reports Functional Aspects of the MIS, Problems in MIS Knowledge required for studying MIS, MIS and Computer</p>	
4	IT and Auditing	05
	<p>Need and importance of IT in auditing Auditing in the IT environment</p>	
5	Information systems	10
	<p>Introduction, Information system, components of Information systems, Accounting Information System</p>	
6	Other emerging technologies	05
	<p>Business Analytics, Financial Analytics</p>	

Choice Based Credit Grading and Semester System (CBCGS)

S.Y.B.Com. Accounting & Finance Semester –IV Syllabus

To be implemented from the Academic year 2020-2021

2B. Skill Enhancement Courses (SEC)

1. Foundation Course in Management (Introduction to Management) - IV

1	Preamble of the Syllabus
	B.Com. in Accounting & Finance is an under graduation course of Department of B.Com. (Accounting & Finance), Changu Kana Thakur Arts, Commerce & Science College, New Panvel. Affiliated to University of Mumbai (MH). The course is designed to guide students of B.Com accounting and finance to understand staffing, directing and controlling. It helps to understand basic management concepts. The performance of the learners shall be evaluated into two components i.e. internal and external. The learner's performance shall be assessed by Internal Assessment with 40 marks and external assessment with 60 marks.

2	Objectives of the Syllabus
•	Students will be able to understand basic management concepts
•	Students will be able to identify the term planning and organising
•	To understand staffing, directing and controlling

3	Course Outcomes
•	Understand the basic management concepts.
•	Understand the terms like planning and organising.
•	Understand staffing, directing and controlling.

4	Detailed Syllabus
	Foundation Course in Management (Introduction to Management) - IV
Sr. No.	Modules / Units
1	Introduction to Basic Management Concepts
	Introduction to Management, Definition of Management Nature of Management Objectives of Management Administration vs Management Levels of Management Principles of Management
2	Planning
	Definition and Importance of Planning Process of Planning Limitations of Planning Features of Sound Planning Features and process of decision making
3	Organising
	Definition, nature and significance Process of organisation Principles of organisation Formal and Informal organisation - features, advantages and disadvantages Centralisation and decentralisation – factors, merits and demerits Departmentation and Delegation
4	Staffing
	Meaning, Importance of Staffing Recruitment and its sources Selection procedure Distinction between Recruitment and Selection Employment tests and types of Interview
5	Directing and Controlling
	Meaning and Importance of directing Principles of Directing Leadership traits and Styles Motivation – Importance and Factors Co-ordination – Meaning, features and Importance Meaning and steps in controlling Essentials of a good control system

Choice Based Credit Grading and Semester System (CBCGS)

S.Y.B.Com. Accounting & Finance Semester –IV Syllabus

To be implemented from the Academic year 2020-2021

3. Core Courses (CC)

1. Business Law (Company Law) - III

1	Preamble of the Syllabus
	<p>B.Com. in Accounting & Finance is an under graduation course of Department of B.Com. (Accounting & Finance), Changu Kana Thakur Arts, Commerce & Science College, New Panvel. Affiliated to University of Mumbai (MH). The course is designed to guide students of B.Com accounting and finance with the knowledge of Indian business law. It helps to provide the brief idea about the legal framework of Indian Business Law and to know role of law in an economic and business context. It also helps to acquaint knowledge of legal environment of business and corporate laws. The performance of the learners shall be evaluated into two components i.e. internal and external. The learner's performance shall be assessed by Internal Assessment with 40 marks and external assessment with 60 marks.</p>

2	Objectives of the Syllabus
•	To cover the principles of company law.
•	To examine the various structures through which business may be run.
•	To examine the ways of financing and conducting the affairs of a company. To examine the duties and rights of directors, Shareholder rights, insolvency
•	To examine the method of establishing and running a company

3	Course Outcomes
•	Demonstrate comprehensive and accurate knowledge and understanding of those areas of company law.
•	Read and study primary and secondary sources of company law, with minimal staff guidance; critically analyse, interpret, evaluate and synthesise information from a variety of sources.
•	Critically analyse complex problems in relation to the regulation of companies, apply the legal principles studied to these problems, and evaluate competing arguments or solutions and present well-supported conclusions both orally and in writing.

4	Detailed Syllabus	
	Business Law (Company Law) – III	
Sr. No.	Modules / Units	No. Of Lectures
1	Company Law – I	20
	<ul style="list-style-type: none"> Definitions (section 2 of Company Act 2013) Incorporation of companies (Section 3 to Section 22) Prospectus & Allotment of Securities (Sections 23 to section 41) Private Placement (Section 42) Share Capital and Debentures (Sections 43 to section 72) Acceptance of deposits by companies (section 73 to section 76) 	
2	Company Law – II	20
	<ul style="list-style-type: none"> Registration of charge (section 77 to section 87) Management & Administration (section 88 to section 122) Declaration & payment of dividend (section 123 to 127) Accounts of companies (section 128 to 138) Audit & Auditors (section 139 to 148) Appointment & qualification of Directors (section 149 to 172) Meeting of board & its powers (section 173 to 195) Winding up (Section 270) 	
3	Insolvency and Bankruptcy code, 2016.	15
	<ul style="list-style-type: none"> Introduction -Historical perspectives of insolvency, bankruptcy and the laws, Need, objects, applicability for the IBC 2016, Definition, Concepts of Insolvency and Bankruptcy, Debtors and Creditors. Insolvency Resolution and Liquidation Process for Corporate Persons -Corporate insolvency resolution process, Liquidation process, Fast track insolvency resolution process. Insolvency Resolution and Bankruptcy for Individuals and Partnership Firms- Insolvency resolution process, Bankruptcy order for individuals and partnership firms, Administration and distribution of the estate of the bankrupt. Authorities under the Code- The Insolvency and Bankruptcy Board of India, Powers and functions of the Board, Insolvency professional agencies Information utilities, Inspection and investigation. Adjudicating Authorities under the Code - Adjudicating Authorities for Corporate Persons, Adjudicating Authorities for Individuals and Partnership Firms, Appeals. Offenses and Penalties for Contravention of the Provisions of the Code- By the debtor, By the creditor & By the bankrupt 	
4	National Company Law Tribunal.	05

	<ul style="list-style-type: none"> • Constitution of National Company Law Tribunal, Appellate Tribunal • Selection of members, terms of office, salary, Removal of members • Order of Tribunal, Powers of Tribunal, Appeal from orders of Tribunals 	
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Choice Based Credit Grading and Semester System (CBCGS)

S.Y.B.Com. Accounting & Finance Semester –III Syllabus

To be implemented from the Academic year 2020-2021

3. Core Courses (CC)

2. Research Methodology in Accounting and Finance

1	Preamble of the Syllabus
	<p>B.Com. in Accounting & Finance is an under graduation course of Department of B.Com. (Accounting & Finance), Changu Kana Thakur Arts, Commerce & Science College, New Panvel. Affiliated to University of Mumbai (MH). The course is designed to guide students of B.Com accounting and finance to develop the research skill. It helps to analyze and enhance the ability of learners for better understanding, interpretation, analysis, and presentation of Research Report. The performance of the learners shall be evaluated into two components i.e. internal and external. The learner's Performance shall be assessed by Internal Assessment with 40 marks and external assessment with 60 marks.</p>

2	Objectives of the Syllabus
•	To enhance the abilities of the learners to develop the research skill.
•	To enable the learners to understand, develop and apply the techniques of the research design for various researches.
•	To analyze and enhance the ability of learners for better understanding, interpretation, analysis, and presentation of Research Report.

3	Course Outcomes
•	Use Literature while preparing for research, research design and further searches.
•	Explain the Research terminologies and methodologies and interpret, analysis and presentation of the report.
•	Demonstrate a basic understanding of Research, Research Design, and Report Writing.

4	Detailed Syllabus	
	Research Methodology in Accounting and Finance	
Sr. No.	Modules / Units	No. of Lectures
1	Introduction to Research	08
	Introduction and meaning of research, Objectives of research, Features and Importance of research in Accounting and Finance, Objectives and Types of research - Basic, Applied, Descriptive, Analytical and Empirical Research. Formulation of the research problem: Meaning and Selection Review of Literature	
2	Research Design in Accounting and Finance	06
	Meaning of Introduction, Need, and Good research design. Hypothesis: Formulation, Sources, Importance and Types Different Research designs	
3	Data Collection and Processing	08
	Data Collection: Introduction and meaning, types of data Primary data: Observation, Experimentation, Interview, Schedules, Survey, Questionnaires, Limitations of Primary data Secondary data: Sources and Limitations Factors affecting the choice of method of data collection. Sampling: Significance, Methods, Factors determining sample size Data Presentation: Significance in Research, Stages in Data Processing: Editing, Coding, Classification, Tabulation, Graphic Presentation Use of computer and internet in data collection and processing	
4	Statistical Analysis	24
	Statistical Analysis: Tools and Techniques, Measures of Central Tendency, Measures of Dispersion, Correlation Analysis and Regression Analysis. Probability	
5	Testing of Hypothesis	08
	Different types of test for testing of hypothesis F Test, T Test, Z Test, Chi-Square	
6	Interpretation and Report Writing	06
	Meaning and techniques of interpretation, Research Report Writing: Importance, Essentials, Structure/ layout, Types	

Department of Management Studies

Criteria 1.1.3 : Number of courses focusing on employability/entrepreneurship/ skill development offered by the Institution during the year

1. Direct Taxes

Course Code : UMS5DIT

Modules at a Glance

Sr. No.	Modules	No. of Lectures
1	Definitions and Residential Status	10
2	Heads of Income – I	15
3	Heads of Income - II	15
4	Deductions under Chapter VI A	10
5	Computation of Taxable Income of Individuals	10
Total		60

Objectives

SN	Objectives
01	To understand the provisions of determining residential status of individual
02	To study various heads of income
03	To study deductions from total income
04	To compute taxable income of Individuals

Sr. No.	Modules
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	/ Units
1	Definitions and Residential Status
	Basic Terms (S. 2,3,4) Assessee, Assessment, Assessment Year, Annual Value, Business, Capital Assets, Income, Previous Year, Person, Transfer, Tax Planning. Determination of Residential Status of Individual, Scope of Total Income (S.5)
2	Heads of Income – I
	Salary (S.15-17) Income from House Property (S. 22-27) Profit & Gain from Business and Profession(S. 28, 30,31,32, 35, 35D,36,37, 40, 40A and 43B)
3	Heads of Income – II
	Capital Gain (S. 45, 48, 49, 50 and 54) Income from other sources (S.56- 59) Exclusions from Total Income (S.10) (Exclusions related to specified heads to be covered with relevant heads of income)
4	Deductions under Chapter VI A & Computation of Taxable Income and Tax Liability of an Individual
	Deductions from Total Income S. 80C, 80CCC, 80D, 80DD, 80E, 80U, 80TTA Computation of Total Income and Taxable Income and Tax Liability of an Individuals
5	TDS, TCS, Advance Tax & Provision for filing return of income
	Tax Deducted at Source, Tax Collected at Source, Advance Tax Provisions for filing return of income

Note: The Syllabus is restricted to study of particular sections, specifically mentioned rules and notifications only.

1. All modules / units include Computational problems / Case Study.
2. The Law In force on 1st April immediately preceding the commencement of Academic year will be applicable for ensuing Examinations.

2. Indirect Taxes

Course Code : UMS6INT

Modules at a Glance

Sr. No.	Modules	No. of Lectures
1	Introduction to Indirect Taxation and GST	10
2	Concept of Supply	20
3	Registration and Computation of GST	20
4	Filing of Returns	10
Total		60

Objectives

SN	Objectives
01	To understand the basics of GST
02	To study the registration and computation of GST
03	To acquaint the students with filing of returns in GST

Sr. No.	Modules / Units
1	Introduction to Indirect Taxation and GST

	<p>A. Basics for Taxation - Direct Taxes and Indirect Taxes – Difference, Advantages and Disadvantages, Sources and Authority of Taxes in India (Art 246 of the Indian Constitution)</p> <p>B. Introduction to GST – Genesis of GST in India, Power to tax GST (Constitutional Provisions), Extent and Commencement, Meaning and Definition of GST, Benefits of GST, Conceptual Framework – CGST, IGST, SGST, UTGST, Imports of goods or services or both, Export of goods or services or both, Taxes subsumed and not subsumed under GST.</p> <p>C. Definitions – Goods (2(52) of CGST Act), Services (2(102) of CGST Act), Money (2(75) of CGST Act), Securities (2(101) of SCRA Act,1956), India(2(56) of CGST Act), Persons (2(84) of CGST Act),Taxable Person (2(107) of CGST Act), Business (2(17) of CGST Act), Consideration(2(31) of CGST Act), E- Commerce Operator (2(45) of CGST Act), Supplier(2(105) of CGST Act),Recipient(2(93) of CGST Act)</p> <p>D. Levy and Collection of GST – Levy and Collection of CGST, IGST, SGST,UTGST (Sec 9 of CGST Act), Composition Scheme under GST (Sec 10 of CGST Act), Power to Grant Exemption (Sec 11 of CGST Act) GST Rate Schedule for Goods and Services.</p>
2	Concept of Supply
	<p>A. Taxable Event Supply– Meaning and Scope of Supply (Section 7 Subsection 1, 2 and 3 of Act) Schedule I, Schedule II, Schedule III, Composite and Mixed Supplies (Sec 8 of CGST Act)</p> <p>B. Place of Supply – Location of Supplier of Goods and Services, Place of Supply of Goods (Sec 10, 11,12 and 13 of IGST Act), Special Provision for Payment of Tax by a Supplier of Online Information Database Access Retrieval.</p> <p>C. Time of Supply- Time of Supply (Sec 31 of CGST Act), Issue of Invoice by the Supplier (Sec 31 (1) and Sec 31(2)of CGST Act), Continuous Supply of Goods and Services, Goods Sent on Approval (Sec 31(7) of CGST Act)</p> <p>D. Value of Supply – Determination of Value of Supply (Sec 15 of CGST Act and CGST Rules 2017), Input Tax Credit (Sec 2(62) of CGST Act) Capital Goods (Sec 2(19) of CGST Act), Input Sec 2(59) of CGST Act), Input Service (Sec 2(60) of CGST Act). Eligibility and Conditions for taking Input Tax Credit (Sec 16 of CGST Act)</p>
3	Registration and Computation of GST
	<p>A. Registration – Persons liable for Registration (Sec 22 of the Act), Persons not liable for Registration, Procedure for Registration (Sec 25 of the Act), Deemed Registration(Sec 26 of the Act), Special Provisions (Sec 27 of the Act), Amendment, Cancellation and Revocation of Registration(Sec 28,Sec29and Sec 31 of the Act)</p> <p>B. Computation of GST – Computation of GST under Inter State and Intra State Supplies.</p> <p>C. Payment of Tax- Payment of Tax, Interest and other Amounts(Sec 49 of the</p>

	Act), Interest on delayed Payment (Sec 50 of the Act), TDS (Sec 51 of the Act), TCS (Sec 52 of the Act)
4	Filing of Returns
	A. Documentation- Tax Invoices (Sec 31 and 32 of the Act), Credit and Debit notes (Sec 34 of the Act), Electronic Way Bill B. Returns – Types of Returns and Provisions relating to filing of Returns (Sec 37 to Sec 48 of the Act)

3. Advertising

Course Code: UMS3ADV

Modules at a Glance

Sr. No.	Modules	No. of Lectures
1	Introduction to Advertising	15
2	Strategy and Planning Process in Advertising	15
3	Creativity in Advertising	15
4	Budget, Evaluation, Current trends and careers in Advertising	15
Total		60

Objectives

SN	Objectives
1	To understand and examine the growing importance of advertising
2	To understand the construction of an effective advertisement
3	To understand the role of advertising in contemporary scenario
4	To understand the future and career in advertising

Sr. No.	Modules / Units
1	Introduction to Advertising
	<ul style="list-style-type: none"> Definition, Evolution of Advertising, Importance, Scope, Features, Benefits, Five M's of Advertising Types of Advertising –consumer advertising, industrial advertising, institutional advertising, classified advertising, national advertising, generic advertising Theories of Advertising : Stimulus Theory, AIDA, Hierarchy Effects Model, Means – End Theory, Visual Verbal Imaging, Cognitive Dissonance Ethics and Laws in Advertising : Puffery, Shock Ads, Subliminal Advertising, Weasel Claim, Surrogate Advertising, Comparative Advertising Code of Ethics, Regulatory Bodies, Laws and Regulation – CSR, Public Service Advertising, Corporate Advertising, Advocacy Advertising Social, cultural and Economic Impact of Advertising, the impact of ads on Kids, Women and Advertising
2	Strategy and Planning Process in Advertising
	<ul style="list-style-type: none"> Advertising Planning process & Strategy : Introduction to Marketing Plan, Advertising Plan- Background, situational analysis related to Advertising issues, Marketing Objectives, Advertising Objectives, Target Audience, Brand Positioning (equity, image personality), creative Strategy, message strategy, media strategy, Integration of advertising with other communication tools Role of Advertising in Marketing Mix : Product planning, product brand policy, price, packaging, distribution, Elements of Promotion, Role of Advertising in PLC Advertising Agencies – Functions – structure – types - Selection criteria for Advertising agency – Maintaining Agency–client relationship, Agency Compensation.
3	Creativity in Advertising
	<ul style="list-style-type: none"> Introduction to Creativity – definition, importance, creative process , Creative strategy development – Advertising Campaign – determining the message theme/major selling ideas – introduction to USP – positioning strategies – persuasion and types of advertising appeals – role of source in ads and celebrities as source in Indian ads – execution styles of presenting ads. Role of different elements of ads – logo, company signature, slogan, tagline, jingle, illustrations, etc – Creating the TV commercial – Visual Techniques, Writing script, developing storyboard, other elements (Optical, Soundtrack, Music) Creating Radio Commercial – words, sound, music – scriptwriting the commercial – clarity, coherence, pleasantness, believability, interest, distinctiveness Copywriting: Elements of Advertisement copy – Headline, sub-headline, Layout, Body copy, slogans. Signature, closing idea, Principles of Copywriting for print, OOH, essentials of good copy, Types of Copy, Copy Research
Sr. No.	Modules / Units
4	Budget, Evaluation, Current trends and careers in Advertising
	<ul style="list-style-type: none"> Advertising Budget – Definition of Advertising Budget, Features, Methods of Budgeting

	<ul style="list-style-type: none"> • Evaluation of Advertising Effectiveness – Pre-testing and Post testing Objectives, Testing process for Advertising effectiveness, Methods of Pre-testing and Post-testing, Concept testing v/s Copy testing • Current Trends in Advertising : Rural and Urban Advertising, Digital Advertising, Content Marketing (Advertorials), retail advertising, lifestyle advertising, Ambush Advertising, Global Advertising – scope and challenges – current global trends • Careers in Advertising : careers in Media and supporting firms, freelancing options for career in advertising, role of Advertising Account Executives, campaign Agency family tree – topmost advertising agencies and the famous advertisements designed by them
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4. Business Research Methods

Course Code: UMS4BRM

Modules at a Glance

Sr. No.	Modules	No. of Lectures
1	Introduction to business research methods	18
2	Data collection and Processing	14
3	Data analysis and Interpretation	16
4	Advanced techniques in Report Writing	12
Total		60

Objectives

SN	Objectives
1	The course is designed to inculcate the analytical abilities and research skills among the students.
2	The course intends to give hands on experience and learning in Business Research.

Sr. No.	Modules / Units
1	Introduction to business research methods
	<ul style="list-style-type: none"> • Meaning and objectives of research • Types of research– a) Pure, Basic and Fundamental b) Applied, c) Empirical d) Scientific & Social e) Historical f) Exploratory g) Descriptive h) Causal • Concepts in Research: Variables, Qualitative and Quantitative Research • Stages in research process. • Characteristics of Good Research • Hypothesis-Meaning, Nature, Significance, Types of Hypothesis, Sources. • Research design– Meaning, Definition, Need and Importance, Steps in research design, Essentials of a good research design, Areas / Scope of research design and Types-Descriptive, Exploratory and causal. • Sampling– <ul style="list-style-type: none"> a) meaning of sample and sampling, a) methods of sampling-i) Non Probability Sampling– Convenient, Judgment, Quota, Snow ball ii) Probability– Simple Random, Stratified, Cluster, Multi Stage.
2	Data collection and Processing
	<ul style="list-style-type: none"> • Types of data and sources-Primary and Secondary data sources • Methods of collection of primary data <ul style="list-style-type: none"> a) Observation- i) structured and unstructured, ii) disguised and undisguised, iii) mechanical observations (use of gadgets) b) Experimental i) Field ii) Laboratory b) Interview – i) Personal Interview ii) focused group, iii) in- depth interviews -Method, c) Survey– Telephonic survey, Mail, E-mail, Internet survey, Social media, and Media listening. d) Survey instrument– i) Questionnaire designing. e) Types of questions– i) structured/ close ended and ii) unstructured/ open ended , iii) Dichotomous , iv) Multiple Choice Questions. f) Scaling techniques-i) Likert scale, ii) Semantic Differential scale
3	Data analysis and Interpretation
	<ul style="list-style-type: none"> • Processing of data– i) Editing- field and office editing, ii) coding– meaning and essentials, iii) tabulation – note • Analysis of data-Meaning, Purpose, types. • Interpretation of data-Essentials, importance and Significance of processing data • Multivariate analysis– concept only • Testing of hypothesis– concept and problems– i) chi square test, ii) Zandt-test (for large and small sample)
4	Advanced techniques in Report Writing
	<ul style="list-style-type: none"> • Report writing – i) Meaning , importance, functions of reports, essential of a good report, content of report , steps in writing a report, types of reports, Footnotes and Bibliography • Ethics and research • Objectivity, Confidentiality and anonymity in Research • Plagiarism

5. HRM in Service Sector Management

Course Code: UMS6HSM

Modules at a Glance

SN	Modules	No. of Lectures
1	Service Sector Management- An Overview	15
2	Managing Human Element in Service Sector	15
3	Issues and Challenges of HR in Service Sector	15
4	HRP Evaluation, Attrition, Retention & Globalization	15
Total		60

Objectives

SN	Objectives
1	To understand the concept and growing importance of HRM in service sector
2	To understand how to manage human resources in service sector
3	To understand the significance of human element in creating customer satisfaction through service quality
4	To understand the issues and challenges of HR in various service sectors

SN	Modules/ Units
1	Service Sector Management- An Overview
	<p>a) Service Sector Management- An Overview:</p> <ul style="list-style-type: none"> • Services - Meaning, Features, Classification of Services: End User, Degree of Tangibility, People Based Services, Expertise Required, Orientation Towards Profit, By Location • Service Sector Management – Meaning, Significance of Service Sector, Reasons for Growth in Service Sector • Service Organization - Importance of Layout and Design of Service Organization, Servicescape • Service Culture in Organization – Meaning, Developing Service Culture in Organization • Relationship Marketing – Meaning, Need and Importance in Service Sector Organizations, Six Market Model • Role of Service Employee • Role of Customers in Service Process– Customers as Productive Resources, Customers as Contributors to Service Quality, Customers as Competitors • Service Encounter and Moment of Truth – Meaning, Nature, Elements of Service Encounter
2	Managing Human Element in Service Sector
	<p>a) Managing Human Element in Service Sector:</p> <ul style="list-style-type: none"> • Human Element in Service Sector – Introduction, Role and Significance • The Services Triangle • Front Line Employees /Boundary Spanners– Meaning, Issues Faced by Front Line Employees: Person/ Role Conflicts, Organization/ Client Conflict, Interclient Conflict • Emotional Labour – Meaning, Strategies for Managing Emotional Labour • Recruitment in Service Sector– Recruiting Right People, Recruitment Procedures and Criteria, Challenges in Recruitment in Service Sector • Selection of Employees in Service Sector – Interviewing Techniques: Abstract Questioning, Situational Vignette, Role Playing • Develop People to Deliver Service Quality • Compensating Employees in Service Sector • Motivating Employees for Services • Empowerment of Service Workers – Meaning, Advantages and Limitations

SN	Modules/ Units
3	Issues and Challenges of HR in Service Sector
	<p>a) Issues and Challenges of HR in Service Sector:</p> <ul style="list-style-type: none"> • Quality Issues in Services: Meaning and Dimensions of Service Quality, The Service – Gap Model, Reasons and Strategies to fill the Gaps • Delivering Services through Agents and Brokers - Meaning, Advantages, Challenges, Strategies for Effective Service Delivery through Agents and Brokers • HRM in Public Sector Organizations and Non – Profit Sector in India • Issues and Challenges of HR in Specific Services: <ul style="list-style-type: none"> ▪ Business and Professional Services: Banking and Insurance, Legal, Accountancy ▪ Infrastructure: Roads, Railways, Power ▪ Public Services: Police, Defense, Disaster Management ▪ Trade Services: Wholesale and Retail, Advertising, Maintenance and Repairs ▪ Personnel Services: Education, Health Care, Hotels • Social and Charitable Services
4	HRP Evaluation, Attrition, Retention & Globalization
	<p>a) HRP Evaluation, Attrition, Retention & Globalization:</p> <ul style="list-style-type: none"> • Human Resource Planning Evaluation in Service Sector – Meaning, HRP Evaluation Process, Purpose of HRP Evaluation in Service Sector, Issues Influencing HRP Evaluation in Service Sector • Service Leadership – Meaning, Integrating Marketing Operation and Human Resources, Creating a Leading Service Organization, The Service – Profit Chain Model • Attrition in Service Sector – Meaning, Reasons for Attrition in Service Sector, Cycle of Failure, Cycle of Mediocrity and Cycle of Success • Retaining the Best People in Service Sector – Including Employees in Company's Vision, Treat Employees as Customers, Measure and Reward String Service Performers • Globalization of Services- Meaning, Reasons for Globalization of Services, Impact of Globalization on Indian Service Sector. Organisational Effectiveness, Ways to Enhance Organisational Effectiveness

6. Logistics and Supply Chain Management

Course Code : UMS5LSM

Modules at a Glance

SN	Modules	No. of Lectures
1	Overview of Logistics and Supply Chain Management	15
2	Elements of Logistics Mix	15
3	Inventory Management, Logistics Costing, Performance Management and Logistical Network Analysis	15
4	Recent Trends in Logistics and Supply Chain Management	15
Total		60

Objectives

SN	Objectives
1	To provide students with basic understanding of concepts of logistics and supply chain management
2	To introduce students to the key activities performed by the logistics function
3	To provide an insight in to the nature of supply chain, its functions and supply chain systems
4	To understand global trends in logistics and supply chain management

SN	Modules/ Units
1	Overview of Logistics and Supply Chain Management <p>a) Introduction to Logistics Management</p> <ul style="list-style-type: none"> • Meaning, Basic Concepts of Logistics- Logistical Performance Cycle, Inbound Logistics, Inprocess Logistics, Outbound Logistics, Logistical Competency, Integrated Logistics , Reverse Logistics and Green Logistics • Objectives of Logistics, Importance of Logistics, Scope of Logistics, Logistical Functions/Logistic Mix, Changing Logistics Environment <p>b) Introduction to Supply Chain Management</p> <ul style="list-style-type: none"> • Meaning, Objectives, Functions, Participants of Supply Chain, Role of Logistics in Supply Chain, Comparison between Logistics and Supply Chain Management, Channel Management and Channel Integration <p>c) Customer Service: Key Element of Logistics</p> <ul style="list-style-type: none"> • Meaning of Customer Service, Objectives, Elements, Levels of customer service, Rights of Customers <p>d) Demand Forecasting</p> <ul style="list-style-type: none"> • Meaning, Objectives ,Approaches to Forecasting, Forecasting Methods, Forecasting Techniques, (Numerical on Simple Moving Average, Weighted Moving Average)
2	Elements of Logistics Mix <p>a) Transportation</p> <ul style="list-style-type: none"> • Introduction, Principles and Participants in Transportation, Transport Functionality, Factors Influencing Transportation Decisions, Modes of Transportation- Railways, Roadways, Airways, Waterways, Ropeways, Pipeline, Transportation Infrastructure, Intermodal Transportation <p>b) Warehousing</p> <ul style="list-style-type: none"> • Introduction, Warehouse Functionality, Benefits of Warehousing, Warehouse Operating Principles, Types of Warehouses, Warehousing Strategies, Factors affecting Warehousing <p>c) Materials Handling</p> <ul style="list-style-type: none"> • Meaning, Objectives, Principles of Materials Handling, Systems of Materials Handling, Equipments used for Materials Handling, Factors affecting Materials Handling Equipments <p>d) Packaging</p> <ul style="list-style-type: none"> • Introduction, Objectives of Packaging, Functions/Benefits of Packaging, Design Considerations in Packaging, Types of Packaging Material, Packaging Costs

SN	Modules/ Units
3	Inventory Management, Logistics Costing, Performance Management and Logistical Network Analysis
	<p>a) Inventory Management</p> <ul style="list-style-type: none"> • Meaning, Objectives, Functions, Importance, Techniques of Inventory Management (Numericals - EOQ and Reorder levels) <p>b) Logistics Costing</p> <ul style="list-style-type: none"> • Meaning, Total Cost Approach, Activity Based Costing, Mission Based Costing <p>c) Performance Measurement in Supply Chain</p> <ul style="list-style-type: none"> • Meaning, Objectives of Performance Measurement, Types of Performance Measurement, Dimensions of Performance Measurement, Characteristics of Ideal Measurement System <p>d) Logistical Network Analysis</p> <ul style="list-style-type: none"> • Meaning, Objectives, Importance, Scope, RORO/LASH
4	Recent Trends in Logistics and Supply Chain Management
	<p>a) Information Technology in Logistics</p> <ul style="list-style-type: none"> • Introduction, Objectives, Role of Information Technology in Logistics and Supply Chain Management, Logistical Information System, Principles of Logistical Information System, Types of Logistical Information System, Logistical Information Functionality, Information Technology Infrastructure <p>b) Modern Logistics Infrastructure</p> <ul style="list-style-type: none"> • Golden Quadrilateral, Logistics Parks, Deep Water Ports, Dedicated Freight Corridor, Inland Container Depots/Container Freight Stations, Maritime Logistics, Double Stack Containers/Unit Trains <p>c) Logistics Outsourcing</p> <ul style="list-style-type: none"> • Meaning, Objectives, Benefits/Advantages of Outsourcing, Third Party Logistics Provider, Fourth Party Logistics Provider, Drawbacks of Outsourcing, Selection of Logistics Service Provider, Outsourcing-Value Proposition <p>d) Logistics in the Global Environment</p> <ul style="list-style-type: none"> • Managing the Global Supply Chain, Impact of Globalization on Logistics and Supply Chain Management, Global Logistics Trends, Global Issues and Challenges in Logistics and Supply Chain Management

7. Commodity and Derivatives Market

Course Code : UMS5C&D

Modules at a Glance

SN	Modules	No. of Lectures
1	Introduction to Commodities Market and Derivatives Market	15
2	Futures and Hedging	15
3	Options and Option Pricing Models	15
4	Trading, Clearing & Settlement In Derivatives Market and Types of Risk	15
Total		60

Objectives

SN	Objectives
1	To understand the concepts related to Commodities and Derivatives market
2	To study the various aspects related to options and futures
3	To acquaint learners with the trading, clearing and settlement mechanism in derivatives market.

SN	Modules/ Units
1	Introduction to Commodities Market and Derivatives Market
	<p>a) Introduction to Commodities Market :</p> <ul style="list-style-type: none"> • Meaning, History & Origin, Types of Commodities Traded, Structure of Commodities Market in India, Participants in Commodities Market, Trading in Commodities in India(Cash & Derivative Segment), Commodity Exchanges in India & Abroad, Reasons for Investing in Commodities <p>b) Introduction to Derivatives Market:</p> <ul style="list-style-type: none"> • Meaning, History & Origin, Elements of a Derivative Contract, Factors Driving Growth of Derivatives Market, Types of Derivatives, Types of Underlying Assets, Participants in Derivatives Market, Advantages & Disadvantages of Trading in Derivatives Market, Current Volumes of Derivative Trade in India, Difference between Forwards & Futures.
2	Futures and Hedging
	<p>a) Futures:</p> <ul style="list-style-type: none"> • Futures Contract Specification, Terminologies, Concept of Convergence, Relationship between Futures Price & Expected Spot Price, Basis & Basis Risk, Pricing of Futures Contract, Cost of Carry Model <p>b) Hedging:</p> <ul style="list-style-type: none"> • Speculation & Arbitrage using Futures, Long Hedge – Short Hedge, Cash & Carry Arbitrage, Reverse Cash & Carry Arbitrage, Payoff Charts & Diagrams for Futures Contract, Perfect & Imperfect Hedge
3	Options and Option Pricing Models
	<p>a) Options:</p> <ul style="list-style-type: none"> • Options Contract Specifications, Terminologies, Call Option, Put Option, Difference between Futures & Options, Trading of Options, Valuation of Options Contract, Factors affecting Option Premium, Payoff Charts & Diagrams for Options Contract, Basic Understanding of Option Strategies <p>b) Options Pricing Models:</p> <ul style="list-style-type: none"> • Binomial Option Pricing Model, Black - Scholes Option Pricing Model
4	Trading, Clearing & Settlement In Derivatives Market and Types of Risk

a) Trading, Clearing & Settlement In Derivatives Market:

- Meaning and Concept, SEBI Guidelines, Trading Mechanism – Types of Orders, Clearing Mechanism – NSCCL – its Objectives & Functions, Settlement Mechanism – Types of Settlement

b) Types of Risk:

- Value at Risk, Methods of calculating VaR, Risk Management Measures, Types of Margins, SPAN Margin

8. Recruitment & Selection

Course Code: UMS3R&S

Modules at a Glance

Sr. No.	Module s	No. of Lectures
1	Recruitment	18
2	Selection	15
3	Induction	15
4	Soft Skills	12
Total		60

Objectives

S N	Objectives
1	The objective is to familiarize the students with concepts and principles, procedure of Recruitment and Selection in an organization.
2	To give an in depth insight into various aspects of Human Resource management and make them acquainted with practical aspect of the subject.

Sr. No.	Modules / Units
1	Recruitment
	<ul style="list-style-type: none"> • Concepts of Recruitment- -Meaning, Objectives, Scope & Definition, Importance and relevance of Recruitment. • Job Analysis--Concept, Specifications, Description, Process And Methods, Uses of Job Analysis • Job Design--Introduction, Definition, Modern Techniques, Factors affecting Job Design, Contemporary Issues in Job Designing. • Source or Type of Recruitment– a) Direct/Indirect, b) Internal/ External. Internal-Notification, Promotion– Types, Transfer –Types, Reference External-Campus Recruitment, Advertisement, Job Boards Website/Portals, Internship, Placement Consultancies-Traditional (In-House, Internal Recruitment, On Campus, Employment And Traditional Agency). Modern (Recruitment Books, Niche Recruitments, Internet Recruitment, Service Recruitment, Website and Job, Search Engine, Social Recruiting and Candidate Paid Recruiters). • Technique of Recruitment-Traditional Vs Modern Recruitment • Evaluation of Recruitment-Outsourcing Programme
2	Selection
	<ul style="list-style-type: none"> • Selection-Concept of Selection, Criteria for Selection, Process, Advertisement and Application (Blank Format). • Screening-Pre and Post Criteria for Selection, Steps of Selection • Interviewing-Types and Guidelines for Interviewer & Interviewee, Types of Selection Tests, Effective Interviewing Techniques. • Selection Hurdles and Ways to Overcome Them
3	Induction
	<ul style="list-style-type: none"> • Induction-Concept, Types-Formal /Informal, Advantages of Induction, How to make Induction Effective • Orientation & On boarding-Programme and Types, Process. • Socialisation-Types-Anticipatory, Encounter, Setting in, Socialisation Tactics • Current trends in Recruitment and Selection Strategies– with respect to Service, Finance, I.T., Law And Media Industry
4	Soft Skills
	<ul style="list-style-type: none"> • Preparing Bio-data and C.V. • Social and Soft Skills – Group Discussion & Personal Interview, Video and Tele Conferencing Skills, • Presentation and Negotiation Skills, Aesthetic Skills, • Etiquettes-Different Types and Quitting Techniques. • Exit Interview-Meaning, importance.

9. Training & Development in HRM

Course Code: UMS4T&D

Modules at a Glance

Sr. No.	Module s	No. of Lectur es
1	Overview of Training	15
2	Overview of development	15
3	Concept of Management development	15
4	Performance measurement, Talent management & Knowledge management	15
Total		60

Objectives

S N	Objectives
1	This paper is not pure academic oriented but practice based. It has been designed, keeping in view the needs of the organizations. Successful managerial performance depends on the individual's ability to observe, interpret the issues and modify his approach and behaviour. All organizations need to pay adequate attention to equip their employees. Rapid progress in technology has changed not only in the physical facilities but also in the abstract qualities required of the men who are using them. This paper will attempt to orient the students to tailor themselves to meet the specific needs of the organizations in training and development activities.

Sr. No.	Modules / Units
1	Overview of Training
	<ul style="list-style-type: none"> • Overview of training– concept, scope, importance, objectives, features, need and assessment of training. • Process of Training–Steps in Training, identification of Job Competencies, criteria for identifying Training Needs(Person Analysis, Task Analysis, Organisation Analysis),Types–On the Job & Off the Job Method. • Assessment of Training Needs, Methods & Process of Needs Assessment. • Criteria & designing-Implementation– an effective training program. • Training calendar in HRM ,Concept, Meaning, Introduction & Format of Training calendar & its preparation.
2	Overview of Development
	<ul style="list-style-type: none"> • Overview of development– concept, scope, importance & need and features, Human Performance Improvement • Counselling techniques with reference to development employees, society and organization. • Career development– Career development cycle, model for planned self development ,succession planning.
3	Concept of Management Development
	<ul style="list-style-type: none"> • Concept of Management Development. • Process of MDP. • Programs & methods, importance, evaluating MDP.
4	Performance measurement, Talent management & Knowledge management
	<ul style="list-style-type: none"> • Performance measurements– Appraisals, pitfalls & ethics of appraisal. • Talent management –Introduction ,Measuring Talent Management, Integration & future of TM, Global TM & knowledge management— OVERVIEW -Introduction: History, Concepts, • Knowledge Management: Definitions and the Antecedents of KM Information Management to Knowledge Management , Knowledge Management: What Is and What Is Not?, Three stages of KM, KM Life Cycle

10.Wealth Management

Course Code: UMS5WEM

Modules at a Glance

Sr. No.	Modules	No. of Lectures
1	Introduction	15
2	Insurance Planning and Investment Planning	15
3	Financial Mathematics/ Tax and Estate Planning	15
4	Retirement Planning/ Income Streams & Tax Savings Schemes	15
Total		60

Objectives

SN	Objectives
1	To provide an overview of various aspects related to wealth management
2	To study the relevance and importance of Insurance in wealth management
3	To acquaint the learners with issues related to taxation in wealth management
4	To understand various components of retirement planning

SN	Modules/ Units
1	Introduction
	a) Introduction To Wealth Management: <ul style="list-style-type: none">• Meaning of WM, Scope of WM, Components of WM, Process of WM, WM Needs & Expectation of Clients, Code of Ethics for Wealth Manager b) Personal Financial Statement Analysis: <ul style="list-style-type: none">• Financial Literacy, Financial Goals and Planning, Cash Flow Analysis, Building Financial Plans, Life Cycle Management. c) Economic Environment Analysis: <ul style="list-style-type: none">• Interest Rate, Yield Curves, Real Return, Key Indicators-Leading, Lagging, Concurrent

2	Insurance Planning and Investment Planning
	<p>a) Insurance Planning:</p> <ul style="list-style-type: none"> • Meaning, Basic Principles of Insurance, Functions and Characteristics of Insurance, Rights and Responsibilities of Insurer and Insured, Types of life Insurance Policies, Types of General Insurance Policies, Health Insurance – Mediciclaim – Calculation of Human Life Value - Belth Method/CPT <p>b) Investment Planning:</p> <ul style="list-style-type: none"> • Types of Investment Risk, Risk Profiling of Investors & Asset Allocation (Life Cycle Model), Asset Allocation Strategies (Strategic, Tactical, Life-Cycle based), Goal-based Financial Planning, Active & Passive Investment Strategies
3	Financial Mathematics/ Tax and Estate Planning
	<p>a) Financial Mathematics:</p> <ul style="list-style-type: none"> • Calculation of Returns (CAGR ,Post-tax Returns etc.), Total Assets, Net Worth Calculations, Financial Ratios <p>b) Tax and Estate Planning:</p> <ul style="list-style-type: none"> • Tax Planning Concepts, Assessment Year, Financial Year, Income Tax Slabs, TDS, Advance Tax, LTCG, STCG, Carry Forward & Set-off, Estate Planning Concepts – Types of Will – Requirements of a Valid Will– Trust – Deductions - Exemptions
4	Retirement Planning/ Income Streams & Tax Savings Schemes
	<p>a) Retirement Planning:</p> <ul style="list-style-type: none"> • Understanding of different Salary Components, Introduction to Retirement Planning, Purpose & Need, Life Cycle Planning, Financial Objectives in Retirement Planning, Wealth Creation (Factors and Principles), Retirement (Evaluation & Planning), Pre & Post-Retirement Strategies - Tax Treatment <p>b) Income Streams & Tax Savings Schemes:</p> <ul style="list-style-type: none"> • Pension Schemes, Annuities- Types of Annuities, Various Income Tax Savings Schemes

11. Business Law

Course Code: UMS1BLW

Modules at a Glance

Sr. No.	Modules	No. of Lectures
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1	Contract Act, 1872 & Sale of Goods Act, 1930	15
2	Negotiable Instrument Act, 1981 & Consumer Protection Act, 1986	15
3	Company Law	15
4	Intellectual Property Rights(IPR)	15
Total		60

OBJECTIVES

Sr. No	Objectives
01	To provide students with practical legal knowledge of legal issues.
02	To provide knowledge of basic concept, ideas, techniques and process in the field of law.

Sr. No.	Modules / Units
1	Contract Act, 1872 & Sale of Goods Act, 1930
	<ul style="list-style-type: none"> • Contract Act, 1872: Essential elements of Contract; Agreement and Contract – Capacity to Contract, free consent, consideration, lawful objects/ consideration, Breach of contract. Remedies for breach of Contract. • Sale of Goods Act, 1930: Scope of Act, Sale and Agreement to sell, essential of a valid Sale Contract – Conditions and warranties – Implied Condition and warranties, Rights of an unpaid seller.
2	Negotiable Instrument Act, 1981 & Consumer Protection Act, 1986

	<ul style="list-style-type: none"> • Negotiable Instrument Act, 1981: Introduction of Negotiable Instruments – Characteristics of negotiable instruments, Promissory note, Bills of exchange, Cheque, Dishonour of Cheque. • Consumer Protection Act, 1986: Objects of Consumer Protection-Introduction of Consumers, who is consumer? Meaning of the words “Goods and services” – Meaning of the words “Defects and Deficiencies of goods and services” Consumer disputes and Complaints.
3	Company Law
	<ul style="list-style-type: none"> • Company Law: What is company?–Incorporation of company–MOA, AOA, Prospectus, Meetings, Meaning of transfer and transmission of shares.
4	Intellectual Property Rights(IPR)
	<ul style="list-style-type: none"> • Intellectual Property Rights(IPR) <ul style="list-style-type: none"> ▪ IPR definition/ objectives ▪ Patent definition. What is patentable? What is not patentable? Invention And its Attributes, Inventors and Applications ▪ Trademarks, definition, types of trademarks, infringement and passing off. ▪ Copy right definition and subject in which copy right exists, Originality, Meaning and Content, Authors and Owners, Rights and Restrictions. ▪ Geographical indications (only short notes)

12. Industrial Law

Course Code: UMS2ILW

Sr. No.	Modules	No. of Lectures
1	Laws Related to Industrial Relations and Industrial Disputes	15
2	Laws Related to Health, Safety and Welfare	15
3	Social Legislation	15
4	Laws Related to Compensation Management	15
Total		60

OBJECTIVES

Sr.No	Objectives
01	To emphasize on the practical aspects and uses of industrial law by the organization since the students will be joining the industry.
02	To familiarize them with the current industrial practices.

Sr. No.	Modules / Units
1	Laws Related to Industrial Relations and Industrial Disputes
	<ul style="list-style-type: none"> Industrial Disputes Act, 1947: Definition, Authorities, Awards, Settlements, Strikes Lockouts, Lay Offs, Retrenchment and Closure The Trade Union Act, 1926
2	Laws Related to Health, Safety and Welfare
	<ul style="list-style-type: none"> The Factory Act 1948: (Provisions related to Health, Safety and Welfare) The Workmen's Compensation Act, 1923 Provisions: <ul style="list-style-type: none"> Introduction: The doctrine of assumed risk, The doctrine of Common Employment, The doctrine of Contributory Negligence Definitions Employers liability for compensation (S-3 to 13) Rules as to Compensation (Sec 4 to Sec 9) (14 A & 17)
3	Social Legislation
	<ul style="list-style-type: none"> Employee State Insurance Act 1948: Definition and Employees Provident Fund Miscellaneous Provision Act 1948: Schemes, Administration and determination of dues
4	Laws Related To Compensation Management
	<ul style="list-style-type: none"> The payment of Wages Act 1948: Objectives, Definition, Authorized Deductions Payment of Bonus Act, 1965 The Payment Of Gratuity Act, 1972

13. E-Commerce and Digital Marketing

Course Code : UMS5EDM

Modules at a Glance

SN	Modules	No. of Lectures
1	Introduction to E-commerce	15
2	E-Business & Applications	15
3	Payment, Security, Privacy & Legal Issues in E-Commerce	15
4	Digital Marketing	15
Total		60

Objectives

SN	Objectives
1	To understand increasing significance of E-Commerce and its applications in Business and Various Sectors
2	To provide an insight on Digital Marketing activities on various Social Media platforms and its emerging significance in Business
3	To understand Latest Trends and Practices in E-Commerce and Digital Marketing, along with its Challenges and Opportunities for an Organisation

SN	Modules/ Units
1	Introduction to E-commerce
	<ul style="list-style-type: none"> Ecommerce- Meaning, Features of E-commerce, Categories of E-commerce, Advantages & Limitations of E-Commerce, Traditional Commerce & E-Commerce Ecommerce Environmental Factors: Economic, Technological, Legal , Cultural & Social Factors Responsible for Growth of E-Commerce, Issues in Implementing E-Commerce, Myths of E-Commerce Impact of E-Commerce on Business, Ecommerce in India Trends in E-Commerce in Various Sectors: Retail, Banking, Tourism, Government, Education Porter Value Chain in E-Commerce Meaning of M-Commerce, Benefits of M-Commerce, Trends in M-Commerce
2	E-Business & Applications
	<ul style="list-style-type: none"> E-Business: Meaning, Launching an E-Business, Different phases of Launching an E-Business Important Concepts in E-Business: Data Warehouse, Customer Relationship Management , Supply Chain Management, Enterprise Resource Planning Bricks and Clicks business models in E-Business: Brick and Mortar, Pure Online, Bricks and Clicks, Advantages of Bricks & Clicks Business Model, Superiority of Bricks and Clicks E-Business Applications: E-Procurement, E-Communication, E- Delivery, E- Auction, E-Trading. Electronic Data Interchange (EDI) in E-Business: Meaning of EDI, Benefits of EDI, Drawbacks of EDI, Applications of EDI. Website : Design and Development of Website, Advantages of Website, Principles of Web Design, Life Cycle Approach for Building a Website, Different Ways of Building a Website
3	Payment, Security, Privacy & Legal Issues in E-Commerce
	<ul style="list-style-type: none"> Issues Relating to Privacy and Security in E-Business Electronic Payment Systems: Features, Different Payment Systems :Debit Card, Credit Card ,Smart Card, E-cash, E-Cheque, E-wallet, Electronic Fund Transfer. Payment Gateway: Introduction, Payment Gateway Process, Payment Gateway Types, Advantages and Disadvantages of Payment Gateway. Types of Transaction Security E-Commerce Laws: Need for E-Commerce laws, E-Commerce laws in India, Legal Issues in E-commerce in India, IT Act 2000

SN	Modules/ Units
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4	Digital Marketing
	<ul style="list-style-type: none"> • Introduction to Digital Marketing, Advantages and Limitations of Digital Marketing. • Various Activities of Digital Marketing: Search Engine Optimization, Search Engine Marketing, Content Marketing & Content Influencer Marketing, Campaign Marketing, Email Marketing, Display Advertising, Blog Marketing, Viral Marketing, Podcasts & Vodcasts. • Digital Marketing on various Social Media platforms. • Online Advertisement, Online Marketing Research, Online PR • Web Analytics • Promoting Web Traffic • Latest developments and Strategies in Digital Marketing.

14. Sales and Distribution Management

Course Code : UMS5SDM

Modules at a Glance

SN	Modules	No. of Lectures
1	Introduction	15
2	Market Analysis and Selling	15
3	Distribution Channel Management	15
4	Performance Evaluation, Ethics and Trends	15
Total		60

Objectives

SN	Objectives
1	To develop understanding of the sales & distribution processes in organizations
2	To get familiarized with concepts, approaches and the practical aspects of the key decision making variables in sales management and distribution channel management

SN	Modules/ Units
1	Introduction
	<p>a) Sales Management:</p> <ul style="list-style-type: none"> ● Meaning, Role of Sales Department, Evolution of Sales Management ● Interface of Sales with Other Management Functions ● Qualities of a Sales Manager ● Sales Management: Meaning, Developments in Sales Management- Effectiveness to Efficiency, Multidisciplinary Approach, Internal Marketing, Increased Use of Internet, CRM, Professionalism in Selling. ● Structure of Sales Organization – Functional, Product Based, Market Based, Territory Based, Combination or Hybrid Structure <p>b) Distribution Management:</p> <ul style="list-style-type: none"> ● Meaning, Importance, Role of Distribution, Role of Intermediaries, Evolution of Distribution Channels. <p>c) Integration of Marketing, Sales and Distribution</p>
2	Market Analysis and Selling

a) Market Analysis:

- Market Analysis and Sales Forecasting, Methods of Sales Forecasting
- Types of Sales Quotas – Value Quota, Volume Quota, Activity Quota, Combination Quota
- Factors Determining Fixation of Sales Quota
- Assigning Territories to Salespeople

b) Selling:

- Process of Selling, Methods of Closing a Sale, Reasons for Unsuccessful Closing
- Theories of Selling – Stimulus Response Theory, Product Orientation Theory, Need Satisfaction Theory
- Selling Skills – Communication Skill, Listening Skill, Trust Building Skill, Negotiation Skill, Problem Solving Skill, Conflict Management Skill
- Selling Strategies – Softsell Vs. Hardsell Strategy, Client Centered Strategy, Product-Price Strategy, Win-Win Strategy, Negotiation Strategy
- Difference Between Consumer Selling and Organizational Selling
- Difference Between National Selling and International Selling

SN	Modules/ Units
3	Distribution Channel Management
	<ul style="list-style-type: none">• Management of Distribution Channel – Meaning & Need• Channel Partners- Wholesalers, Distributors and Retailers & their Functions in Distribution Channel, Difference Between a Distributor and a Wholesaler• Choice of Distribution System – Intensive, Selective, Exclusive• Factors Affecting Distribution Strategy – Locational Demand, Product Characteristics, Pricing Policy, Speed or Efficiency, Distribution Cost• Factors Affecting Effective Management Of Distribution Channels<ul style="list-style-type: none">▪ Channel Design▪ Channel Policy▪ Channel Conflicts: Meaning, Types – Vertical, Horizontal, Multichannel, Reasons for Channel Conflict▪ Resolution of Conflicts: Methods – Kenneth Thomas’s Five Styles of Conflict Resolution▪ Motivating Channel Members▪ Selecting Channel Partners▪ Evaluating Channels

- Channel Control

4

Performance Evaluation, Ethics and Trends

a) Evaluation & Control of Sales Performance:

- Sales Performance – Meaning
- Methods of Supervision and Control of Sales Force
- Sales Performance Evaluation Criteria- Key Result Areas (KRAs)
- Sales Performance Review
- Sales Management Audit

b) Measuring Distribution Channel Performance:

- Evaluating Channels- Effectiveness, Efficiency and Equity
- Control of Channel – Instruments of Control – Contract or Agreement, Budgets and Reports, Distribution Audit

c) Ethics in Sales Management

d) New Trends in Sales and Distribution Management

15. International Marketing

Course Code : UMS6INM

Modules at a Glance

SN	Modules	No. of Lectures
1	Introduction to International Marketing & Trade	15
2	International Marketing Environment and Marketing Research	15
3	International Marketing Mix	15
4	Developments in International Marketing	15
Total		60

Objectives

SN	Objectives
1	To understand International Marketing, its Advantages and Challenges.
2	To provide an insight on the dynamics of International Marketing Environment.
3	To understand the relevance of International Marketing Mix decisions and recent developments in Global Market

SN	Modules/ Units
1	Introduction to International Marketing & Trade

	<p>a) Introduction of International Marketing:</p> <ul style="list-style-type: none"> Meaning, Features of International Marketing, Need and Drivers of International Marketing, Process of International Marketing, Phases of International Marketing, Benefits of International Marketing, Challenges of International Marketing, Difference between Domestic and International Marketing, Different Orientations of International Marketing : EPRG Framework, Entering International Markets :Exporting, Licensing, Franchising, Mergers and Acquisition, Joint Ventures, Strategic Alliance, Wholly Owned Subsidiaries, Contract Manufacturing and Turnkey Projects, Concept of Globalization <p>b) Introduction to International Trade:</p> <ul style="list-style-type: none"> Concept of International Trade, Barriers to Trade: Tariff and Non Tariff, Trading Blocs : SAARC, ASEAN, NAFTA, EU, OPEC
2	International Marketing Environment and Marketing Research
	<p>a) International Marketing Environment:</p> <ul style="list-style-type: none"> Economic Environment : International Economic Institution (World Bank, IMF, IFC) ,International Economic Integration (Free Trade Agreement, Customs Union, Common Market, Economic Union) Political and Legal Environment: Political System (Democracy, Authoritarianism, Communism), Political Risk, Political Instability, Political Intervention. Legal Systems (Common Law, Civil Law, Theocratic Law), Legal Differences, Anti Dumping Law and Import License. Cultural Environment : Concept , Elements of Culture (Language, Religion, Values and Attitude , Manners and Customs, Aesthetics and Education) , HOFSTEDE's Six Dimension of Culture , Cultural Values (Individualism v/s Collectivism) <p>b) Marketing Research:</p> <ul style="list-style-type: none"> Introduction, Need for Conducting International Marketing Research, International Marketing Research Process, Scope of International Marketing Research, IT in Marketing Research
3	International Marketing Mix
	<p>a) International Product Decision</p> <ul style="list-style-type: none"> International Product Line Decisions, Product Standardization v/s Adaptation Argument, International Product Life Cycle, Role of Packaging and Labelling in International Markets, Branding Decisions in International Markets, International Market Segmentation and Targeting, International Product Positioning
SN	Modules/ Units

b) International Pricing Decision:

- Concept of International Pricing, Objectives of International Pricing, Factors Affecting International Pricing
- International Pricing Methods: Cost Based, Demand Based, Competition Based , Value Pricing, Target Return Pricing and Going Rate Pricing
- International Pricing Strategies : Skimming Pricing, Penetration Pricing , Predatory Pricing
- International Pricing Issues : Gray Market , Counter Trade, Dumping, Transfer Pricing
- Overview of Foreign Currency involved in International Marketing

c) International Distribution Decisions

- Concept of International Distribution Channels, Types of International Distribution Channels, Factors Influencing Selection of International Distribution Channel, Mode of Transportation in International Marketing

d) International Promotion Decisions

- Concept of International Promotion Decision
- Planning International Promotional Campaigns: Steps - Determine the Target Audience, Determine Specific Campaigns, Determine Budget, Determine Message, Determine Campaign Approach and Determine Campaign Effectiveness
- Standardization V/S Adaptation of International Promotional Strategies
- International Promotional Tools/Elements

4 Developments in International Marketing

a) Introduction -Developing International Marketing Plan:

- Preparing International Marketing Plan, Examining International Organisational Design, Controlling International Marketing Operations, Devising International Marketing Plan

b) International strategies:

- Need for International Strategies, Types of International Strategies

c) International Marketing of Services

- Concept of International Service Marketing, Features of International Service Marketing, Need of International Service Marketing, Drivers of Global Service Marketing, Advantages and Disadvantages of Global Service Marketing, Service Culture

16.Brand Management

Course Code : UMS6BRM

Modules at a Glance

SN	Modules	No. of Lectures
1	Introduction to Brand Management	15
2	Planning and Implementing Brand Marketing Programs	15
3	Measuring and Interpreting Brand Performance	15
4	Growing and Sustaining Brand Equity	15
Total		60

Objectives

SN	Objectives
1	To understand the meaning and significance of Brand Management
2	To Know how to build, sustain and grow brands
3	To know the various sources of brand equity

SN	Modules/ Units
1	Introduction to Brand Management
	a) Introduction to Brand Management: <ul style="list-style-type: none">• Meaning of Brand, Branding, Brand Management, Importance of Branding to Consumers, Firms, Brands v/s Products, Scope of Branding, Branding Challenges and Opportunities, Strategic Brand Management Process, Customer Based Brand Equity model (CBBE), Sources of Brand Equity, Steps of Brand Building including Brand Building Blocks, Brand Positioning: Meaning, Importance, Basis

2	Planning and Implementing Brand Marketing Programs
	<p>a) Planning and Implementing Brand Marketing Programs:</p> <ul style="list-style-type: none"> • Brand Elements: Meaning, Criteria for choosing Brand Elements, Types of Brand Elements • Integrating Marketing Programs and Activities • Personalising Marketing: Experiential Marketing, One to One Marketing, Permission Marketing • Product Strategy: Perceived Quality and Relationship Marketing • Pricing Strategy: Setting Prices to Build Brand Equity • Channel Strategy: Direct, Indirect Channels • Promotion Strategy: Developing Integrated Marketing Communication Programs • Leveraging Secondary Brand Associations to Build Brand Equity: Companies, Countries, Channel of Distribution, Co-branding, Characters, Events.
3	Measuring and Interpreting Brand Performance
	<p>a) The Brand Value Chain</p> <p>b) Measuring Sources of Brand Equity:</p> <ul style="list-style-type: none"> • Qualitative Research Techniques: Projective Techniques: Completion, Comparison, Brand Personality and Values: The Big Five, Free Association • Quantitative Research Techniques: Brand Awareness: Recognition, Recall, Brand Image, Brand Responses <p>c) Young and Rubicam's Brand Asset Valuator</p> <p>d) Measuring Outcomes of Brand Equity</p> <ul style="list-style-type: none"> • Comparative Methods: Brand based Comparative Approaches, Marketing Based Comparative Approaches, Conjoint Analysis • Holistic Methods: Residual Approaches, Valuation Approaches: Historical Perspectives and Interbrand's Brand Valuation Methodology

4	Growing and Sustaining Brand Equity
	<p>a) Designing & Implementing Branding Strategies:</p> <ul style="list-style-type: none"> ● Brand Architecture: Meaning of Brand Architecture, The Brand-Product Matrix, Breadth of a Branding Strategy, Depth of a Branding Strategy ● Brand Hierarchy: Meaning of Brand Hierarchy, Building Equity at Different Hierarchy Levels ● Cause Marketing to Build Brand Equity: Meaning of Cause Marketing, Advantages, Green Marketing <p>b) Brand Extensions:</p> <ul style="list-style-type: none"> ● Meaning, Advantages, Disadvantages, Brand Extension and Brand Equity <p>c) Managing Brands over Time:</p> <ul style="list-style-type: none"> ● Reinforcing Brands, Revitalising Brands <p>d) Building Global Customer Based Brand Equity</p>

17. Strategic Management

Course Code: UMS3SMG
Modules at a Glance

Sr. No.	Modules	No. of Lectures
1	Introduction	12
2	Strategy Formulation	16
3	Strategic Implementation	18
4	Strategic Evaluation & Control	14
Total		60

Objectives

SN	Objectives
1	The objective of this course is to learn the management policies and strategies at every Level to develop conceptual skills in this area as well as their application in the corporate world.
2	The focus is to critically examine the management of the entire enterprise from the Top Management viewpoints.
3	This course deals with corporate level Policy & Strategy formulation areas. This course aims to developing conceptual skills in this area as well as their application in the corporate world.

Sr. No.	Modules / Units
1	Introduction
	<ul style="list-style-type: none"> • Business Policy-Meaning, Nature,Importance • Strategy-Meaning,Definition • Strategic Management-Meaning,Definition,Importance, Strategic management • Process&Levelsof Strategyand Concept and importanceof Strategic Business Units (SBU's) • StrategicIntent-Mission, Vision, Goals,Objective, Plans
2	StrategyFormulation
	<ul style="list-style-type: none"> • EnvironmentAnalysisand Scanning(SWOT) • CorporateLevel Strategy (Stability, Growth,Retrenchment,Integration andInternationalization) • BusinessLevel Strategy(CostLeadership,Differentiation,Focus) • FunctionalLevel Strategy(R&D,HR,Finance,Marketing,Production)
3	Strategic Implementation
	<ul style="list-style-type: none"> • Models of Strategymaking. • StrategicAnalysis&Choices &Implementation: BCG Matrix, GE 9Cell, Porter5 Forces, 7S FrameWork • Implementation: Meaning, Steps and implementation at Project, Process, Structural,Behavioural,Functionallevel.
4	Strategic Evaluation&Control
	<p>Strategic Evaluation&Control– Meaning, StepsofEvaluation & Techniques of Control</p> <p>Synergy:Concept ,Types , evaluation of Synergy.Synergyas a Component of Strategy&its Relevance.</p> <p>ChangeManagement– ElementaryConcept</p>

18. Integrated Marketing Communication

Course Code: UMS4IMC

Modules at a Glance

Sr. No.	Modules	No. of Lectures
1	Introduction to Integrated Marketing Communication	15
2	Elements of IMC – I	15
3	Elements of IMC – II	15
4	Evaluation & Ethics in Marketing Communication	15
Total		60

Objectives

SN	Objectives
1	To equip the students with knowledge about the nature, purpose and complex construction in the planning and execution of an effective Integrated Marketing Communication (IMC) program.
2	To understand the various tools of IMC and the importance of co-ordinating them for an effective marketing communication program.

Sr. No.	Modules / Units
1	Introduction to Integrated Marketing Communication
	<ul style="list-style-type: none"> • Meaning, Features of IMC, Evolution of IMC, Reasons for Growth of IMC. • Promotional Tools for IMC, IMC planning process, Role of IMC in Marketing • Communication process, Traditional and alternative Response Hierarchy Models, One voice communication v/s IMC. • Establishing objectives and Budgeting: Determining Promotional Objectives, Sales vs Communication Objectives, DAGMAR, Problems in setting objectives, setting objectives for the IMC Program.
2	Elements of IMC – I
	<ul style="list-style-type: none"> • Advertising – Features, Role of Advertising in IMC, Advantages and Disadvantages, Types of Advertising, Types of Media used for advertising. • Sales promotion – Scope, role of Sales Promotion as IMC tool, Reasons for the growth, Advantages and Disadvantages, Types of Sales Promotion, objectives of consumer and trade promotion, strategies of consumer promotion and trade promotion, sales promotion campaign, evaluation of Sales Promotion campaign.
3	Elements of IMC – II
	<ul style="list-style-type: none"> • Direct Marketing - Role of direct marketing in IMC, Objectives of Direct Marketing, Components for Direct Marketing, Tools of Direct Marketing – direct mail, catalogues, direct response media, internet, telemarketing, alternative media evaluation of effectiveness of direct marketing • Public Relations and Publicity – Introduction, Role of PR in IMC, Advantages and Disadvantages, Types of PR, Tools of PR ,Managing PR – Planning, implementation, evaluation and Research, Publicity, Sponsorship – definition, Essentials of good sponsorship, event sponsorship, cause sponsorship • Personal Selling – Features, Role of Personal Selling in IMC, advantages and disadvantages of Personal Selling, Selling process, Importance of Personal Selling
4	Evaluation & Ethics in Marketing Communication
	<ul style="list-style-type: none"> • Evaluating an Integrated Marketing program – Evaluation process of IMC – Message Evaluations, Advertising tracking research – copy testing – emotional reaction test, cognitive Neuro science – online evaluation, Behavioural Evaluation – sales and response rate, POPAI, Toll free numbers, QR codes and facebook likes, response cards, Internet responses, redemption rate Test Markets – competitive responses, scanner data, Purchase simulation tests • Ethics and Marketing communication – stereotyping, targeting vulnerable customers, offensive brand messages – legal issues – Commercial free speech, misleading claims, puffery, fraud, questionable B2B practices • Current Trends in IMC –/ Digital Marketing – concept and importance, Internet & IMC, Advertising on internet, PR through Internet Banner, Sales promotion on Internet, direct marketing on internet, Role of AI in IMC- Chatbots & Programmatic advertising.

19. Production & Total Quality Management

Course Code: UMS4PTQ

Modules at a Glance

Sr. No.	Modules	No. of Lectures
1	Production Management	14
2	Materials Management	16
3	Basics Of Productivity & TQM	16
4	Quality Improvement Strategies & Certifications	14
Total		60

Objectives

SN	Objectives
1	To acquaint learners with the basic management decisions with respect to production and quality management
2	To make the learners understand the designing aspect of production systems
3	To enable the learners apply what they have learnt theoretically.

Sr. No.	Modules / Units
1	Production Management
	<p>Production Management</p> <ul style="list-style-type: none"> Objectives, Components–Manufacturing systems :Intermittent and Continuous Production Systems. Product Development, Classification and Product Design. Plant location & Plant layout– Objectives, Principles of good product layout, types of layout. Importance of purchase management. Production Batch, Batch Release & Batch Certificate of analysis.
2	Materials Management
	<ul style="list-style-type: none"> Materials Management: Concept, Objectives and importance of materials management Various types of Material Handling Systems. Inventory Management: Importance–Inventory Control Techniques ABC, VED, FSN, GOLF, XYZ, SOS, HML. EOQ: Assumptions limitations & advantages of Economic Order Quantity, Simple numerical on EOQ, Lead Time, Reorder Level, Safety Stock.
3	Basics Of Productivity &TQM
	<ul style="list-style-type: none"> Basics Of Productivity &TQM: Concepts of Productivity, modes of calculating productivity. Importance Of Quality Management, factors affecting quality; TQM– concept and importance, Cost of Quality, Philosophies and Approaches To Quality: Edward Deming, J. Juran , Kaizen , P. Crosby's philosophy. Product & Service Quality Dimensions, SERVQUAL Characteristics of Quality, Quality Assurance, Quality Circle : Objectives Of Quality Circles, Ishikawa Fish Bone, Applications in Organizations. Simple numerical on productivity
4	Quality Improvement Strategies &Certifications
	<ul style="list-style-type: none"> Quality Improvement Strategies &Certifications: Lean Thinking, Kepner Tregor Methodology of problem solving, Sigma features, Enablers, Goals, DMAIC/DMADV. TAGUCHI'S QUALITYENGINEERING, ISO9000 ,ISO 1400, QS9000. Quality Audit.

20. Information Technology in Business Management- I

Course Code: UMS3IT1

Modules at a Glance

Sr. No.	Module s	No. of Lecture s
1	Introduction to IT Support in Management	15
2	Office Automation using MS-Office	15
3	Introduction to Google Forms	10
4	Email, Internet and its Applications	10
5	E-Security	10
Total I		60

Objectives

S N	Objective s
1	To learn basic concepts of Information Technology, its support and role in Management, for managers
2	Module II comprises of practical hands on training required for office automation. It is expected to have practical sessions of latest MS-Office software
3	To understand basic concepts of Email, Internet and websites, domains and security therein
4	To recognize security aspects of IT in business, highlighting electronic transactions, advanced security features

Sr. No.	Modules / Units
1	Introduction to IT Support in Management
	<ul style="list-style-type: none"> • Information Technology concepts Concept of Data, Information and Knowledge Concept of Database • Introduction to Information Systems and its major components. Types and Levels of Information systems. Main types of IT Support systems Computer based Information Systems (CBIS) <ul style="list-style-type: none"> ▪ Types of CBIS - brief descriptions and their interrelationships/hierarchies ▪ Office Automation System(OAS) ▪ Transaction Processing System(TPS) ▪ Management Information System(MIS) ▪ Decision Support Systems (DSS) ▪ Executive Information System(EIS) ▪ Knowledge based system, Expert system • Success and Failure of Information Technology. Failures of Nike and AT&T • IT Development Trends. Major areas of IT Applications in Management • Concept of Digital Economy and Digital Organization. • IT Resources Open Source Software - Concept and Applications. Study of Different Operating Systems. (Windows / Linux/ DOS)
2	Office Automation using MS Office
	<ul style="list-style-type: none"> • Learn Word: Creating/Saving of Document Editing and Formatting Features Designing a title page, Preparing Index, Use of SmartArt Cross Reference, Bookmark and Hyperlink. Mail Merge Feature. • Spreadsheet application (e.g. MS-Excel/openoffice.org) Creating/Saving and editing spreadsheets Drawing charts. Using Basic Functions: text, math & trig, statistical, date & time, database, financial, logical Using Advanced Functions : Use of VLookup/HLookup Data analysis – sorting data, filtering data (AutoFilter , Advanced Filter), data validation, what-if analysis (using data tables/scenarios), creating sub-totals and grand totals, pivot table/chart, goal seek/solver, • Presentation Software Creating a presentation with minimum 20 slides with a script. Presenting in

	<p>different views, Inserting Pictures, Videos, Creating animation effects on them Slide Transitions, Timed Presentations Rehearsal of presentation</p>
3	Introduction to Google Forms
	<ul style="list-style-type: none"> • Google Forms <ul style="list-style-type: none"> Definition, Uses & Applications Creating/Saving and editing Google Forms Add Questions, Title, Image, Video, Section & Required field Import Questions, Customize Theme, Delete, Copy, Undo, Print, Add Collaborators, Add-ons & Preferences • Validation <ul style="list-style-type: none"> Length, Number, Maximum Character • Settings <ul style="list-style-type: none"> General, Presentation & Quiz • Preview your Google Form • Send Google Form <ul style="list-style-type: none"> E-mail, Link & Html Embed Share forms via Facebook & Twitter • Responses <ul style="list-style-type: none"> Individual & Summary Responses Download Responses (.csv), Get E-mail notifications for new responses <p>Create a Questionnaire using Google Form with minimum 20 Questions</p>
4	Email, Internet and its Applications
	<ul style="list-style-type: none"> • Introduction to Email <ul style="list-style-type: none"> Writing professional emails Creating digitally signed documents. • Use of Outlook : Configuring Outlook, Creating and Managing profile in outlook, Sending and Receiving Emails through outlook Emailing the merged documents. Introduction to Bulk Email software • Internet <ul style="list-style-type: none"> Understanding Internet Technology Concepts of Internet, Intranet, Extranet Networking Basics, Different types of networks. Concepts (Hubs, Bridges, Routers, IP addresses) Study of LAN, MAN, WAN • DNS Basics. <ul style="list-style-type: none"> Domain Name Registration, Hosting Basics. • Emergence of E-commerce and M-Commerce <ul style="list-style-type: none"> Concept of E-commerce and M-Commerce Definition of E-commerce and M-Commerce Business models of e-commerce: models based on transaction party (B2B, B2C, B2G, C2B, C2C, E-Governance)

	Models based on revenue models, Electronics Funds Transfer, Electronic Data Interchange.
5	E-Security Systems <ul style="list-style-type: none"> • Threats to Computer systems and control measures. <ul style="list-style-type: none"> Types of threats Virus, hacking, phishing, spyware, spam, physical threats (fire, flood, earthquake, vandalism) Threat Management • IT Risk <ul style="list-style-type: none"> Definition, Measuring IT Risk, Risk Mitigation and Management • Information Systems Security • Security on the internet <ul style="list-style-type: none"> Network and website security risks Website Hacking and Issues therein. Security and Email • E-Business Risk Management Issues <ul style="list-style-type: none"> Firewall concept and component, Benefits of Firewall • Understanding and defining Enterprise wide security framework • Information Security Environment in India with respect to real Time Application in Business <ul style="list-style-type: none"> Types of Real Time Systems, Distinction between Real Time, On – line and Batch Processing System. Real Time Applications viz. Railway / Airway / Hotel Reservation System, ATMs, EDI Transactions - definition, advantages, examples;E-Cash, Security requirements for Safe E-Payments Security measures in International and Cross Border financial transactions • Threat Hunting Software

21. Media Planning and Management

Course Code : UMS6MPM

Modules at a Glance

S N	Modules	No. of Lecture s
1	Overview of Media and Media Planning	15
2	Media Mix & Media Strategy	15
3	Media Budgeting, Buying & Scheduling	15
4	Media Measurement, Evaluation	15
Total		60

Objectives

SN	Objectives
1	To understand Media Planning, Strategy and Management with reference to current business scenario.
2	To know the basic characteristics of all media to ensure most effective use of advertising budget.
3	To provide an insight on Media Planning, Budgeting, Scheduling and Evaluating the Different Media Buys.

SN	Module s/ Units
1	Overview of Media and Media Planning

	<p>a) Overview of Media and Media Planning:</p> <ul style="list-style-type: none"> • Meaning of Media & Features of Media, Meaning of Media Planning , Scope of Media planning , Media Planning Elements, Role of Media in Business, Media Planning Process, Impact of Marketing Objectives on Media Planning, Factors Influencing Media Planning Decisions, Role and Importance of Media in Consumer Buying Decision, Role of Media Planner, Challenges of Media Planning, Organization Structure of Media Company, Regulatory Framework and Legal Aspects in Media Planning <p>b) Media Research:</p> <ul style="list-style-type: none"> • Meaning, Role and Importance • Sources of Media Research : Audit Bureau of Circulation, Press Audits, National Readership Survey/IRS, Businessmen's Readership Survey, TRP, National Television Study, ADMAR Satellite Cable Network Study, Reach and Coverage Study, CIB Listenership Survey
2	Media Mix and Media Strategy
	<p>a) Media Mix:</p> <ul style="list-style-type: none"> • Meaning, Need for Media Mix, Identifying Audience for Mass Media , Factors Affecting Media Mix Decision, Types of Media Mix Decisions: Broad Media Classes, Media Vehicles, Media Units, Deciding Ideal Media Mix <p>b) Media Choices:</p> <ul style="list-style-type: none"> • Print Meaning- Factors Affecting Selection of Print Media Decisions , Types of Print Media, Advantages and Limitations • Television- Meaning, Factors Affecting Selection of Television Media Decisions, Advantages and Limitations • Radio- Meaning, Factors Affecting Selection of Radio Media Decision, Advantages and Limitations • Out of Home (OOH)- Meaning, Types of OOH, Factors Affecting OOH Planning Decision, Advantages and Limitations <p>c) Emerging Media:</p> <ul style="list-style-type: none"> • Online, Mobile, Gaming, In flight, In Store, Interactive Media, Digital Marketing <p>d) Media Strategy:</p> <ul style="list-style-type: none"> • Meaning, Need for Media Strategy, Situation Analysis for Media Strategy and its Components • Steps in Formulating Media Strategies: Defining the Target Group, Market

Prioritization, Media Weights, Media Mix, Media Scheduling.

SN	Modul es/ Units
3	Media Budgeting, Buying & Scheduling

a) Media Budget

- Meaning
- Factors to be considered while Framing a Budget: Advertising Task, Competitive Framework, Market Dominance, Market Coverage, Media Cost, Market Task, Pricing ,Frequency of Purchase
- Importance of Media Budget.
- Methods of Setting Media Budget - Status Quo, Inflation Adjusted, Advertising Sales, Case Rate & Advertising Margin Method, Share of Market, Yardstick Method, Effective Frequency & Reach Method & Margin Analysis ROI Based Approach, Experimental Approach, Break Even Planning.

b) Media Buying:

- Meaning, Role of Media Buyer, Objectives of Media Buying,
- Buying Process: Buying Brief, Environmental Analysis, Science and Art of Buying, Benchmarking Buying Plan Presentation Deal Management and Post Buy
- Buying brief: Concept & Elements of Buying Brief, Art of Media Buying –
Negotiation in Media Buying, Plan Presentation and Client Feedback
- Criteria in Media Buying

c) Media Scheduling

- Meaning, Importance
- Factors Affecting Scheduling: Sales Pattern, Purchase Cycle, Product Availability, Competitive Activity, Marketing Task, Budget Constraints, Target Group.
- Scheduling Patterns – Continuity, Flighting, Pulsing
- Scheduling Strategies for Creating Impact: Road Block , Day or Day part
- Emphasis, Multiple Spotting, Teasers

SN	Modules / Units
4	Developments in International Marketing
	<p>a) Media Measurement:</p> <ul style="list-style-type: none"> • Basic Metrics: Reach, Cumulative/Frequency Reach, Discrete & Cumulative distribution, Average Opportunity to See (AOTS), Effective frequency/Reach • Television Metrics: Dairy v/s Peoplemeter, TRP, TVR, Program Reach & Time Spent, Stickiness Index, Ad Viewership • Radio Metrics: Arbitron Radio Rating • Print Metrics: Circulation, Average Issue Readership (AIR), Total or Claimed Reader, Sole or Solus reader. • OOH Metrics: Traffic Audit Bureau (TAB) <p>b) Benchmarking Metrics:</p> <ul style="list-style-type: none"> • Share, Profile, and Selectivity Index <p>c) Plan Metrics:</p> <ul style="list-style-type: none"> • Gross Rating Points (GRP), Gross Impressions (GI), Share of Voice (SOV). <p>d) Evaluating Media Buys</p> <ul style="list-style-type: none"> • Evaluating Television Media Buying: Dysfunctional Card Rate, Secondary and Effective Rate, Deal Composition, Cost Per Rating Point(CPRP), Reach Delivered by the Buy, Visibility Spots, Bonus Percentage, Upgrades and Spot Fixing, Sponsorships • Evaluating Print Media Buying: Discount on Rate Card, Negotiated Rate, Cost Per Thousand (CPT), Market Share Incentives, Readership v/s Circulation Track, Growth Incentives, Combination Rate Incentives, Full Page Discounts and Size Upgrades, Discount for Colour Ads, Date Flexibility Incentives, Positioning, Innovations. • Evaluating Other Media Buys: Radio Buys, Outdoor Buys, Cinema Buys, Internet Buys, and Mobile Buys

22. Elective Courses (EC)
Group A. Finance Electives
Corporate Restructuring
Course Code: UMS4COR
Modules at a Glance

Sr. No.	Modules	No. of Lectures
1	Corporate Restructuring – Introduction and Concepts (Only Theory)	15
2	Accounting of Internal Reconstruction (Practical and theory)	15
3	Accounting of External Reconstruction (Amalgamation/ Mergers/ Takeovers and Absorption)(Practical and theory)	15
4	Impact of Reorganization on the Company - An Introduction (Only Theory)	15
Total		60

Objectives

SN	Objectives
1	To impart knowledge relating to legal, accounting and practical implementation of corporate restructuring.
2	The subject covers the complex facets of corporate restructuring process

Sr. No.	Modules / Units
1	Corporate Restructuring – Introduction and Concepts (Only Theory)
	<ul style="list-style-type: none"> Corporate Restructuring - Historical Background, Meaning of Corporate Restructuring, Corporate Restructuring as a Business Strategy, Need and Scope of Corporate Restructuring. Planning, Formulation and Execution of Various Restructuring Strategies, Important Aspects to be considered while Planning or Implementing Corporate Restructuring Strategies. Forms of Restructuring - Merger, Demerger, Reverse merger , Disinvestment , Takeover/acquisition, Joint Venture (JV), Strategic Alliance, Franchising and Slump sale
2	Accounting of Internal Reconstruction (Practical and theory)
	<ul style="list-style-type: none"> Need for reconstruction and Company Law provisions, Distinction between internal and external reconstructions Methods including alteration of share capital, variation of share-holder rights, sub division, consolidation, surrender and reissue/cancellation, reduction of share capital, with relevant legal provisions and accounting treatments for same.
3	Accounting of External Reconstruction (Amalgamation/ Mergers/ Takeovers and Absorption)(Practical and theory)
	<ul style="list-style-type: none"> In the nature of merger and purchase with corresponding accounting treatments of pooling of interests and purchase methods respectively Computation and meaning of purchase consideration and Problems based on purchase method of accounting only.
4	Impact of Reorganization on the Company - An Introduction (Only Theory)
	<ul style="list-style-type: none"> Change in the Internal Aspects on Reorganization – Change of Name and Logo, Revised Organization Chart, Communication, Employee Compensation, Benefits and Welfare Activities, Aligning Company Policies, Aligning Accounting and Internal Database Management Systems, Re-Visiting Internal Processes and Re-Allocation of People Change in External Aspects on Reorganization - Engagement with Statutory Authorities, Revised ISO Certification and Similar Other Certifications, Revisiting past Government approvals, decisions and other contracts. Impact of Reorganization - Gain or Loss to Stakeholders, Implementation of Objectives, Integration of Businesses and Operations, Post Merger Success and Valuation and Impact on Human and Cultural Aspects.

23. Elective Courses (EC)
Group A. Finance Electives
Corporate Finance
Course Code: UMS3COF
Modules at a Glance

Sr. No.	Modules	No. of Lectures
1	Introduction	15
2	Capital Structure and Leverage	15
3	Time Value of Money	15
4	Mobilisation of Funds	15
Total		60

Objectives

SN	Objectives
1	The objectives of develop a conceptual frame work of finance function and to acquaint the participants with the tools techniques and process of financial management in the realm of financial decision making
2	The course aims at explaining the core concepts of corporate finance and its importance in managing a business
3	To providing understanding of nature, importance, structure of corporate finance related areas and to impart knowledge regarding source of finance for a business

Sr. No.	Modules / Units
1	Introduction
	<ul style="list-style-type: none"> • Introduction To Corporate Finance: Meaning, Principles of Corporate Finance, Significance of Corporate Finance, Amount of Capitalisation, Over Capitalisation and Under Capitalisation, Fixed capital and Working Capital funds. • Introduction to ownership securities– Ordinary Shares, Reference Shares, Creditor Ship Securities, Debtors and Bonds, Convertible Debentures, Concept of Private Placement of Securities.
2	Capital Structure and Leverage
	<ul style="list-style-type: none"> • Introduction to Capital Structure theories, EBIT – EPS analysis for Capital Structure decision. • Cost of Capital – Cost of Debt, Cost of Preference Shares, Cost of Equity Shares and Cost of Retained Earnings, Calculation of Weighted Cost of Capital. • Introduction to concept of Leverage - Operating Leverage, Financial Leverage and Combined Leverage.
3	Time Value of Money
	<ul style="list-style-type: none"> • Introduction to Time Value of Money – compounding and discounting • Introduction to basics of Capital Budgeting (time value of money based methods) – NPV and IRR (Net Present Value and Internal Rate of Return) • Importance of Risk and Return analysis in Corporate Finance
4	Mobilisation of Funds
	<p>Public deposits and RBI regulations, Company deposits and SEBI regulations, Protection of depositors, RBI and public deposits with NBFC's.</p> <p>Foreign capital and collaborations, Foreign direct Investment (FDI)</p> <p>Emerging trends in FDI</p> <p>Global Depositary Receipts, Policy development, Capital flows and Equity Debt.</p> <p>Brief introduction & sources of short term Finance Bank Overdraft, Cash Credit, Factoring</p>

24. Elective Courses (EC)
Group C. Human Resource Electives
Motivation & Leadership
Course Code: UMS3M&L
Modules at a Glance

Sr. No.	Modules	No. of Lectures
1	Motivation –I	12
2	Motivation-II	15
3	Leadership-I	17
4	Leadership-II	16
Total		60

Objectives

SN	Objectives
1	To gain knowledge of the leadership strategies for motivating people and changing organizations
2	To study how leaders facilitate group development and problem solving and work through problems and issues as well as transcend differences
3	To acquaint the students about practical approaches to Motivation and Leadership & its application in the Indian context

Sr.	Modules / Units
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No.	
1	Motivation-I
	<ul style="list-style-type: none"> • Concept of motivation, Importance, Tools of Motivation. • Theory Z, Equity theory. • Process Theories-Vroom's Expectancy Theory, Valency-Four drive model.
2	Motivation-II
	<ul style="list-style-type: none"> • East v/s West, motivating workers (in context to Indian workers) • The Indian scene – basic differences. • Work –Life balance – concept, differences, generation and tips on work life balance.
3	Leadership-I
	<ul style="list-style-type: none"> • Leadership– Meaning, Traits and Motives of an Effective Leader, Styles of Leadership. • Theories –Trait Theory, Behavioural Theory, Path Goal Theory. • Transactional v/s Transformational leaders. • Strategic leaders– meaning, qualities. • Charismatic Leaders– meaning of charisma, Qualities, characteristics, types of charismatic leaders (socialized, personalized, office-holder, personal, divine)
4	Leadership-II
	<ul style="list-style-type: none"> • Great leaders, their style, activities and skills (Ratan Tata, Narayan Murthy, Dhiru bhai Ambani, Bill Gates, Mark Zuckerberg, Donald Trump) Sudha Murthy. • Characteristics of creative leaders and organization methods to enhance creativity (Andrew Dubrein). • Contemporary issues in leadership–Leadership roles, team leadership, mentoring, self leadership, online leadership, finding and creating effective leader.

25. Business Planning & Entrepreneurial Management

Course Code: UMS3BPM
Modules at a Glance

Sr. No.	Modules	No. of Lectures
1	Foundations of Entrepreneurship Development	15
2	Types & Classification Of Entrepreneurs	15
3	Entrepreneur Project Development & Business Plan	15
4	Venture Development	15
Total		60

Objectives

SN	Objectives
1	Entrepreneurship is one of the major focus are as of the discipline of Management. This course introduces Entrepreneurship to budding managers.
2	To develop entrepreneurs & to prepare students to take the responsibility of full line of management function of a company with special reference to SME sector.

Sr. No.	Modules / Units
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1	Foundations of Entrepreneurship Development:
	<ul style="list-style-type: none"> • Foundations of Entrepreneurship Development: Concept and Need of Entrepreneurship Development Definition of Entrepreneur, Entrepreneurship, Importance and significance of growth of entrepreneurial activities Characteristics and qualities of entrepreneur • Theories of Entrepreneurship: Innovation Theory by Schumpeter & Imitating Theory of High Achievement by McClelland X-Efficiency Theory by Leibenstein Theory of Profit by Knight Theory of Social change by Everett Hagen • External Influences on Entrepreneurship Development: Socio-Cultural, Political, Economical, Personal. Role of Entrepreneurial culture in Entrepreneurship Development.
2	Types & Classification Of Entrepreneurs
	<ul style="list-style-type: none"> • Intrapreneur –Concept and Development of Intrapreneurship • Women Entrepreneur – concept, development and problems faced by Women Entrepreneurs, Development of Women Entrepreneurs with reference to Self Help Group • Social entrepreneurship–concept, development of Social entrepreneurship in India. Importance and Social responsibility of NGO's. • Family Entrepreneurship- Concept, importance , developments and problems. • Entrepreneurial development Program (EDP)–concept, factor influencing EDP. Option available to Entrepreneur. (Ancillarisation, BPO, Franchise, M&A)
3	Entrepreneur Project Development & Business Plan
	<ul style="list-style-type: none"> • Innovation, Invention, Creativity, Business Idea, Opportunities through change. • Idea generation– Sources-Development of product /idea, • Environmental scanning and SWOT analysis • Entrepreneurship Development Cycle • Business Planning Process-The business plan as an Entrepreneurial tool, scope and value of Business plan. • Elements of Business Plan, Objectives, Market and Feasibility Analysis, Marketing, Finance, Organization & Management, Ownership, • Critical Risk Contingencies of the proposal, Scheduling and milestones.
4	Venture Development

	<ul style="list-style-type: none">• Steps involved in starting of Venture• Institutional support to an Entrepreneur• Rules & Regulations of start-up India, requirements of Capital (Fixed and working) Sources of finance, problem of Venture set-up and prospects• Marketing: Methods, Channel of Marketing, Marketing Institutions and Assistance.• New trends in entrepreneurship- E-commerce, Disruptive Innovations, Interactive marketing and IOT in business.
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UNIVERSITY OF MUMBAI



Janardan Bhagat Shikshan Prasarak Sanstha's
Changu Kana Thakur
Arts, Commerce and Science College, New Panvel
(Autonomous)

Re-accredited A+ Grade by NAAC
'College with Potential for Excellence' Status Awarded by University
Grants Commission 'Best College Award' by University of Mumbai

Programme : S.Y.B.Sc.
(Choice Based Credit System)
Course: Chemistry
Syllabus for Semester III and IV

To be implemented from the Academic year 2020-2021

JanardanBhagatshikshanPrasarakSanstha's
Changu Kana Thakur
Arts, Commerce and Science College, New Panvel (Autonomous)
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'Best College Award' by University of Mumbai

Draft of the proposed revised syllabus for
Choice Based Credit System
S.Y.B.Sc. Chemistry
To be implemented from the Academic year 2020-2021

For the subject of chemistry there shall be three papers for 45 lectures each comprising of three units of 15 L each.

Semester-III

1. Paper-I (General Chemistry) Unit-I Physical Chemistry
Unit-II Inorganic Chemistry
Unit-III Organic Chemistry.
2. Paper-II (General Chemistry) Unit-I Physical Chemistry
Unit-II Inorganic Chemistry
Unit-III Organic Chemistry.
3. Paper III Basics of Analytical Chemistry
Unit-I Introduction to Analytical Chemistry and Statistical Treatment of analytical data-
Unit-II Classical Methods of Analysis
Unit-III Instrumental Methods-I

Semester-IV

1. Paper-I (General Chemistry) Unit-I Physical Chemistry
Unit-II Inorganic Chemistry
Unit-III Organic Chemistry.
2. Paper-II (General Chemistry) Unit-I Physical Chemistry
Unit-II Inorganic Chemistry
Unit-III Organic Chemistry.
Basics of Analytical Chemistry
4. Paper III Basics of Analytical Chemistry
Unit-I Separation Techniques in Analytical Chemistry -
Unit-II Instrumental Methods-II
Unit-III Statistical Treatment of analytical data --II

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Choice Based Credit System

S. Y. B. Sc.

Chemistry Syllabus

To be implemented from the Academic year 2020-2021

Course Content

Semester III

Course Code	Unit	Topics	Credits	L/Week
USC3CH1	I	Chemical Thermodynamics-II, Electrochemistry	2	1
	II	Chemical Bonding		1
	III	Reactions and reactivity of halogenated hydrocarbons, alcohols, phenols and epoxides		1
USC3CH2	I	Chemical Kinetics-II, Solutions	2	1
	II	Selected topics on p block elements		1
	III	Carbonyl Compounds		1
USC3CH3	I	Introduction to Analytical Chemistry and Statistical Treatment of analytical data-I	2	1
	II	Classical Methods of Analysis.		1
	III	Instrumental Methods-I		1
USC3CHP	Chemistry Practicals I		1	3
	Chemistry Practicals II		1	3
	Chemistry Practicals III		1	3

Semester IV

Course Code	Unit	Topics	Credits	L/Week
USC4CH1	I	Electrochemistry-II, Phase Equilibria	2	1
	II	Comparative Chemistry of the transition metals & Coordination Chemistry		1
	III	Carboxylic acids and their derivatives, Stereochemistry		1
USC4CH2	I	Solid state, Catalysis	2	1
	II	Ions in aqueous medium & Uses and Environmental Chemistry of volatile Oxides and oxo-acids		1
	III	Amines, Diazonium salts, Heterocyclic Compounds, Stereochemistry		1
USC4CH3	I	Separation Techniques in Analytical Chemistry	2	1
	II	Instrumental Methods-II		1
	III	Statistical Treatment of analytical data --II		1
USC4CHP	Chemistry Practicals I		1	3
	Chemistry Practicals II		1	3
	Chemistry Practicals III		1	3

Semester III
Paper I
Theory: 45 Lectures

Unit I: Physical Chemistry

1.1 Chemical Thermodynamics-II(8L)

1.1.1 Free Energy Functions: Helmholtz Free Energy, Gibb's Free Energy, Variation of Gibb's

free energy with Pressure and Temperature.

1.1.2 Gibbs-Helmholtz equation, van't Hoff reaction isotherm and van't Hoff reaction isochore.

(Numericals expected).

1.1.3 Thermodynamics of Open System: Partial Molal Properties, Chemical Potential and its variation with Pressure and Temperature, Gibb's Duhem equation.

1.1.4 Concept of Fugacity and Activity

1.2 Electrochemistry: (7L)

1.2.1 Conductivity, equivalent and molar conductivity and their variation with dilution for weak and strong electrolytes.

1.2.2 Kohlrausch law of independent migration of ions.

1.2.3 Applications of conductance measurements: determination of degree of ionization and ionization constant of weak electrolyte, solubility and solubility product of sparingly soluble salts, ionic product of water. (Numericals expected).

1.2.4 Transference number and its experimental determination using Moving boundary method. (Numericals expected). Factors affecting transference number.

Unit-II

Chemical Bonding

2.1 Non-Directional Bonding (4L)

2.1.1 Ionic Bond: Conditions for the Formation of Ionic Bond.

2.1.2 Types of Ionic Crystals

2.1.3 Radius Ratio Rules

2.1.4 Lattice Energy, Born-Landé Equation

2.1.5 Kapustinski Equation

2.1.6 Born-Haber Cycle and its Application

2.2. Directional Bonding: Orbital Approach. (6L)

2.2.1 Covalent Bonding The Valence Bond Theory- Introduction and basic tenets.

- 2.2.2 Interaction between two hydrogen atoms and the Potential energy diagram of the resultant system.
- 2.2.3 Homonuclear diatomic molecules from He₂ to Ne₂
- 2.2.4 Resonance and the concept of Formal Charge; Rules for Resonance or Canonical structures.
- 2.2.5 Bonding in Polyatomic Species: The role of Hybridization. And types of hybrid orbitals-*sp*, *sp*², *sp*³, *sp*³*d*, *sp*²*d*² and *sp*²*d* *sp*³*d*².
- 2.2.6 Equivalent and Non-Equivalent hybrid orbitals
- 2.2.7 Contribution of a given atomic orbital to the hybrid orbitals (with reference to *sp*³ hybridisation as in CH₄, NH₃ and H₂O and series like NH₃, PH₃, AsH₃, BiH₃)

2.3 Molecular Orbital Theory (5L)

- 2.3.1. Comparing Atomic Orbitals and Molecular Orbitals.
- 2.3.2. Linear combination of atomic orbitals. to give molecular orbitals LCAO-MO approach for diatomic homonuclear molecules).
- 2.3.3 Molecular orbital Theory and Bond Order and magnetic property: with reference to O₂, O₂⁺, O₂⁻, O₂²⁻

(Problems and numerical problems expected wherever possible)

Unit III: Organic Chemistry

3.1.1. Reactions and reactivity of halogenated hydrocarbons: [4L]

3.1.1. Alkyl halides: Nucleophilic substitution reactions: S_N1, S_N2 and S_Ni mechanisms with stereochemical aspects and factors affecting nucleophilic substitution reactions-nature of substrate, solvent, nucleophilic reagent and leaving group.

3.1.2. Aryl halides: Reactivity of aryl halides towards nucleophilic substitution reactions. Nucleophilic aromatic substitution (S_NAr) addition-elimination mechanism and benzyne mechanism.

3.1.3. Organomagnesium and organolithium compounds: [3L]

Nomenclature, nature, type and reactivity of carbon-metal bond. Preparation using alkyl / aryl halide. Structure, stability and reactions with compounds containing acidic hydrogen, carbonyl compounds, CO₂, cyanides and epoxides.

3.2 Alcohols, phenols and epoxides: [8L]

3.2.1. Alcohols: Nomenclature, Preparation: Hydration of alkenes, hydrolysis of alkyl halides, reduction of aldehydes and ketones, using Grignard reagent. Properties: Hydrogen bonding, types and effect of hydrogen bonding on different properties. Acidity of alcohols, Reactions of alcohols

3.2.2. Phenols: Preparation, physical properties and acidic character. Comparative acidic strengths of alcohols and phenols, resonance stabilization of phenoxide ion. Reactions of phenols.

3.2.3. Epoxides: Nomenclature, methods of preparation and reactions of epoxides: reactivity, ring opening reactions by nucleophiles (a) In acidic conditions: hydrolysis, reaction with halogen halide, alcohol, hydrogen cyanide. (b) In neutral or basic conditions: ammonia, amines, Grignard reagents, alkoxides.

Semester III

Paper II

Unit I: Physical Chemistry

1.1 Chemical Kinetics-II (7L)

1.1.1 Types of Complex Chemical reactions: Reversible or opposing, consecutive and parallel reactions (No derivations, only examples expected),

Thermal chain reactions: H. and Br. reaction. (only steps involved, no kinetic expression expected).

1.1.2 Effect of temperature on the rate of reaction, Arrhenius equation, Concept of energy of activation (E_a). (Numericals expected).

1.1.3 Theories of reaction rates: Collision theory and activated complex theory of bimolecular reactions. Comparison between the two theories (Qualitative treatment only)

1.2 Solutions: (8 L)

1.2.1 Thermodynamics of ideal solutions: Ideal solutions and Raoult's law, deviations from Raoult's law–non-ideal solutions. Vapour pressure-composition and temperature -composition curves of ideal and non-ideal solutions. Distillation of solutions. Lever rule. Azeotropes.

1.2.2 Partial miscibility of liquids: Critical solution temperature; effect of impurity on partial miscibility of liquids with respect to Phenol-Water , Triethanolamine – Water and Nicotine – Water systems

1.2.3 Immiscibility of liquids- Principle of steam distillation.

1.2.4 Nernst distribution law and its applications, solvent extraction.

Unit-II

2. Selected topics on p block elements

(15L)

2.1 Chemistry of Boron compounds

- 2.1.1 Electron deficient compounds – BH_3 , BF_3 , BCl_3 with respect to Lewis acidity and applications.
- 2.1.2 Preparation of simple boranes like diborane and tetraborane.
- 2.1.3 Structure and bonding in diborane and tetraborane (2e-3c bonds)
- 2.1.4 Synthesis of Borax.

2.2 Chemistry of Silicon and Germanium

- 2.2.1 Silicon compounds: Occurrence, Structure and inertness of SiO_2
- 2.2.2 Preparation of structure of SiCl_4
- 2.2.3 Occurrence and extraction of Germanium
- 2.2.4 Preparation of extra pure Silicon and Germanium

2.3 Chemistry of Nitrogen family

- 2.3.1 Trends in chemical reactivity - Formation of hydrides, halides, oxides with special reference to oxides of nitrogen.
- 2.3.2 Oxides of nitrogen with respect to preparation and structure of NO , NO_2 , N_2O and N_2O_4 .
- 2.3.3 Synthesis of ammonia by Bosch – Haber process.

Unit III: Organic Chemistry

Carbonyl Compounds: [15L]

- 31 Nomenclature of aliphatic, alicyclic and aromatic carbonyl compounds. Structure, reactivity of aldehydes and ketones and methods of preparation; Oxidation of primary and secondary alcohols using PCC, hydration of alkynes, action of Grignard reagent on esters, Rosenmund reduction, Gattermann – Koch formylation and Friedel Craft acylation of arenes
- 32 General mechanism of nucleophilic addition, and acid catalyzed nucleophilic addition reactions.
- 33 Reactions of aldehydes and ketones with NaHSO_3 , HCN , RMgX , alcohol, amine, 2,4-Dinitrophenyl hydrazine, LiAlH_4 and NaBH_4 .
- 34 Mechanisms of following reactions: Benzoin condensation, Knoevenagel condensation, and Cannizzaro reaction.
- 35 Keto-enol tautomerism: Mechanism of acid and base catalysed enolization
- 36 Active methylene compounds: Acetylacetone, ethyl acetoacetate diethyl malonate, stabilised enols.

37 Stereochemistry: (5 L)

- Regioselective, chemoselective, stereoselective and stereospecific reactions.
Stereochemistry of: i) Substitution reaction (SN^1 , SN^2 and SN^i)
ii) Addition reaction (catalytic hydrogenation) (5L)

Semester III
Paper III
Basics in analytical Chemistry

1. Introduction to Analytical Chemistry (15 L)

1.1 Introduction (6L)

1.1.1 General introduction of analytical chemistry

1.1.2 Chemical Analysis: Qualitative and Quantitative analysis. Common Analytical Problems, Important terms associated with chemical analysis, Steps in chemical analysis, Purpose of chemical analysis; Analysis Based (i) On the nature of information required: (Proximate, Partial, Trace, Complete Analysis) and (ii) On the size of the sample used (Macro, semi-micro and micro analysis)

1.1.3 Classification of analytical methods (Classical & instrumental methods)

Importance of analytical chemistry in various fields (Pharmaceutical, Clinical, agriculture, environmental studies and research).

1.2 Errors in Analysis (3L)

1.2.1 Concepts of Accuracy and Precision: terms,

1.2.2 Types of Errors: Determinate and Indeterminate error

1.2.3 Expression of error: Absolute and Relative Error & Constant and proportionate error

1.2.4 Minimization of Determinate error

1.3 Interpretation of Results of Analysis (6L)

1.3.1 Concept of true and acceptable value

1.3.2 Measures of central tendency: Mean, median, mode

1.3.3 Measures of Dispersion: Absolute Deviation, Relative Deviation, Relative average deviation, standard deviation, variance, coefficient of variation.

1.4 Significant Figure

(Problems including Numericals expected)

2. Classical methods of Analysis –I (15L)

2.1 Titrimetric Analysis -I(1L)

2.1.1 Terms involved in Titrimetric Analysis

2.1.2 Types of Titrations

2.2 Tools of titrimetry: Graduated glassware and their Calibration (3L)

i) Volumetric Flask

ii) Burette

iii) Pipette

2.3 Standardization (4L)

2.3.1 Introduction, Concept of standard solution, primary standard, secondary standard

2.3.2 Requirements for primary and secondary standard

2.3.3 Preparation of standard solutions: (Molarity, Formality Normality W/W W/V, ppm) dilution of solution. (Numerical Problems expected)

2.4 Neutralization Titrations (6L)

2.4.1. Concept of pH and its importance in Neutralisation Titrations

2.4.2 End point and Equivalence point of Neutralisation titrations

2.4.3 Construction of titration curve (on the basis of change in pH) and choice of indicator of a titration of

i. Strong acid-strong base

ii. Strong acid-weak base

iii. Strong base-weak acid

2.4.4 Theory of Acid base indicators; Illustrate Acid base indicators with examples (1L)

3. Basic Concepts in Instrumental methods (15L)

- 3.1 Relation between the Analyte, Stimulus and measurement of change in the observable property.
- 3.2 Block Diagram of an Analytical instrument.
- 3.3 Types of Analytical Instrumental methods based on
 - i. Optical interactions (eg. Spectrometry: uv-visible, Polarimetry)
 - ii. Electrochemical interactions (eg. Potentiometry, Conductometry,)
 - iii. Thermal interactions (eg. Thermogravimetry) (3L)
- 3.4. Absorption Spectroscopy(12 L)
 - 3.4.1. Interaction of electromagnetic radiation with matter: Absorption and Emission spectroscopy
 - 3.4.2. Basic Terms: Radiant Power, Absorbance, Transmittance, Monochromatic light, Polychromatic light, Wavelength of maximum absorbance, Absorptivity and Molar Absorbitivity
 - 3.4.3. Statement of Beer's Law and Lambert's Law, Combined Mathematical Expression of Beer - Lambert's Law, Validity of Beer-Lambert's Law, Deviations from Beer-Lambert's Law ((Real deviations, Instrumental deviations and Chemical deviations)
(Numerical problems based on Beer-Lambert's Law)
 - 3.4.4. Instrumentation for absorption spectroscopy: Colorimeters
 - 3.4.5. Block Diagrams for Single beam and double beam Colorimeter
 - 3.4.6. quantitative applications of colorimetry: Calibration curve method

Semester IV
Paper I

Unit I: Physical Chemistry

1.1 Electrochemistry-II: (8 L)

- 1.1.1 Electrochemical conventions, Reversible and irreversible cells.
- 1.1.2 Nernst equation and its importance, Types of electrodes, Standard electrode potential, Electrochemical series (Numericals expected).
- 1.1.3 Thermodynamics of a reversible cell, calculation of thermodynamic properties: ΔG , ΔH and ΔS from EMF data. (Numericals expected)
- 1.1.4 Calculation of equilibrium constant from EMF data. (Numericals expected)
- 1.1.5 Concentration cells with transference and without transference. Liquid junction potential and salt bridge.
- 1.1.6 pH determination using hydrogen electrode and quinhydrone electrode. (Numericals expected)

1.2 Phase Equilibria: (7L)

- 1.2.1 Phases, components and degrees of freedom of a system, criteria of phase equilibrium. Gibbs Phase Rule and its thermodynamic derivation.
- 1.2.2 Derivation of Clausius – Clapeyron equation and its importance in phase equilibria. (numericals expected)
- 1.2.3 Phase diagrams of one-component systems (water and sulphur).

- 1.2.4 Two component systems involving eutectics, congruent and incongruent melting points (lead-silver system).

Unit-II

2.1 Comparative Chemistry of the transition metals (9 L)

- 2.1.1 Position in the periodic table; Natural occurrence principal ores and minerals;
- 2.1.2 Significance of special stability of d^0 , d^5 and d^{10} leading to variable oxidation states; Unusual oxidation states and their stabilities in aqueous solutions (with special reference to vanadium, and chromium.)
- 2.1.3 Origin of colour for transition metals and their compounds: such as reflectivity, surface coatings, particle size, packing density for metals and nature of d-orbitals, number of electrons in the d-orbitals, geometry, and ability for charge transfer).
- 2.1.4 Magnetic properties of transition metal compounds: Origin of magnetism-spin and orbital motion of electrons; equation for spin only and spin-orbital magnetism in terms of Bohr magnetons (No derivation of relevant equations expected); Reasons for quenching of orbital moments.
- 2.1.5 Chemistry of Titanium and vanadium: properties of Oxides and chlorides; use in titrimetric analysis
- 2.1.6 Qualitative tests for transition metal ions: General considerations in devising tests (with reference to Chromium, Manganese, iron, Cobalt Nickel and Copper)

2.2 Coordination Chemistry : (6 L)

2.2.1 Introduction to Chemistry of Coordination Compounds

- i. Isomerism :General Types with special reference to stereoisomerism of coordination compounds (C.N=6)
- ii. Evidence for the formation of coordination compounds,

2.2.2. Theories of coordination compounds

- i. Effective atomic number rule.
- ii. Eighteen electron Rule

2.2.3. Nature of the Metal-Ligand Bond:

- i. Valence Bond Theory; Hybridisation of the central metal orbitals- sp^3 , sd^3/d^3s sp^3d^2/d^2sp^3 , sp^2d ,
- ii. Inner and outer orbital complexes of .(suitable examples of Mn(II) Fe(II),Fe(III),Co(II)/Co(III),Ni(II), Cu(II) Zn(II) complexes with ligands like aqua, ammonia CN^- and halides may be used)
- iii. Limitations of V.B.T

2.2.4. Application of coordination compounds.

Unit III: Organic Chemistry

3.1 Carboxylic Acids and their Derivatives :(11 Lectures)

- 3.1.1. Nomenclature, structure and physical properties, acidity of carboxylic acids, effects of substituents on acid strength of aliphatic and aromatic carboxylic acids.
- 3.1.2. Preparation of carboxylic acids: oxidation of alcohols and alkyl benzene, carbonation of Grignard and hydrolysis of nitriles.
- 3.1.3. Reactions: Acidity, salt formation, decarboxylation, Reduction of carboxylic acids with LiAlH_4 , diborane, Hell-Volhard-Zelinsky reaction, Conversion of carboxylic acid to acid chlorides, esters, amides and acid anhydrides and their relative reactivity.
- 3.1.4. Mechanism of nucleophilic acyl substitution and acid-catalysed nucleophilic acyl substitution. Interconversion of acid derivatives by nucleophilic acyl substitution.
- 3.1.5. Mechanism of Claisen condensation and Dieckmann condensation.

3.2 Stereochemistry (4L) Stability of cycloalkane: Strain in cycloalkanes, angle, eclipsing, trans annular (3 to 6membered). Conformations of cyclohexane, mono and di-alkyl cyclohexane and their relative stability.(4L)

Semester IV
Paper II

Unit I: Physical Chemistry

1.1 Solid State: (7L)

- 1.1.1 Recapitulation of laws of crystallography and types of crystals
- 1.1.2 Characteristics of simple cubic, face centered cubic and body centered cubic systems, interplanar distance in cubic lattice (only expression for ratio of interplanar distances are expected)
- 1.1.3 Use of X-rays in the study of crystal structure, Bragg's equation (derivation expected), X-rays diffraction method of studying crystal lattice structure, structure of NaCl and KCl. Determination of Avogadro's number (Numericals expected)

1.2 Catalysis: (8 L)

- 1.2.1 Types of catalysis, catalytic activity, specificity and selectivity, inhibitors, catalyst poisoning and deactivation
- 1.2.2 Mechanisms and kinetics of acid-base catalyzed reactions, effect of pH.
- 1.2.3 Mechanisms and kinetics of enzyme catalyzed reactions (Michaelis-Menten equation)
- 1.2.4 Effect of particle size and efficiency of nanoparticles as catalyst.

Unit-II

2 Ions in aqueous medium

2.1. Acidity of Cations and Basicity of Anions

- i. Hydration of Cations; Hydrolysis of Cations predicting degree of hydrolysis of Cations-effect of Charge and Radius.
- ii. Latimer Equation. Relationship between pKa, acidity and z^2/r ratios of metal ions graphical Presentation
- iii. Classification of cations on the basis of acidity category – Non acidic, Moderately acidic, strongly acidic, very strongly acidic with pKa values range and examples
- iv. Hydration of Anions; Effect of Charge and Radius; Hydration of anions-concept, diagram classification on the basis of basicity

2.2. Uses and Environmental Chemistry of volatile Oxides and oxo-acids

- i. Physical properties of concentrated oxo-acids like sulfuric, Nitric and Phosphoric acid
- ii. Uses and environments aspects of these acids

Unit III: Organic Chemistry

Nitrogen containing compounds and heterocyclic compounds:

3.1 Amines: Nomenclature, effect of substituent on basicity of aliphatic and aromatic amines;

- 3.1.1. Preparation: Reduction of aromatic nitro compounds using catalytic hydrogenation, chemical reduction using Fe-HCl, Sn-HCl, Zn-acetic acid, reduction of nitriles, ammonolysis of halides, reductive amination, Hofmann bromamide reaction.
- 3.1.2. Reactions- Salt Formation, N-acylation, N-alkylation, Hofmann's exhaustive methylation (HEM), Hofmann-elimination reaction, reaction with nitrous acid, carbylamine reaction, Electrophilic substitution in aromatic amines: bromination, nitration and sulphonation.

3.2 Diazonium Salts: (7 Lectures)

Preparation and their reactions/synthetic application - Sandmeyer reaction, Gattermann reaction, Gomberg reaction, Replacement of diazo group by -H, -OH. Azo coupling with phenols, naphthols and aromatic amines, reduction of diazonium salt to aryl hydrazine

3.3 Heterocyclic Compounds: (8 Lectures)

3.3.1. Classification, nomenclature, electronic structure, aromaticity in 5-numbered and 6-membered rings containing one heteroatom;

3.3.2. Synthesis of Furan, Pyrrole (Paal-Knorr synthesis and Hantzsch synthesis), Thiophene, Pyridine (Hantzsch synthesis),

3.3.3. Reactivity of furan, pyrrole and thiophene towards electrophilic substitution reactions on the basis of stability of intermediate and of pyridine on the basis of electron distribution. Reactivity of pyridine towards nucleophilic substitution on the basis of electron distribution.

3.3.4. Reactions of furan, pyrrole and thiophene: halogenation, nitration, sulphonation, Vilsmeier-Haack reaction, Friedel-Crafts reaction. Furan: Diels-Alder reaction, Pyrrole: Acidity and basicity of pyrrole. Comparison of basicity of pyrrole and pyrrolidine.

3.3.5. Pyridine: Basicity. Comparison of basicity of pyridine, pyrrole and piperidine. Sulphonation of pyridine (with and without catalyst), reduction and action of sodamide (Chichibabin reaction).

Semester IV
Paper III
Basics in analytical Chemistry

1. Methods of Separation in Analytical Chemistry (15L)

1.1 An Introduction to Analytical Separations and its importance in analysis. (2L)

1.2 Estimation of an analyte without effecting separation.

1.3 Types of separation methods

1.3.1 Based on Solubilities (Precipitation, Filtration Crystallisation)

1.3.2 Based on Gravity- Centrifugation

1.3.3 Based on volatility-Distillation ;

1.3.4 Based on Electrical effects-Electrophoresis

1.3.5 Based on retention capacity of a Stationary Phase -Chromatography;

1.3.6 Based on distribution in two immiscible phases-Solvent Extraction;

1.3.7 Based on capacity to exchange with a resin-Ion Exchange;

1.4 Chromatography:(2L)

1.4.1 Introduction to Chromatography

1.4.2 Classification of chromatographic methods based on stationary and mobile phase

1.5 Planar Chromatography (7L)

Principle, techniques and applications of

1.5.1 Paper chromatography

1.5.2 Thin layer chromatography

1.6 Electrophoresis (4L)

Introduction, Principle and theory of electrophoresis, Different types of electrophoresis techniques, Moving Boundary Electrophoresis, Zone electrophoresis- Paper, Cellulose acetate and Gel electrophoresis, Applications of electrophoresis

2. Instrumental Methods – II (15L)

Instrumental techniques based on the electrochemical properties of the analytes

2.1 Potentiometry: (5 L)

2.1.1 Principle. Selection of indicator electrode system for various types of titrimetric reaction Acid base titrations

2.1.2. Role of Reference and indicator electrodes

2.1.3. Applications, advantages and limitations

2.1.4. detection of equivalence points Graphically

2.2. pHmetry: (4 L)

2.2.1. Principle

2.2.2. Types of pH meters.

2.2.3. Principle, Construction Working and Care of Combined Glass electrode

2.2.4. Applications in Titrimetry (Strong acid-Strong Base) biological and environmental analysis.

2.3. Conductometry(6 L)

2.3.1. Principle

2.3.2. Conductivity cell its construction and care

2.3.3. conductometric titration curves for following titrations

i. Strong Acid-Strong Base

ii. Strong Acid-Weak Base

iii. Strong Base-weak Acid

iv. Weak Acid- Weak Base.

2.3.4. Advantages & limitations of conductometric titrations.

3. A] Classical Methods of Analysis -II (10L)

3.1. Titrimetric Analysis-II

3.2. Precipitation Titration (4L)

3.1.1. Argentimetric titration

3.1.2 Construction of titration curve(numerical problems expected)

3.2.3 Selecting and evaluating the end point: Volhard method, Mohr's method, using adsorption indicator

3.2 Gravimetric Analysis (6 L)

3.2.1. General Introduction to Gravimetry.

3.2.2. Types of Gravimetric Methods

3.2.3 Steps involved in gravimetry analysis

3.2.4 Isolation of ion of interest

3.2.5. Precipitation: Nucleation (homogeneous and heterogeneous)& crystal growth, Super solubility curve, significance of metastable region

i. Factors affecting precipitation: Common ion effect and solubility product

ii. Colloidal precipitates (coagulation of colloids, peptization of colloids, treatment of colloidal precipitates). Crystalline precipitates (particle size and filterability).

iii. Conditions for precipitation

iv. Completion of precipitation,

v. Role of Digestion, Filtration, Washing : Choice of washing liquid, Drying Ignition of precipitate.

3.2.6 Co-precipitation (surface adsorption, mixed-crystal formation, occlusion, and mechanical entrapment, co precipitation errors).

B] Introduction to environmental analysis (5 L)

3.3.1 Environmental pollution from industrial effluents.

i. sources and types of pollutants

ii. Causes and consequences

- iii. Role of EPA and central pollution control board.
- 3.3.2 Analysis of soil: Composition of soil, Sampling of soil, Industrial effluents and their interactions with soil components.
 - i. Determination of pH of soil samples.
 - ii. Estimation of Calcium and Magnesium ions as Calcium carbonate by complexometric titration.
- 3.3.3 Analysis of water: Definition of pure water, sources responsible for contaminating water, water sampling methods, water purification methods.
 - i. Physical Parameters: Colour, Temperature, Taste and Odour, Turbidity, Conductivity, Hydrogen Ion Concentration (pH), Total Solids, Suspended and Dissolved Solids.
 - ii. Chemical Parameters: Acidity, Alkalinity, Hardness, Chlorides, Fluorides, Dissolved Oxygen,
 - iii. Determination of pH, acidity and alkalinity of a water sample.
 - iv. Determination of dissolved oxygen (DO) of a water sample.

(Semester 4 is not having any numerical based unit; however semester 3 is having all 3 units with numericals)

Semester III Chemistry Practicals:

Unit I: Physical Chemistry

1. To verify Ostwald's dilution law for weak acid conductometrically.
2. To determine dissociation constant of weak acid conductometrically.
3. Determination of energy of activation of acid catalyzed hydrolysis of methyl acetate.
4. To investigate the reaction between $K_2S_2O_8$ and KI with equal initial concentrations of the reactants
5. To determine solubility of sparingly soluble salts (any two) conductometrically.

Unit II: Inorganic Chemistry

1. 1) Identification of two cations and two anions in a given mixture containing following: cations Pb^{2+} (II), Ba^{2+} (II), Ca^{2+} (II), Sr^{2+} (II), Cu^{2+} (II), Cd^{2+} (II), Mg^{2+} (II), Zn^{2+} (II), Fe^{2+} (II), Fe^{3+} (III), Ni^{2+} (II), Co^{2+} (II), Al^{3+} (III), Cr^{3+} (III)] and Anions : Cl^- , Br^- , I^- , NO_3^- , SO_4^{2-} , and CO_3^{2-}
2. Crystallization of potassium iodate and to estimate its purity before and after the separation.
3. Estimation of total hardness
4. Investigation of the reaction between Copper sulfate and Sodium Hydroxide (Standard EDTA solution to be provided to the learner).

Unit III: Organic Chemistry

Short organic preparation and their purification: Use 0.5-1.0g of the organic compound.

Purify the product by recrystallization. Report theoretical yield, percentage yield and melting point of the purified product.

Preparation of:

1. Cyclohexanone oxime from cyclohexanone.
2. Glucosazone from dextrose or fructose
3. Tribromoaniline from aniline.
4. β -Naphthylbenzoate
5. m-Dinitrobenzene from nitrobenzene

6. Phthalic anhydride from phthalic acid by sublimation
7. Acetanilide from aniline
8. p-Bromoacetanilide from acetanilide
9. Iodoform from acetone

(Any eight preparations)

Semester IV Chemistry Practicals:

Unit I: Physical Chemistry

1. To determine standard EMF and the standard free energy change of Daniel cell potentiometrically .
2. To determine the amount of HCl in the given sample potentiometrically.
3. Compare the strengths of HCl and H₂SO₄ by studying kinetics of acid hydrolysis of methyl acetate.
6. Industrial visit report.

Unit II: Inorganic Chemistry

1. Inorganic preparation – Nickel dimethyl glyoxime using microscale method.
2. Complex cation – *Tris* (ethylene diamine) nickel (II) thiosulphate.
3. Complex anion – Sodium Hexanitrocobaltate (III) The aim of this experiment is to understand the preparation of a soluble cation (sodium) and a large anion hexanitrocobaltate(III) and its use to precipitate a large cation (potassium)

Unit III: Organic Chemistry

Qualitative Analysis of bi-functional organic compounds on the basis of

1. Preliminary examination
2. Solubility profile
3. Detection of elements C, H, (O), N, S, X.
4. Detection of functional groups
5. Determination of physical constants (M.P/B.P)

Solid or liquid Compounds containing not more than two functional groups from among the following classes may be given for analysis to be given: Carboxylic acids, phenol, carbohydrates, aldehydes, ketones, ester, amides, nitro, anilides, amines, alkyl and aryl halides.

Students are expected to write balanced chemical reactions wherever necessary.
(Minimum 6 compounds to be analyzed)

As such it is felt that this paper will be a subject of choice and interest for learners preferring a specialisation in Chemistry as well as to those who may have interests in other science fields as Physics, Botany, Zoology, Microbiology, Geochemistry and so on.

Goal:

To introduce the learner to an area of learning that is vital for the inherent nature of the subject itself but also is important and irreplaceable irrespective of the long term interest of specialisation or subject of interest of the learner.

**Unit I- Introduction to Analytical Chemistry and Statistical Treatment
of analytical data-I (15 L)**

Scope/ Objectives:

Learners should be able to

1. Select a method of analysis
2. Decide how to identify a sample and prepare it for analysis
3. Select a procedure for analysis
4. Identify sources of possible errors in the results obtained.

(Problems including numericals expected wherever necessary)

1.1. Role of Analytical Chemistry (9 L)

- 1.1.1. Language of analytical chemistry: important terms and their significance in Analytical Chemistry.
- 1.1.2. Purpose of Chemical Analysis; Analysis Based (i) On the nature of information required: (Proximate, Partial, Trace, Complete Analysis) and (ii) On the size of the sample used (Macro, semi-micro and micro analysis)
- 1.1.3. Classical and Non-Classical Methods of Analysis; their types and importance.

1.2. Significance of Sampling in Analytical Chemistry

- 1.2.1. Terms involved in Sampling
- 1.2.2. Types of Sampling
- 1.2.3. Sampling techniques

1.3. Results of Analysis. (6L)

- 1.3.1. Errors in Analysis and their types
- 1.3.2. Precision and Accuracy in Analysis
- 1.3.3. Corrections for Determinate Errors

(Problems including Numericals expected wherever required)

References:

1. Instrumental Analysis by Douglas A. Skoog, F. James Holler, Stanley R. Crouch
2. Instrumental methods of analysis by Willard, H.H.; Merritt, L.L. Jr.; Dean, J.A.; Settle, 7th Edition
3. Fundamental of Analytical Chemistry by Douglas A. Skoog, West, F. James Holler, S. R. Crouch

4. Modern Analytical Chemistry by David Harvey, McGraw-Hill Higher Education

Unit II- Classical Methods of Analysis(15 L)

Objectives:

The main objectives of this unit is to

- Introduce classical methods of chemical analysis.
- Appreciate the various terms and types of titrimetric analysis.
- Ability to select proper titrimetric method
- Appreciate the usefulness of the gravimetric method of analysis
- Identify a suitable gravimetric method
- Perform the required calculations involved in the analysis by titrimetry as well as gravimetry.

2. Classical Methods of Analysis. (04L)

21. Titrimetric Methods

- 2.1.1. Terms involved in Titrimetric methods of analysis. Comparing volumetry and Titrimetry
- 2.1.2. The Conditions suitable for titrimetry
- 2.1.3. Types of titrimetry – Neutralisation (Acidimetry, alkalimetry), Redox, (Iodometry, Iodimetry,) Precipitation and Complexometric titrations and indicators used in these titrations
- 2.1.4. Tools of Titrimetry: Graduated glasswares and Calibration

22 Standard solutions (Primary and Secondary standards in Titrimetry) and Calculations in Titrimetry.

23. Neutralisation Titrations (04L)

- 2.3.1. Concept of pH and its importance in Neutralisation Titrations
- 2.3.2. End point and Equivalence point of Neutralisation titrations
- 2.3.3. Determination of End point by using
 - i. Indicators causing colour change
 - ii. Change in potential, (by potentiometry)
 - iii. Change in conductance (by conductometry)
- 2.3.4. Construction of titration curve (on the basis of change in pH)of a titration of
 - i. Strong acid-weak base
 - ii. Strong base-weak acid

24 Gravimetric analysis (06 L)

- 2.4.1. General Introduction to Gravimetry.
- 2.4.2. Types of Gravimetric Methods –
- 2.4.3. Precipitation Gravimetry:
 - i. Steps involved in precipitation gravimetry analysis
 - ii. Conditions for precipitation
 - iii. Completion of precipitation,
 - iv. Role of Digestion, Filtration, Washing, Drying Ignition of precipitate.

- v. Applications of Gravimetric Analysis: Determination of sulfur in organic compounds; Estimation of Nickel in Cu-Ni alloy using dimethyl glyoxime; Determination of Aluminum by converting it to its oxide.

References:

- 1) Skoog et al. "Fundamentals of Analytical chemistry" Cengage Learning, Eight Edition, chapter 13, 14 and 15
- 2) Day and Underwood, "Quantitative analysis" prentice hall 1991, chapter 3
- 3) S.M. Khopkar, "Basic Concepts of Analytical Chemistry", IInd Edition New Age International Publisher
- 4) Gary D. Christan, "Analytical Chemistry", VIth Edition, Wiley Students Edition, Chapter No 8, 9, 10
- 5) Fundamental of Analytical Chemistry by Douglas A. Skoog, West, F. James Holler, S. R. Crouch
- 6) Modern Analytical Chemistry, David Harvey (page numbers 232 -265)

Unit III: Instrumental Methods-I [15 L]

Objectives:

On completing the learning of this unit the learner is expected to

- Know the various instrumental methods of analysis
- Advantages of using instruments to make measurements
- The various observable properties of a given analyte and the stimulus best suited for its analysis
- Know about a generalized diagram of an analytical instrument
- Select a suitable instrumental method for analysis
- Appreciate the basic terms in spectrometry
- Use the relationship between absorbance (and its variations) and concentration of the analyte.
- Chose a suitable method for photometric titrations.

3. Basic Concepts in Instrumental methods (03)

- 31.** Relation between the Analyte, Stimulus and measurement of change in the observable property.
- 32.** Block Diagram of an Analytical instrument.
- 33.** Types of Analytical Instrumental methods based on
 - i. Optical interactions (eg. Spectrometry: uv-visible, Polarimetry)
 - ii. Electrochemical interactions (eg. Potentiometry, Conductometry,)
 - iii. Thermal interactions (eg. Thermogravimetry)

34. Spectrometry (07 L)

- 3.4.1. Interaction of electromagnetic radiation with matter: Absorption and Emission spectroscopy
- 3.4.2. Basic Terms: Radiant Power, Absorbance, Transmittance, Monochromatic

light, Polychromatic light, Wavelength of maximum absorbance, Absorptivity and Molar Absorbivity

- 3.4.3. Statement of Beer's Law and Lambert's Law, Combined Mathematical Expression of Beer -Lambert's Law, Validity of Beer-Lambert's Law, Deviations from Beer-Lambert's Law ((Real deviations, Instrumental deviations and Chemical deviations)
(Numerical problems based on Beer-Lambert's Law)

3.4.4. Instrumentation for absorption spectroscopy: Colorimeters and Spectrophotometers

3.4.5. Block Diagrams for Single beam and Colorimeter, and Spectrophotometer (Principles, Construction and working-Details of Components expected i.e , source ,Sample holder , Filters/Monochromators, Detectors such as Photomultiplier tube)

3.4.6. Applications of UV-Visible Spectrophotometry (02 L)

- (a) Qualitative analysis such as Identification of functional groups in Organic compounds ,Chromophores and Auxochrome,*cis* and *trans* isomers
- (b) Quantitative analysis by Calibration curve method and

3.4.7. Photometric Titrations: Principle ,Instrumentation, Types of Photometric titration Curves with examples. (03L)

Semester III Chemistry
Practicals: Paper III
Basics in Analytical Chemistry

1. Tools of Analytical Chemistry-I:

- a) Analytical glass wares like burettes, pipettes, Standard flasks, Separating funnels.
- b) Weighing tools such as two pan balance and monopan balance, digital balances:
- c) Incineration devices: Burners, Electrical Incinerators, Muffle Furnace,
- d) Drying Devices: Hot Air Oven, Microwave Oven, Descicators, Vacuum descicators
- e) Monochromators, Filters, Sample holders, Prisms, Diffraction Gratings, Photoemissive cells, Photomultiplier tubes

(The learner should draw diagrams and write-ups providing uses, care and maintenance of the items mentioned in (a) and principle, construction and uses of items (b) to (e) in his journal.

2. Gravimetric estimation of Nickel (II) as Ni-DMG and calculation of % error.
(The learner is expected to know the role of the various reagents/chemicals used In the estimation, various steps involved. They should write the complete and Balanced chemical reaction for the formation of the $\text{Ni}(\text{DMG})_2$ complex.
3. Colorimetric Determination of Copper Ions in given Solution by using calibration curve method and calculation of % error.
(The learner is expected to learn the relation between concentration and Absorbance, to draw a calibration curve, use the slope of the calibration curve and compare it with the calculated slope. They are also expected to state the error estimate of their results).
4. Determination of buffer capacity of acid buffer and basic buffer.
(The learner is expected to learn the use pH meter, standardization of pH meter, use of Henderson's equation and calculation of buffer capacity)
5. Estimation of Aspirin
6. Gravimetric estimation of barium ions using K_2CrO_4 as precipitant calculation of % error.
(The learner is expected to learn the skills of using the counterpoise technique used in this gravimetric estimation; Using counterpoise method whatman No.42 for filtration. In such a case no incineration or use of silica crucible is required. They are also expected to state the error estimate of their results)

Objectives:

Semester IV
Paper III Basics in Analytical Chemistry -II
Theory: 45 Lectures
Unit –I -Methods of separation (15 L)

The learner is expected to understand

- The importance of separation in sample treatment
- Various methods of separations
- How to select a method of separation of an analyte from the matrix
- How a solute gets distributed between two immiscible phases
- Principle of solvent extraction and various terms involved therein
- Effect of various parameters on solvent extraction of a solute
- Classification of Chromatographic methods
- Paper and thin layer chromatography and using them in practice.

1. Separation Techniques in Analytical Chemistry

(02 L)

- 1.1.** An Introduction to Analytical Separations and its importance in analysis.
- 1.2.** Estimation of an analyte without effecting separation.
- 1.3.** Types of separation methods
 - 1.3.1.** Based on Solubilities (Precipitation, Filtration Crystallisation)
 - 1.3.2.** Based on Gravity- Centrifugation
 - 1.3.3.** Based on volatility-Distillation ;

- 1.3.4. Based on Electrical effects-Electrophoresis
- 1.3.5. Based on retention capacity of a Stationary Phase -Chromatography;
- 1.3.6. Based on distribution in two immiscible phases-Solvent Extraction;
- 1.3.7. Based on capacity to exchange with a resin-Ion Exchange;
- 1.4. Electrophoresis:** Principles, Basic Instrumentation, Working and Application in separation of biomolecules like enzymes and DNA. (02L)

1.5. Solvent extraction (06 L)

- 1.5.1. Introduction, Nernst distribution Law, Distribution Ratio, Partition Coefficient.
- 1.5.2. Conditions of extraction: Equilibration time, Solvent volumes, temperature, pH.
- 1.5.3. Single step and multi step extraction, Percentage extraction for single step and multistep extraction. Separation factor.
- 1.5.4. Batch and continuous extraction

1.6. Chromatography : (05L)

- 1.6.1. Introduction to Chromatography
- 1.6.2. Classification of chromatographic methods based on stationary and mobile phase
- 1.6.3. Paper Chromatography: Principle, techniques and applications of Paper Chromatography in separation of cations.
- 1.6.4. Thin layer Chromatography Principle, technique and Applications in determining the purity of a given solute; Following progress of a given reaction .

References :

1. D.A. Skoog, D.M. West, F.J. Holler and CX.R. Crouch – Fundamentals of Analytical chemistry, 8th edition
2. G.H. Morrison and H. Freiser , Solvent extraction in analytical chemistry
3. P. G. Swell and B. Clarke, Chromatographic separations , Analytical chemistry by open Learning , John Wiley and sons, 1987
4. Modern Analytical Chemistry , David Harvey (page numbers 596 -606)
5. Modern Analytical Chemistry , David Harvey (page numbers 215 -217)

Unit –II - Instrumental Methods-II (15 L)

Objectives

On completing this unit the learner is

- Expected to appreciate the nature of interaction between applied electrical potential and the concentration of the analyte.
- The nature of chemical reactions that influence potential of a given cell.
- Familiar with the various types of electrodes or half cells.
- Appreciate the nature, need and importance of pH
- Expected to know the applications of the various instrumental methods dealt with in this unit.

2. Instruments based on the electrochemical properties of the analytes

2.1. Potentiometry: (05 L)

2.1.1. Principle.

2.1.2. Role of Reference and indicator electrodes

- 2.1.3. Applications in Neutralisation reactions with reference to the titration of a Strong acid against a Strong Base (using quinhydrone electrode)
- 2.1.4. Graphical methods for detection of end points
- 2.2. pHmetry: (04 L)**
- 2.2.1. Principle
- 2.2.2. Types of pH meters.
- 2.2.3. Principle, Construction Working and Care of Combined Glass electrode
- 2.2.4. Applications in Titrimetry (Strong acid-Strong Base) biological and environmental analysis.
- 2.3. Conductometry: (06 L)**
- 2.3.1. Principle
- 2.3.2. Conductivity cell its construction and care
- 2.3.3. Applications in Neutralisation Titrimetry with respect to
- Strong Acid-Strong Base
 - Strong Acid-Weak Base
 - Strong Base-weak Acid
 - Weak Acid- Weak Base.
- 2.3.4. Advantages & limitations of conductometric titrations.

References:

- Principles of Instrumental analysis, D. A. Skoog, 3rd edition, Saunders college publishing. Chapters: 20, 23 Page nos: 600 - 605, 631, 704 - 711.
- Vogel's Text book of quantitative inorganic analysis, 4th edition, ELBS/ Longman. Chapters: XIV, XV Page nos: 566 - 601, 615 - 625.
- Instrumental methods of analysis, B. K. Sharma, Goel publishing house. Miscellaneous methods: Chapters: 1, 3, 4 Page nos: 1 - 14, 21 - 57.

Unit III- Statistical Treatment of analytical data --II (15 L)

Objectives:

On completing this unit the learner is expected to understand

- The use of statistical methods in chemical analysis.
- The nature of indeterminate errors
- The randomness of such errors and its distribution around a correct or acceptable result
- Computation of Confidence limits and confidence interval
- Test for rejection of doubtful result
- Method to draw best fitting straight line

3.1.Nature of Indeterminate Errors: (03L)

- 3.1.1. The true and acceptable value of a result of analysis
- 3.1.2. Measures of central tendency: mean, median. mode, average
- 3.1.3. Measures of dispersion: Absolute deviation, relative deviation, relative average deviation, standard deviation,(s,sigma) variance, coefficient of variation

3.2. Distribution of random errors: (02L)

3.2.1. Gaussian distribution curve.

3.2.2. Equation and salient features of Gaussian distribution curve

3.3. Concept of Confidence limits and confidence interval and its computation using (03 L)

- (i) Population standard deviation
- (ii) Student's t test
- (iii) Range

3.4. Criteria for rejection of doubtful result (02 L)

- (i) 2.5 d rule
- (ii) 4.0 d rule
- (iii) Q test

3.5. Test of Significance (02 L)

- (i) Null hypothesis
- (ii) F-test (variance ratio test)

3.6. Graphical representation of data and obtaining best fitting straight line (03 L)

- (a) For line passing through origin
- (b) For line not passing through origin

[Numerical problems wherever possible, expected]

References:

1. Modern Analytical Chemistry , David Harvey (page numbers 53 -84)
2. Fundamentals of analytical chemistry – Skoog and West

**Semester IV Chemistry
Practicals:**

Paper III Elective

(Basics in analytical Chemistry)

1. Tools of Analytical Chemistry-II
 - a. Filtration Flasks, Funnels, Separating Funnels, Distillation apparatus, Vacuum Distillation assembly, Centrifuge machine, Electrophoresis apparatus.
 - b. Development chamber for chromatography
 - c. Electrodes like Reference Electrodes and Indicator Electrodes (with respect to care and maintenance.)
 - d. Conductivity cell (with respect to care and maintenance.)
 - e. Combined Glass electrode (with respect to care and maintenance.)
 - f. Types of Salt Bridges and preparation of any one or use of salt bridge, its effect on the potential of a given electrode/cell

(The learner should draw diagrams and write-ups providing uses of the items mentioned in (a and b) and Principle, Construction care and Uses of items (c) to (f) in his journal.)

2. **Paper chromatography:** Separation of cations like Fe(III), Ni(II) and Cu(II) in a sample.

3. Separation of a solute between two immiscible solvents to determine the distribution ratio and/or extraction efficiency. (Solutes could be as their aqueous solutions and the organic solvent ethyl acetate) Suggested solute for the distribution study: Fe (III) in aqueous solutions.

(The learner is expected to learn the technique of solvent extraction by using separating funnel, method to estimate the concentrations of the solute distributed in the two immiscible phases, determination of the extraction efficiency)

4. Conductometric titration: Estimation of given acid by conductometric titration with strong base and calculation of % error. (The learner is expected to learn the handling of the conductometer and the conductivity cell, determination of end point by plotting a graph. They are also expected to state the error estimate of their results).
5. Estimation of Fe(II) in the given solution by titrating against $K_2Cr_2O_7$ potentiometrically and calculation of % error. (The learner is expected to learn the handling of the potentiometer, use of Platinum electrode and reference electrode like SCE. They will learn to determine end point by plotting a graph. They are also expected to state the error estimate of their results).
6. Gravimetric estimation of Sulfate as $BaSO_4$ and calculation of % error. (The learner is expected to write a balanced chemical reaction, need for digestion of the precipitate and the skill required to carry out the incineration and to estimate the % error.)
(The learner is expected to write a balanced chemical reaction, need for digestion of the precipitate and the skill required to carry out the incineration and to estimate the % error.)

REFERENCES:

For paper III

1. D. A. Skoog, D. M. West, F. J. Holler, and S. R. Crouch, **Analytical Chemistry: An Introduction**, 7th ed., Chapter 15, pp. 345-381.
2. A.I. Vogel. "Textbook of Quantitative Inorganic Analysis," Longman, London (1961).
3. R.V. Dilts. "Analytical Chemistry. Methods of Separation," van Nostrand, N.Y. (1974).
4. Some Experiments for B. Tech in Chemistry & Chemical Technology compiled by Prof. J.B.BARUAH, Mrs. Abhilasha Mohan Bauah and Mr. Parikshit Gogoi

UNIVERSITY OF MUMBAI

No. UG/73 of 2018-19

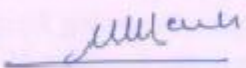
CIRCULAR:-

Attention of the Principals of the affiliated Colleges and Directors of the recognized Institutions in Science & Technology Faculty is invited to this office Circular Nos. UG/156 of 2016-17, dated 16th November, 2016 relating to syllabus of the Bachelor of Science (B.Sc.) degree course.

They are hereby informed that the recommendations made by the Board of Studies in Chemistry at its meeting held on 28th May, 2018 have been accepted by the Academic Council at its meeting held on 14th June, 2018 vide item No. 4.41 and that in accordance therewith, the revised syllabus as per the (CBCS) for the Chemistry of T.Y.B.Sc. Physical Chemistry, Inorganic Chemistry, Organic Chemistry and Analytical Chemistry (Sem - V & VI) (3 and 6 Units) including Applied Component Drugs and Dyes, Heavy Fine Chemicals and Petrochemicals has been brought into force with effect from the academic year 2018-19, accordingly. (The same is available on the University's website www.mu.ac.in).

MUMBAI - 400 032

To 6th June, 2018
6th July


(Dr. Dinesh Kamble)
I/c REGISTRAR

The Principals of the affiliated Colleges & Directors of the recognized Institutions in Science & Technology Faculty. (Circular No. UG/334 of 2017-18 dated 9th January, 2018.)

A.C./4.41/14/06/2018

No. UG/ 73 -A of 2018

MUMBAI-400 032

6th June, 2018
6th July

Conv. forwarded with Compliments for information to:-

Syllabus for the T.Y.B.Sc. Chemistry Semester V and VI

Credit Based Semester and Grading System

Course: Physical Chemistry

Paper I (Physical Chemistry)

SEMESTER V

Course Code	Paper No. and Name	Unit	Topics	Credits	L/Week
USC5CH1	Paper I Physical Chemistry	I	Molecular Spectroscopy	2.5	4
		II	i) Chemical Thermodynamics ii) Chemical Kinetics		
		III	Nuclear Chemistry		
		IV	i) Surface Chemistry and Catalysis ii) Colloidal State		
USC5CP1	Practical's	<ul style="list-style-type: none">• Non- Instrumentation• Instrumentation		1.5	4

SEMESTER VI

Course Code	Paper No. and Name	Unit	Topics	Credits	L/Week
USC6CH1	Paper I Physical Chemistry	I	i) Electrochemistry ii) Nanomaterials		4
		II	Polymers		
		III	i) Basics of Quantum Chemistry ii) Renewable Energy Resources		
		IV	i) NMR- Nuclear Magnetic Resonance Spectroscopy ii) Phase Rule		
USC6CP1	Practical's	<ul style="list-style-type: none">• Non-Instrumentation• Instrumentation		1.5	4

SEME

STER V (THEORY)

Unit		Topics	
I		MOLECULAR SPECTROSCOPY	(15L)
	1.1	Rotational Spectrum: Introduction to dipole moment, polarization of a bond, bond moment, molecular structure, Rotational spectrum of a diatomic molecule, rigid rotor, moment of inertia, energy levels, conditions for obtaining pure rotational spectrum, selection rule, nature of spectrum, determination of internuclear distance and isotopic shift.	
	1.2	Vibrational spectrum: Vibrational motion, degrees of freedom, modes of vibration, vibrational spectrum of a diatomic molecule, simple harmonic oscillator, energy levels, zero-point energy, conditions for obtaining vibrational spectrum, selection rule, nature of spectrum.	
	1.3	Vibrational-Rotational spectrum of diatomic molecule: Energy levels, selection rule, nature of spectrum, P and R branch lines. Anharmonic oscillator - energy levels, selection rule, fundamental band, overtones. Application of vibrational-rotational spectrum in determination of force constant and its significance. Infrared spectra of simple molecules like H ₂ O and CO ₂ .	
	1.4	Raman Spectroscopy: Scattering of electromagnetic radiation, Rayleigh scattering, Raman scattering, nature of Raman spectrum, Stoke's lines, anti-Stoke's lines, Raman shift, quantum theory of Raman spectrum, comparative study of IR and Raman spectra, rule of mutual exclusion- CO ₂ molecule.	
II		CHEMICAL THERMODYNAMICS	(9L)
	2.1.1	Colligative properties: Vapour pressure, Raoult's law and relative lowering of vapour pressure.	

	2.1.2	Solutions of Solid in Liquid: Elevation in boiling point of a solution, thermodynamic derivation relating elevation in boiling point of the solution and molar mass of non-volatile solute. Depression in freezing point of a solution, thermodynamic derivation relating the depression in the freezing point of a solution and the molar mass of the non-volatile solute.	
	2.1.3	Osmotic Pressure: Introduction, thermodynamic derivation of Van't Hoff equation, Van't Hoff Factor, Reverse Osmosis.	
		CHEMICAL KINETICS	(6L)
	2.2.1	Collision theory of reaction rates: Application of collision theory to i. Unimolecular reaction Lindemann theory ii. Bimolecular reaction. (derivation expected for both) Merits and drawbacks of collision theory	
	2.2.2	Activated complex theory: Activated complex theory of bimolecular reactions. Merits of Activated complex theory. Comparison of collision theory and activated complex theory.	
	2.2.3	Classification of reactions as slow, fast and ultra -fast. Study of kinetics of fast reactions by Stop flow method and Flash photolysis (No derivation expected).	
III		NUCLEAR CHEMISTRY	(15L)
	3.1	Introduction: Nuclear disintegration/ Nuclear radioactivity, Types of nuclear radiations (α -particle, β - particle and γ -ray). Basic terms-radioactive constants (decay constant, half-life and average life) and units of radioactivity.	
	3.2	Detection and Measurement of Radioactivity: Types and characteristics of nuclear radiations, behavior of ion pairs in electric field, detection and measurement of nuclear radiations using G.M. Counter and Scintillation Counter.	
	3.3	Application of use of radioisotopes as Tracers:	

		Chemical reaction mechanism, age determination - dating by C^{14} .	
	3.4	Nuclear reactions: Nuclear transmutation (one example for each projectile), artificial radioactivity, Q - value of nuclear reaction, threshold energy.	
	3.5	Fission Process: Fissile and fertile material, nuclear fission, chain reaction, factor controlling fission process. Multiplication factor and critical size or mass of fissionable material, nuclear power reactor and breeder reactor.	
	3.6	Fusion Process: Thermonuclear reactions occurring on stellar bodies and earth.	
IV		SURFACE CHEMISTRY AND CATALYSIS	(10L)
	4.1.1	Adsorption: Physical and Chemical Adsorption, types of adsorption isotherms. Langmuir's adsorption isotherm (Postulates and derivation expected). B.E.T. equation for multilayer adsorption, (derivation not expected). Determination of surface area of an adsorbent using B.E.T. equation.	
	4.1.2	Catalysis: Homogeneous and heterogeneous catalysis, catalytic activity and selectivity, promoters, inhibitors, catalyst poisoning and deactivation.	
	4.1.3	Acid catalysis and Base catalysis, mechanism and kinetics of acid and base catalysed reactions, effect of pH on acid and base catalysed reactions. Enzyme catalysis, mechanism and kinetics of reaction (Michaelis- Menten equation).	
		COLLOIDAL STATE	(5L)
	4.2.1	Introduction to colloids: Emulsions, Sols and Gels	
	4.2.2	Colloidal electrolytes: Introduction, micelle formation.	

COURSE CODE: USC5CP1 CREDITS: 1.50 for USC5CH1 (Physical Chemistry)

Sr. No.	TYPE	PRINCIPLE	TITLE
1	Non-Instruments	Colligative properties	To determine the molecular weight of compound by Rast Method
2		Chemical Kinetics	To determine the order between $K_2S_2O_8$ and KI by fractional change method.
3		Surface phenomena	To investigate the adsorption of acetic acid on activated charcoal and test the validity of Freundlich adsorption isotherm.
4	Instruments	Potentiometry	To determine the solubility product and solubility of AgCl potentiometrically using chemical cell.
5		Conductometry	To determine the velocity constant of alkaline hydrolysis of ethyl acetate by conductometric method.
6		pH-metry	To determine acidic and basic dissociation constants of amino acid and hence to calculate isoelectric point.

References

1. **Practical Physical Chemistry** 3rd edition A.M. James and F.E. Prichard, Longman publication
2. **Experiments in Physical Chemistry** R.C. Das and B. Behra, Tata Mc Graw Hill
3. **Advanced Practical Physical Chemistry** J.B. Yadav, Goel Publishing House
4. **Advanced Experimental Chemistry** Vol-I J.N. Gurtu and R Kapoor, S. Chand and Co.
5. **Experimental Physical Chemistry** by V.D. Athawale.
6. **Senior Practical Physical Chemistry** by B.D. Khosla, V.C. Garg and A. Gulati, R Chand and Co.

SEMESTER VI (THEORY)

Unit			Topics	
I	1.1		ELECTROCHEMISTRY	(7L)
		1.1.1	Activity and Activity Coefficient: Lewis concept, ionic strength, mean ionic activity and mean ionic activity coefficient of an electrolyte, expression for activities of electrolytes. Debye-Huckel limiting law (No derivation).	
		1.1.2	Classification of cells: Chemical cells and Concentration cells Chemical cells with and without transference, Electrode Concentration cells, Electrolyte concentration cells with and without transference (Derivation expected)	
	1.2		NANOMATERIALS	(8L)
		1.2.1	Terminology and history: Optical properties of nanomaterials. i. Semiconducting nanoparticle ii. Metallic nanoparticle	
		1.2.2	Characterization and fabrication: i. Characterization methods a) Scanning electron microscopy (SEM) b) Transmission electron microscopy (TEM) ii. Top-down, bottom-up fabrication a) Co-precipitation method b) Sol-gel method c) Chemical reduction method d) Electrochemical method.	
		1.2.3	Applications of Nanomaterials.	
II	2.0		POLYMERS	(15L)
		2.1	Basic terms: Macromolecule, monomer, repeat unit, degree of polymerization.	
		2.2	Classification of polymers: Classification based on source, structure, thermal response and physical properties.	
		2.3	Molar masses of polymers: Number average, Weight average, Viscosity average molar mass, Monodispersity and Polydispersity	
		2.4	Method of determining molar masses of polymers: Viscosity method using Ostwald Viscometer. (Derivation expected)	

		2.5	Light Emitting Polymers: Introduction, Characteristics, Method of preparation and applications.	
		2.6	Antioxidants and Stabilizers: Antioxidants, Ultraviolet stabilizers, Colourants, Antistatic agents and Curing agents.	
III	3.1		BASICS OF QUANTUM CHEMISTRY	(10L)
		3.1.1	Classical mechanics: Introduction, limitations of classical mechanics, Black body radiation, photoelectric effect, Compton effect.	
		3.1.2	Quantum mechanics: Introduction, Planck's theory of quantization, wave particle duality, de-Broglie's equation, Heisenberg's uncertainty principle.	
		3.1.3	Interpretation and properties of the wave function on the basis of postulates of quantum mechanics: State function and its significance, Concept of operators - definition, addition, subtraction and multiplication of operators, commutative and non - commutative operators, linear operator, Hamiltonian operator, Eigen function and Eigen value.	
	3.2		RENEWABLE ENERGY RESOURCES	(5L)
		3.2.1	Renewable energy resources: Introduction.	
		3.2.2	Solar energy: Solar cells, Photovoltaic effect, Differences between conductors, semiconductors, insulators and its band gap, Semiconductors as solar energy converters, Silicon solar cell.	
		3.2.3	Hydrogen: Fuel of the future, production of hydrogen by direct electrolysis of water, advantages of hydrogen as a universal energy medium.	
IV	4.1		NMR- NUCLEAR MAGNETIC RESONANCE SPECTROSCOPY	(7L)
		4.1.1	Principle: Nuclear spin, magnetic moment, nuclear 'g' factor, energy levels, Larmor precession, Relaxation processes in NMR (spin -spin relaxation and spin - lattice relaxation).	
		4.1.2	Instrumentation: NMR Spectrometer.	
	4.2		PHASE RULE	(8L)
		4.2.1	Gibb's phase rule and terms involved in the equation.	

		4.2.2	Application of phase rule to TWO component systems, condensed systems, condensed phase rule, eutectic systems (Lead-Silver system), desilverisation of lead.	
		4.2.3	Introduction to THREE component systems, explanation of the phase diagram for three liquids forming one immiscible pair.	

SEMESTER VI (PRACTICALS)

COURSE CODE: USC6CP1 CREDITS: 1.50 for USC6CH1 (Physical chemistry)

Sr. No.	TYPE	PRINCIPLE	TITLE
1	Non-Instruments	Viscosity	To determine the molecular weight of high polymer polyvinyl alcohol (PVA) by viscosity measurement.
2		Chemical Kinetics	To interpret the order of reaction graphically (Graph should be plot traditional way or using origin software) from the given experimental data and calculate the specific rate constant. (No fractional order)
3	Instruments	Potentiometry	<ul style="list-style-type: none">i. To determine the amount of iodide, bromide and chloride in the mixture by potentiometric titration with silver nitrate.ii. To determine the number of electrons in the redox reaction between ferrous ammonium sulphate and ceric sulphate potentiometrically.
4		Conductometry	To titrate a mixture of weak acid and strong acid against strong base and estimate the amount of each acid in the mixture conductometrically.
5		Colorimetry	To estimate the amount of Fe (III) in the complex formation with salicylic acid by Static Method.

Semester V (THEORY)**COURSE CODE: USC5CH2****CREDITS: 2.50****LECTURES: 60**

Unit			Topics	
I	1.0		MOLECULAR SYMMETRY AND CHEMICAL BONDING	(6L)
	1.1		MOLECULAR SYMMETRY	
		1.1.1	Introduction and Importance of Symmetry in Chemistry.	
		1.1.2	Symmetry elements and Symmetry operations.	
		1.1.3	Concept of a Point Group with illustrations using the following point groups :(i) $C_{\infty v}$ (ii) $D_{\infty h}$ (iii) C_{2v} (iv) C_{3v} (v) C_{2h} and (vi) D_{3h}	
	1.2		MOLECULAR ORBITAL THEORY FOR HETERONUCLEAR DIATOMIC MOLECULES AND POLYATOMIC SPECIES	(9L)
		1.2.1.	Comparison between homonuclear and heteronuclear diatomic molecules.	
		1.2.2	Heteronuclear diatomic molecules like CO, NO and HCl, appreciation of modified MO diagram for CO.	
		1.2.3	Molecular orbital theory for H_3 and H_3^+ (correlation diagram expected).	
		1.2.4	Molecular shape to molecular orbital approach in AB_2 molecules. Application of symmetry concepts for linear and angular species considering σ - bonding only. (Examples like: i) BeH_2 , ii) H_2O).	
II	2.0		SOLID STATE CHEMISTRY	
	2.1		STRUCTURES OF SOLIDS	(11L)
		2.1.1	Explanation of terms viz. crystal lattice, lattice point, unit cell and lattice constants.	
		2.1.2	Closest packing of rigid spheres (hcp, ccp), packing density in simple cubic, bcc and fcc lattices. Relationship between density, radius of unit cell and lattice parameters.	
		2.1.3	Stoichiometric Point defects in solids (discussion on Frenkel and Schottky defects expected).	
		2.1.4	Metallic Bond: Band theory, Explanation of electrical properties of conductors, insulators and semiconductors (n- and p- types) on the basis of Band theory.	

	2.2		SUPERCONDUCTIVITY	(4L)
		2.2.1	Discovery of superconductivity.	
		2.2.2	Explanation of terms like superconductivity, transition temperature, Meissner effect.	
		2.2.3	Different types of super conductor's viz. conventional superconductors, alkali metal fullerenes, and high temperature super conductors.	
		2.2.4	Brief application of superconductors.	
III	3.0		CHEMISTRY OF INNER TRANSITION ELEMENTS	(15L)
		3.1	Introduction: Position in periodic table and electronic configuration of lanthanides and actinides.	
		3.2	Chemistry of Lanthanides with reference to (i) lanthanide contraction and its consequences(ii) Oxidation states (iii) Ability to form complexes (iv) Magnetic and spectral properties	
		3.3	Occurrence, extraction and separation of lanthanides by (i) Ion Exchange method and (ii) Solvent extraction method (Principles and technique)	
		3.4	Applications of lanthanides	
		3.5	Chemistry of Uranium with reference to occurrence, extraction (Solvent extraction method), properties and applications.	
IV	4.0		SOME SELECTED TOPICS	
	4.1		CHEMISTRY OF NON-AQUEOUS SOLVENTS	(5L)
		4.1.1	Classification of solvents and importance of non-aqueous solvents.	
		4.1.2	Characteristics and study of liquid ammonia, dinitrogen tetra oxide as non-aqueous solvents with respect to: (i) acid-base reactions and (ii) redox reactions.	
	4.2		COMPARATIVE CHEMISTRY OF GROUP 16	(5L)
		4.2.1	Electronic configuration, trends in physical properties, allotropy	
		4.2.2	Manufacture of sulphuric acid by Contact process.	
	4.3		COMPARATIVE CHEMISTRY OF GROUP 17	(5L)
		4.3.1	Electronic configuration, General characteristics, anomalous properties of fluorine, comparative study of acidity of oxyacids of chlorine w.r.t acidity, oxidizing properties and structures (on the basis of VSEPR	

			theory)	
		4.3.2	Chemistry of interhalogens with reference to preparations, properties and structures (on the basis of VSEPR theory).	

EMESTER V (PRACTICALS)

COURSE CODE: USC5CP1 CREDITS: 1.50 for USC5CH2 (Inorganic Chemistry)

Sr. No.	TYPE	TITLE
1	Inorganic preparations	Preparation of Potassium diaquobis-(oxalato)cuprate (II)
2		Preparation of Ferrous ethylene diammonium sulphate.
3		Preparation of bis-acetylacetonato copper (II)
4	percentage purity	Determination of percentage purity of the given water-soluble salt and qualitative detection w.r.t added cation and/or anion (qualitative analysis only by wet tests). (Any three salts of transition metal ions)

Semester VI (THEORY)

COURSE CODE: USC5CH2

CREDITS: 2.50

LECTURES: 60

III	3.0		ORGANOMETALLIC CHEMISTRY	
	3.1		ORGANOMETALLIC COMPOUNDS OF MAIN GROUP METAL	(6L)
		3.1.1	General characteristics of various types of organometallic compounds, viz. ionic, σ -bonded and electron deficient compounds.	

		3.1.2	General synthetic methods of organometallic compounds: (i) Oxidative-addition (ii) Metal-metal exchange (transmetallation) (iii) Carbanion-halide exchange (iv) Metal-hydrogen exchange (metallation) and (v) Methylene-insertion reactions.	
		3.1.3	Some chemical reactions of organometallic compounds: (i) Reactions with oxygen and halogens, (ii) Alkylation and arylation reactions (iii) Reactions with protic reagents, (iv) Redistribution reactions and (v) Complex formation reactions.	
	3.2		METALLOCENE'S	(3L)
		3.2.1	Introduction, Ferrocene: Synthesis, properties, structure and bonding on the basis of VBT.	
	3.3		METAL CLUSTERS	(2L)
		3.3.1	δ bonding, bonding in Rhenium and Molybdenum halide complexes.	
	3.4		CATALYSIS	(4L)
		3.4.1	Comparison between homogeneous and heterogeneous catalysis	
		3.4.2	Basic steps involved in homogeneous catalysis	
		3.4.3	Mechanism of Wilkinson's catalyst in hydrogenation of alkenes.	
IV	4.0		SOME SELECTED TOPICS	
	4.1		METALLURGY	(7L)
		4.1.1	Types of metallurgies,	
		4.1.2	General steps of metallurgy; Concentration of ore, calcinations, roasting, reduction and refining.	
		4.1.3	Metallurgy of copper: occurrence, physicochemical principles, Extraction of copper from pyrites & refining by electrolysis.	
	4.2		Chemistry of Group 18	(5L)
		4.2.1	Electronic configuration, General characteristics and trends in physical and chemical properties	
		4.2.2	Compounds of Xenon (oxides and fluorides) with respect to preparation and structure (VSEPR)	
		4.2.3	Uses of noble gases	
	4.3		Introduction to Bioinorganic Chemistry.	(3L)
		4.3.1	Essential and non-essential elements in biological systems.	
		4.3.2	Biological importance of metal ions such as Na^+ , K^+ , $\text{Fe}^{+2}/\text{Fe}^{+3}$ and Cu^{+2} (Role of Na^+ and K^+ w.r.t ion pump)	

SEMESTER VI (PRACTICALS)

COURSE CODE: USC6CP1 CREDITS: 1.50 for USC6CH2 (Inorganic Chemistry)

Sr. No.	TYPE	TITLE
1	Inorganic preparations	Preparation of Tris(acetylacetonato) iron (III)
2		Green synthesis of bis(dimethylglyoximato) nickel (II) complex using nickel carbonate and sodium salt of dmg.
3		Preparation of potassium trioxalato aluminate (III)
4	percentage purity	Determination of percentage purity of the given water-soluble salt and qualitative detection w.r.t added cation and/or anion (qualitative analysis only by wet tests). (Any three salts of main group metal ions)

Course: B.Sc.**Paper III (Organic Chemistry)****SEMESTER V**

Course Code	Paper No. and Name	Unit	Topics	Credits	L/Week
USC5CH3	Paper III Organic Chemistry	I	Mechanism of Organic Reactions Photochemistry	2.5	4
		II	Stereochemistry I Organometallic Chemistry Heterocyclic Chemistry		
		III	IUPAC Nomenclature Synthesis of Organic Compounds Agrochemicals		
		IV	Spectroscopy		
USC5CP2	Practicals	Separation of Binary solid-solid mixture of organic compounds and identification using micro-scale technique.		1.5	4

SEMESTER VI

Course Code	Paper No. and Name	Unit	Topics	Credits	L/Week
USC6CH3	Paper III Organic Chemistry	I	Molecular Rearrangements Carbohydrates	2.5	4
		II	Stereochemistry II Amino acids and Proteins		
		III	Polymers Catalyst and Reagents		
		IV	Natural Products Nucleic Acids		
USC6CP2	Practicals	<ul style="list-style-type: none">Separation of Binary liquid-liquid and liquid- solid mixture using micro-scale techniquePlanning of Organic Synthesis		1.5	4

SEMESTER V (THEORY)**COURSE CODE: USC5CH3****CREDITS: 2.50****LECTURES: 60**

				(10L)

		1.2	Photochemistry Introduction: Difference between thermal and photochemical reactions. Singlet and triplet states, allowed and forbidden transitions, Jablonski diagram, fate of excited molecules, Photosensitization. Photochemical reactions of olefins: photoisomerization, photochemical rearrangement of 1,4- dienes (di- π methane) Photochemistry of carbonyl compounds: Norrish I, Norrish II cleavages. Photoreduction (e.g. benzophenone to benzpinacol)	(5L)
II	2.0			
		2.1	Stereochemistry-I Molecular chirality and elements of symmetry: Mirror plane symmetry, inversion center, rotation-reflection (alternating) axis. Chirality of compounds without a stereogenic center: cummulenes and biphenyls.	(5L)
		2.2	Organometallic Chemistry Introduction: Carbon-metal bond nature, types, reactivity. Organomagnesium Compounds: Grignard reagent: Preparation, structure, and stability, Reaction with compounds containing acidic hydrogen, carbonyl compounds, cyanides and CO ₂ . Organolithium Compounds: Preparation using alkyl/aryl halides. Reactions with compounds containing acidic hydrogen, alkyl halides, carbonyl compounds, CO ₂ , cyanides and epoxides. Organozinc compounds: Reformatsky reaction and Simmons-Smith reaction with mechanism and applications	(5L)
		2.3	Heterocyclic Chemistry Reactivity of pyridine-N-oxide, quinoline and coumarins. Preparation of pyridine-N-oxide, quinoline (Skraup synthesis) and coumarin (Pechmann synthesis). Reactions of pyridine-N-oxide: halogenation, nitration and reaction with NaNH ₂ /liq.NH ₃ , n-BuLi. Reactions of quinoline; oxidation, reduction, nitration, halogenation and reaction with NaNH ₂ /liq.NH ₃ , n-BuLi. Reactions of coumarin; bromination, nitration, reaction with hydroxide and photochemical reactions.	(5L)
III	3.0			

		3.1	IUPAC Nomenclature	(5L)
			IUPAC Systematic nomenclature of the following classes of compounds (including compounds up to two substituents / functional groups): Bicyclic compounds – spiro, fused and bridged (up to 11 carbon atoms) – saturated and unsaturated compounds Biphenyls, Cummulenes with up to 3 double bonds, Quinolines and isoquinolines	
		3.2	Synthesis of Organic Compounds Introduction: Linear and convergent synthesis, criteria for an ideal synthesis, concept of chemoselectivity and regioselectivity with examples, calculation of yields. Multicomponent Synthesis: Mannich reaction and Biginelli reaction. Synthesis with examples (no mechanism) 3.2.3 Green chemistry and synthesis: Introduction: Twelve principles of green chemistry, concept of atom economy and E-factor, calculations and their significance, numerical examples. <ol style="list-style-type: none"> 1. Green reagents: dimethyl carbonate 2. Green starting materials: D-glucose 3. Green solvents : supercritical CO₂ 4. Green catalysts: Bio catalysts. 	(7L)
		3.3	3.3 Agrochemicals General introduction & scope, meaning & examples of insecticides, herbicides, fungicide, rodenticide, pesticides, plant growth regulators. Advantages & disadvantages of agrochemicals Synthesis & application of IAA (Indole Acetic Acid) & EndosulphanBio pesticides – Neem oil & Karanj oil.	(3L)
	4.0		Spectroscopy	(15L)
		4.1	Introduction: Electromagnetic spectrum, units of wavelength and frequency	
		4.2	UV–Visible spectroscopy: Basic theory, solvents, nature of UV-Visible spectrum, concept of chromophore, auxochrome, bathochromic and hypsochromic shifts, hyperchromic and hypochromic effects, chromophore-chromophore and chromophore-auxochrome interactions.	
		4.3	IR spectroscopy: Basic theory, selection rule, fingerprint region and functional group region, characteristic IR peaks for different functional groups.	

		<p>4.4 PMR spectroscopy: Basic theory of PMR, Nature of PMR spectrum, reference standard, solvents, chemical shift, factors affecting chemical shift: Inductive effect and anisotropic effect (with reference to acetylene, benzene and aldehyde), spin-spin coupling and coupling constant, D₂O exchange technique. Application of PMR in structure determination</p> <p>4.5 Mass spectrometry: Basic theory, Nature of mass spectrum, Importance of molecular ion peak, base peak and isotopic peaks. Nitrogen rule. General rules for fragmentation. Fragmentation of alkanes and aliphatic carbonyl compounds</p> <p>4.6 Spectral characteristics of following classes of organic compounds, including benzene and monosubstituted benzenes, with respect to IR and PMR: (1) alkanes (2) alkenes (3) alkynes (4) haloalkanes (5) alcohols (6) carbonyl compounds (7) Carboxylic acid, esters and amides (8) amines (broad regions characteristic of different groups are expected).</p> <p>4.7 Problems of structure elucidation of simple organic compounds using individual or combined use of UV-VIS, IR, PMR and Mass spectral data. (Index of Hydrogen Deficiency should be the first step in solving the problems)</p>	
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Separation of Binary solid-solid mixture of organic compounds and identification using micro-scale technique. (2.0 gm mixture to be given)

1. Minimum six mixtures to be completed by the students.
2. Components of the mixture should include water soluble and water insoluble acids (carboxylic acid), water insoluble phenols (2-naphthol, 1-naphthol), water insoluble bases (nitro anilines) , water soluble neutral (thiourea) and water insoluble neutral compounds (anilides , amides, m-DNB, hydrocarbons)
3. After correct determination of chemical type, the separating reagent should be decided by the student for separation.
4. Follow separation scheme with the bulk sample of binary mixture.
5. After separation into component A and component B, one component (decided by the examiner) is to be analyzed and identified with m.p.

References

1. Practical organic chemistry – A. I. Vogel
2. Practical organic chemistry – H. Middleton
3. Practical organic chemistry – O.P. Agarwal
4. Laboratory Manual of Organic Chemistry, Fifth edition, R K Bansal, New Age Publishers.

SEMESTER VI (THEORY)**COURSE CODE: USC6CH1****CREDITS 2.50****LECTURES: 60**

Unit			Topics	
I	1.0			
		1.1	Molecular Rearrangements Mechanism of the following rearrangements with examples and stereochemistry wherever applicable. Migration to the electron deficient carbon: Pinacol-pinacolone rearrangement, Benzilic acid rearrangement Migration to the electron deficient nitrogen: Beckmann rearrangement. Migration involving a carbanion: Favorski rearrangement. Migration to electron deficient oxygen: Baeyer-Villiger rearrangement	(5L)
		1.2	Carbohydrates Introduction: classification, reducing and non-reducing sugars, DL notation Structures of monosaccharides: Fischer projection (4-6 carbon monosaccharide) and Haworth formula (furanose and pyranose forms of pentoses and hexoses) Interconversion: open chain and Haworth forms of monosaccharide with 5 and 6 carbons. Chair conformation with stereochemistry of D-glucose, Stability of chair form of D-glucose Stereoisomers of monosaccharide: epimers, anomers Mutarotation and its mechanism Chain lengthening & shortening reactions: Modified Kiliani-Fischer synthesis (D-arabinose to D-glucose and D-mannose), Wohl's method (D-glucose to D-arabinose) Reactions of D-glucose and D-fructose: (a) osazone formation (b) reduction: H_2/Ni , $NaBH_4$ (c) oxidation: bromine water, HNO_3 , HIO_4 (d) acetylation (e) methylation: (d) and (e) with cyclic pyranose forms Biologically important sugar: 2DG	(10L)

II	2.0	2.1	Stereochemistry-II Stereoselectivity and stereospecificity: Idea of enantioselectivity (ee) and diastereoselectivity (de), Topicity: enantiotopic and diastereotopic atoms, groups and faces. Stereochemistry of- i) Substitution reactions: S _N i (reaction of alcohol with thionyl chloride) ii) Elimination reactions: E ₂ -Base induced dehydrohalogenation of 1-bromo-1, 2- diphenylpropane. iii) Addition reactions to olefins: a) bromination (electrophilic anti addition) b) syn-hydroxylation with OsO ₄ and KMnO ₄ c) epoxidation followed by hydrolysis.	(10L)
		2.2	Amino acids & Proteins α-Amino acids: General Structure, configuration, and classification based on structure and nutrition. Properties: pH dependency of ionic structure, isoelectric point and zwitter ion. Methods of preparations: Strecker synthesis, Gabriel phthalamide synthesis. Polypeptides and Proteins: Nature of peptide bond. Nomenclature and representation of polypeptides (di- and tri-peptides) with examples Merrifield solid phase polypeptide synthesis. Proteins: general idea of primary, secondary, tertiary & quaternary structure	(5L)
III	3.0	3.1	Polymer Introduction: terms monomer, polymer, homopolymer, copolymer, thermoplastics and thermosets. Mechanism of free radical addition polymerization Addition polymers: polyethylene, polypropylene, teflon, polystyrene, PVC, Uses. Condensation polymers: polyesters, polyamides. Uses, Stereochemistry of polymers: Tacticity, mechanism of stereochemical control of polymerization using Ziegler Natta catalysts. Natural and synthetic rubbers: Polymerization of isoprene: 1, 2 and 1, 4 addition (cis and trans), Styrene butadiene Additives to polymers: Plasticizers, stabilizers and fillers. Biodegradable polymers: Classification and uses. polylactic acid structure, properties and use for packaging and medical purposes. e: Identification of monomer in a given polymer & structure of polymer for a given monomer is expected. condition for polymerization is not expected	8 L

		3.2 Catalyst and Reagents Study of the following catalysts and reagents with respect to functional group transformations and selectivity (no mechanism) Catalysts: Catalysts for hydrogenation: <ol style="list-style-type: none"> Raney Nickel Pt and PtO₂ (C=C, CN, NO₂, aromatic ring) Pd/C: C=C, COCl → CHO (Rosenmund) Lindlar catalyst: alkyne Reagents: <ol style="list-style-type: none"> LiAlH₄ (reduction of CO, COOR, CN, NO₂) NaBH₄ (reduction of CO) SeO₂ (Oxidation of CH₂ alpha to CO) m-CPBA (epoxidation of C=C) 5. NBS (allylic and benzylic bromination)	(7L)
VI	4.0	4.1 Natural Products Terpenoids: Introduction, Isoprene rule, special isoprene rule and the gem-dialkyl rule. Citral: <ol style="list-style-type: none"> Structural determination of citral. Synthesis of citral from methyl heptenone Isomerism in citral. (cis and trans form). Alkaloids: Introduction and occurrence. Hofmann's exhaustive methylation and degradation in: simple open chain and N-substituted monocyclic amines.	10 L
		Nicotine: <ol style="list-style-type: none"> Structural determination of nicotine. (Pinner's work included) Synthesis of nicotine from nicotinic acid Harmful effects of nicotine Hormones: Introduction, structure of adrenaline (epinephrine), physiological action of adrenaline. Synthesis of adrenaline from <ol style="list-style-type: none"> Catechol p-hydroxybenzaldehyde (Ott's synthesis)	

		4.2	Nucleic Acids	(5L)
			Controlled hydrolysis of nucleic acids. Sugars and bases in nucleic acids. Structures of nucleosides and nucleotides in DNA and RNA. Structures of nucleic acids (DNA and RNA) including base pairing.	

Semester VI: (Practicals)

Course code: USC6CP2

Separation of Binary liquid-liquid and liquid- solid mixture of organic compounds using micro-scale technique.

1. Minimum six mixtures to be completed by the students.
2. Components of the liquid-liquid mixture should include volatile liquids like acetone, methyl acetate, ethyl acetate, isopropyl alcohol, ethyl alcohol, EMK and non-volatile liquids like chlorobenzene, bromobenzene, aniline, N, N dimethyl aniline, acetophenone, nitrobenzene, ethyl benzoate.
3. Components of the liquid-solid mixture should include volatile liquids like acetone, methyl acetate, ethyl acetate, ethyl alcohol, IPA, EMK and solids such as water insoluble acids, phenols, bases, neutral.
4. A sample of one ml mixture to be given to the student for detection of the physical type of the mixture.
5. After correct determination of physical type, separation of the binary mixture to be carried out by distillation method using micro-scale technique.
6. After separation into component A and component B, yield and physical constant are to be determined.

Planning of Organic Synthesis: To be recorded in to the journal (minimum four preparations)

Students are expected to know (i) the planning of synthesis, Literature, effect of reaction parameters including stoichiometry and green chemistry aspects ii) the possible mechanism, expected spectral data (IR and NMR) of the starting material and final product.

1. Cyclohexanone to oxime
2. Nitrobenzene to m-dinitrobenzene
3. m-dinitrobenzene to m-nitroaniline
4. Acetanilide to p-bromoacetanilide
5. p-nitroacetanilide to p-nitroaniline
6. Acetanilide to p-nitroacetanilide

Draft Syllabus
Syllabus for the T.Y.B.Sc. Chemistry Semester V and VI
 Credit Based Semester and Grading System
Course: B.Sc.
To be implemented from the academic year 2021-2022

Paper IV (Analytical Chemistry)
SEMESTER V

Course Code	Paper No. and Name	Unit	Topics	Credits	L/Week
USC5CH4	Paper IV Analytical Chemistry	I	Introduction to quality concepts in industry, chemical calculations and sampling	2.5	4
		II	Classical methods of analysis (Titrimetry)		
		III	Separation methods and molecular spectroscopy (uv-visible spectroscopy)		
		IV	Optical methods		
USC5CP2	Practical's			1.5	4

SEMESTER VI

Course Code	Paper No. and Name	Unit	Topics	Credits	L/Week
USC6CH4	Paper IV Analytical Chemistry	I	Electro analytical techniques	2.5	4
		II	Methods of separation - II		
		III	Food and cosmetics analysis		
		IV	Miscellaneous methods of analysis and ion exchange chromatography		
USC6CP2	Practical's			1.5	4

SEMESTER V (THEORY)

COURSE CODE: USC5CH4

CREDITS: 2.50

LECTURES: 60

Unit			Topics	
I	1.0		INTRODUCTION TO QUALITY CONCEPTS IN INDUSTRY, CHEMICAL CALCULATIONS AND SAMPLING	
	1.1		QUALITY IN ANALYTICAL CHEMISTRY	(3L)
		1.1.1	Concepts of Quality, Quality Control and Quality Assurance	
		1.1.2	Importance of Quality concepts in Industry	
		1.1.3	Chemical Standards and Certified Reference Materials; Importance in chemical analysis Quality of material: Various grades of laboratory reagents	
	1.2		CHEMICAL CALCULATIONS (NUMERICALS AND WORD PROBLEMS ARE EXPECTED)	(6L)
		1.2.1	Inter conversion of various concentration units. (Conversion of concentration from one unit to another unit with examples)	
		1.2.2	Percent composition of elements in chemical compounds	
	1.3		SAMPLING	(6L)
		1.3.1	Purpose, significance and difficulties encountered in sampling	
		1.3.2	Sampling of solids: Sample size – bulk ratio, size to weight ratio, multistage and sequential sampling, size reduction methods, sampling of compact solids, equipments and methods of sampling of compact solids, sampling of particulate solids, method sand equipments used for sampling of particulate solids.	
		1.3.3	Sampling of liquids: Homogeneous and heterogeneous, Static and flowing liquids.	
		1.3.4	Sampling of gases: Ambient and stack sampling: Apparatus and methods for sampling of gases.	
		1.3.5	Collection, preservation and dissolution of the sample.	
II	2.0		CLASSICAL METHODS OF ANALYSIS (TITRIMETRY)	
	2.1		REDOX TITRATIONS (Numerical and word Problems are expected)	(8L)
		2.1.1	Introduction	

		2.1.2	Construction of the titration curves and calculation of E_{system} in aqueous medium in case of: One electron system, Multielectron system.	
		2.1.3	Theory of redox indicators, Criteria for selection of an indicator, Use of diphenyl amine and ferroin as redox indicators	
	2.2		COMPLEXOMETRIC TITRATIONS	(7L)
		2.2.1	Introduction, construction of titration curve	
		2.2.2	Use of EDTA as titrant and its standardization, absolute and conditional formation constants of metal EDTA complexes, Selectivity of EDTA as a titrant. Factors enhancing selectivity with examples. Advantages and limitations of EDTA as a titrant.	
		2.2.3	Types of EDTA titrations.	
		2.2.4	Metallochromic indicators, theory, examples and applications	
III	3.0		SEPERATION METHODS-I AND MOLECULAR SPECTROSCOPY (UV-VISBLE SPECTROSCOPY)	
	3.1		SOLVENT EXTRACTION	(9L)
		3.1.1	Introduction, Nernst distribution Law, Distribution Ratio, Partition Coefficient. Conditions of extraction: Equilibration time, Solvent volumes, temperature, pH. Single-step and multi- step extraction, Percentage extraction for single step and multistep extraction. Separation factor.	
		3.1.2	Factors affecting extraction: Chelation, Ion pair formation and Solvation	
		3.1.3	Graph of percent extraction versus pH. Concept of $[pH]_{1/2}$ and its significance (derivation not expected)	
		3.1.4	Batch and continuous extraction, Craig's counter current extraction: Principle, apparatus and applications	
		3.1.5	Solid phase extraction: Principle, process and applications with Special reference to water and industrial effluent analysis.	
		3.1.6	Comparison of solid phase extraction and solvent extraction.	
	3.2		BASIC COMPONENTS OF SPECTROSCOPIC INSTRUMENTATION	(2L)
		3.2.1	Sources of Energy, Wavelength Selectors, Detectors, Signal Processors	
	3.3		MOLECULAR SPECTROSCOPY: ULTRA-VIOLET AND	(4L)

			VISIBLE SPECTROSCOPY	
		3.3.1	Instrumentation: Single beam and double beam spectrophotometer; Quantitative Applications (Calibration curve method); Qualitative Applications in Photometric titration, Job's method for study of complexes.	
IV	4.0		OPTICAL METHODS	
	4.1		ATOMIC SPECTROSCOPY: FLAME EMISSION SPECTROSCOPY (FES) AND ATOMIC ABSORPTION SPECTROSCOPY (AAS)	(7L)
		4.1.1	Introduction, Energy level diagrams, Atomic spectra, Absorption and Emission Spectra	
		4.1.2	Flame Photometry – Principle, Instrumentation (Flame atomizers, types of Burners, Wavelength selectors, Detectors)	
		4.1.3	Atomic Absorption Spectroscopy – Principle, Instrumentation (Source, Chopper, Flame and Electrothermal Atomizer)	
		4.1.4	Quantification methods of FES and AAS – Calibration curve method, Standard addition method and Internal standard method.	
		4.1.5	Comparison between FES and AAS	
		4.1.6	Applications, Advantages and Limitations	
	4.2		MOLECULAR FLUORESCENCE AND PHOSPHORESCENCE SPECTROSCOPY	(4L)
		4.2.1	Introduction and Principle	
		4.2.2	Relationship of Fluorescence intensity with concentration	
		4.2.3	Factors affecting Fluorescence and Phosphorescence	
		4.2.4	Instrumentation and applications	
		4.2.5	Comparison of Fluorimetry and Phosphorimetry	
		4.2.6	Comparison with Absorption methods	
	4.3		TURBIDIMETRY AND NEPHELOMETRY	(4L)
		4.3.1	Introduction and Principle	
		4.3.2	Factors affecting scattering of Radiation: Concentration, particle size, wavelength, refractive index	
		4.3.3	Instrumentation and Applications	
		4.3.4	Introduction and Principle	

SEMESTER V (PRACTICALS)

COURSE CODE: USC5CP2 CREDITS: 1.50 for USC5CH4 (Analytical Chemistry)

Sr. No.	TITLE
1	Spectrophotometric estimation of fluoride in given water sample.
2	Estimation of magnesium content in Talcum powder by complexometry, using standardized solution of EDTA
3	Determination of percent extraction of benzoic acid in given sample by solvent extraction.
4	To determine potassium content of a Fertilizer by Flame Photometry (Calibration curve method).
5	To determine the amount of persulphate in the given sample solution by back titration with standard Fe (II) ammonium sulphate solution.
6	To determine the amount of sulphate in given water sample turbidimetrically.

Note: Calculation of percent error is expected for all the experiments.

SEMESTER VI (THEORY)

COURSE CODE: USC6CH4

CREDITS: 2.50

LECTURES: 60

Unit			Topics	
I	1.0		ELECTRO ANALYTICAL TECHNIQUES	
	1.1		POLAROGRAPHY (Numerical and word problems are expected)	(11L)
		1.1.1	Difference between potentiometry and voltammetry, Polarizable and non-polarizable electrodes	
		1.1.2	Basic principle of polarography H shaped polarographic cell, DME (construction, working, advantages and limitations)	
		1.1.3	DC polarogram: Terms involved - Residual current, Diffusion current, Limiting current, Half-Wave Potential Role and selection of supporting electrolyte, Interference of oxygen and its removal, polarographic Maxima and Maxima Suppressors Qualitative aspects of Polarography: Half wave potential $E_{1/2}$, Factors affecting $E_{1/2}$ Quantitative aspects of polarography: Ilkovic equations: various terms involved in it (No derivation)	
		1.1.4	Quantification Wave height – Concentration plots working plots/ calibration) Internal standard (pilot ion) method, Standard addition method.	
		1.1.5	Applications advantages and limitations	
	1.2		AMPEROMETRIC TITRATIONS	(4L)
		1.2.1	Principle, Rotating Platinum Electrode (Construction, advantages and limitations)	
		1.2.2	Titration curves with example	
		1.2.3	Advantages and limitations	
II	2.0		METHODS OF SEPARATION - II	
	2.1		GAS CHROMATOGRAPHY (Numerical and word problems are expected)	(7L)
		2.1.1	Introduction, Principle, Theory and terms involved	
		2.1.2	Instrumentation: Block diagram and components, types of columns, stationary phases in GSC and GLC, Detectors: TCD, FID, ECD	
		2.1.3	Qualitative, Quantitative analysis and applications	
		2.1.4	Comparison between GSC and GLC	
	2.2		HIGH PERFORMANCE LIQUID CHROMATOGRAPHY	(5L)

		2.2.1	Introduction and Principle Instrumentation- components with their significance: Solvent Reservoir, Degassing system, Pumps-(reciprocating pumps, screw driven- syringe type pumps, pneumatic pumps, advantages and disadvantages of each pump), Precolumn, Sample injection system, HPLC Columns, Detectors(UV – Visible detector, Refractive index detector)	
		2.2.2	Qualitative and Quantitative Applications of HPLC	
	2.3		HIGH PERFORMANCE THIN LAYER CHROMATOGRAPHY (HPTLC)	(3L)
		2.3.1	Introduction and Principle Stationary phase, Sample application and mobile phase	
		2.3.2	Detectors- a) Scanning densitometer- Components. Types of densitometer- Single beam and Double beam, b) Fluorometric Detector	
		2.3.3	Advantages, disadvantages and applications	
		2.3.4	Comparison of TLC and HPTLC	
III	3.0		FOOD AND COSMETICS ANALYSIS	
	3.1		INTRODUCTION TO FOOD CHEMISTRY	(10L)
		3.1.1	Food processing and preservation:	
		3.1.2	Introduction, need, chemical methods, action of chemicals (Sulphur dioxide, boric acid, sodium benzoate, acetic acid, sodium chloride and sugar) and pH control Physical methods (Pasteurization and Irradiation)	
		3.1.3	Determination of boric acid by titrimetry and sodium benzoate by HPLC.	
		3.1.4	Study and analysis of food products and detection of adulterants Milk: Composition & nutrients, types of milk (fat free, organic and lactose milk) Analysis of milk for lactose by Lane Eynon's Method Honey: Composition, Analysis of reducing sugars in honey by Coles Ferricyanide method Tea: Composition, types (green tea and mixed tea) Analysis of Tannin by Lowenthal's method Coffee: Constituents and composition, Role of Chicory Analysis of caffeine by Bailey Andrew method	
	3.2		COSMETICS	(5L)
		3.2.1	Introduction and sensory properties	
		3.2.2	Study of cosmetic products –	

			<p>Face powder: Composition</p> <p>Estimation of calcium and magnesium by complexometric titration</p> <p>Lipstick: Constituents</p> <p>Ash analysis for water soluble salts: borates, carbonates and zinc oxide</p> <p>Deodorants and Antiperspirants: Constituents, properties</p> <p>Estimation of zinc by gravimetry</p>	
IV	4.0		MISCELLANEOUS METHODS OF ANALYSIS AND ION EXCHANGE CHROMATOGRAPHY	
	4.1		THERMAL METHODS	(7L)
		4.1.1	<p>Introduction to various thermal methods</p> <p>Thermogravimetric Analysis (TGA):</p> <p>Principle, Instrumentation, Factors affecting on thermogravimetric analysis, Thermal decomposition profile of $\text{CaC}_2\text{O}_4 \cdot \text{H}_2\text{O}$ and $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$, Applications.</p>	
		4.1.2	<p>Differential Thermal Analysis (DTA):</p> <p>Principle, Instrumentation, and Reference material used, Differential thermogram (DTA curve) of $\text{CaC}_2\text{O}_4 \cdot \text{H}_2\text{O}$ and $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$</p> <p>Applications, Comparison between TGA and DTA.</p>	
	4.2		RADIO-ANALYTICAL METHODS	(3L)
		4.2.1	Introduction to Radio analytical Methods, Classification	
		4.2.2	Introduction to Neutron Activation Analysis, Theory, Advantages, Disadvantages, Applications	
	4.3		ION EXCHANGE CHROMATOGRAPHY	(5L)
		4.3.1	Introduction, Principle.	
		4.3.2	Types of Ion Exchangers, Ideal properties of resin	
		4.3.3	Ion Exchange equilibria and mechanism, selectivity coefficient and separation factor, Factors affecting separation of ions	
		4.3.4	Ion exchange capacity and its determination for cation and anion exchangers.	
		4.3.5	Applications of Ion-Exchange Chromatography with reference to Preparation of demineralized water, Separation of amino acids	

Note: Concept of sensitivity is to be discussed for all techniques and instruments mentioned in the syllabus.

SEMESTER VI (PRACTICALS)

COURSE CODE: USC6CP2 CREDITS: 1.50 for USC6CH4 (Analytical Chemistry)

Sr. No.	TITLE
1	Estimation of Chromium in water sample spectrophotometrically by using Diphenyl carbazide.
2	Estimation of reducing sugar in honey by Willstatter method.
3	Separation of Mg (II) and Zn (II) by using anion exchange resin and their estimation by complexometric titration.
4	Estimation of acetic acid in Vinegar sample by using Quinhydrone electrode potentiometrically.
5	Determination of phosphoric acid in cola sample pH metrically.

Note: Calculation of percent error is expected for all the experiments.

References

1. Vogel's Textbook of Quantitative Chemical Analysis, 5thEdn., G. H. Jeffery, J Bassett, J. Memdham and R C Denney, ELBS with Longmann (1989).
2. Vogel's Textbook of Quantitative Chemical analysis, Sixth edition, J. Mendham et.al
3. The chemical analysis of food and food products III edition Morris Jacob
4. The chemical analysis of food by David Pearson and Henry Edward

Paper V (Drugs and Dyes)

SEMESTER V

Course Code	Paper No. and Name	Unit	Topics	Credits	L/Week
USC5CH5	Paper V Drugs and Dyes	I	General introduction to Drugs i) Routes of Drug administration ii) Pharmacodynamics agent	2.0	4
		II	Analgesic, antipyretic, antihistaminic, cardiovascular drugs, antidiabetic, antiparkinsonism and Drug for respiratory		
		III	Introduction to Dye stuff industry Types of Dyes and Classification of Dyes		
		IV	Colour and Chemical constitution Unit process and Dyes intermediates		
USC5CP1	Practical's	Estimation and preparation of Drugs		2.0	4

SEMESTER VI

Course Code	Paper No. and Name	Unit	Topics	Credits	L/Week
USC6CH1	Paper I Physical Chemistry	I	i) Drug discovery desing and Development i) Drug metabolism and Drug intermediates	2.0	4
		II	Antiamoebic drugs, Antitubercular and antileprotic drugs, anti-HIV, Drug intermediates, Nanoparticles in medicinal Chemistry and Environmental Aspects		
		III	Classification and Synthesis of Dyes .Health and Env. Hazards		
		IV	Non-Textile Use of Dyes Pigment and Dyestuff Industry		
USC6CP1	Practical's	Preparation of Drugs		2.0	4

SEMESTER V (THEORY)

COURSE CODE: USC5CH5

CREDITS: 02

LECTURES: 60

Unit			Topics	
I	1.1		General Introduction to Drugs	(8L)
		1.1.1	Definition of a drug, sources of drugs, requirements of an ideal drug, classification of drugs (based on therapeutic action),	
		1.1.2	Nomenclature of drugs: Generic name, Brand name, Systematic name	
		1.1.3	Definition of the following medicinal terms: Pharmacon, Pharmacology, Pharmacophore, Prodrug, Half – life efficiency, LD ₅₀ , ED ₅₀ , GI ₅₀ Therapeutic Index.	
		1.1.4	Brief idea of the following terms: Receptors, Agonists, Antagonists, Drug-receptor interaction, Drug Potency, Bioavailability, Drug toxicity, Drug addiction, Spurious Drugs, Misbranded Drugs, Adulterated Drugs, Pharmacopoeia.	
	1.2		Routes of Drug Administration and Dosage Forms	(3L)
		1.2.1	Oral and Parenteral routes with advantages and disadvantages.	
		1.2.2	Formulations & combination formulation, Different dosage forms (including Patches & Adhesives, emphasis on sustained release formulations and enteric coated tablets).	
	1.3		Pharmacodynamic agents: A brief introduction of the following pharmacodynamic agents and the study with respect to their chemical structure, chemical class, therapeutic uses, and side effects.	
		1.3.1	CNS Drugs: Classification based on pharmacological actions: CNS Depressants & CNS Stimulants. Concept of sedation and hypnosis, anaesthesia. <ul style="list-style-type: none"> • Phenytoin (Hydantoin) • Trimethadione (Oxazolidinediones) (Synthesis from acetone) • Alprazolam (Benzodiazepines) • Levetiracetam (Pyrrolidines) • Amphetamine (Phenethylamine) (Asymmetric synthesis from phenyl acetic acid) • Chlorpromazine (Phenothiazines) 	(4L)

UNIT-II (Drugs)

2	2.1		Analgesics, Antipyretics and Anti-inflammatory Drugs.	(4L)
		2.1.1	Analgesics and Antipyretics	
			<ul style="list-style-type: none"> • Morphine (Phenanthrene alkaloids) • Tramadol (Cyclohexanols) (Synthesis from salicylic acid) • Aspirin (Salicylates) Paracetamol (p-Amino phenols)	

		2.1.2	Anti-inflammatory Drugs Mechanism of inflammation and various inflammatory conditions. <ul style="list-style-type: none"> • Steroids: Prednisolone, Betamethasone • Sodium Diclofenac, Aceclofenac (N- Aryl anthranilic acids) (Synthesis from 2,6-dichlorodiphenyl amine) 	
	2.2		Antihistaminic Drugs	(2L)
			<ul style="list-style-type: none"> • Diphenhydramine (Ethanol amines) • Cetrizene (Piperazine) (Synthesis from 4-Chlorobenzhydryl chloride) • Chlorpheniramine maleate (Ethyl amines) • Pantoprazole (Benzimidazoles) 	
	2.3		Cardiovascular drugs	(3L)
			Classification based on pharmacological action <ul style="list-style-type: none"> • Isosorbide dinitrate (Nitrates) • Valsartan (Amino acids) (structure not expected) • Atenolol (Aryloxy propanol amines) (Synthesis from 3-Hydroxy phenyl acetamide) • Amlodipine (Pyridines) • Frusemide /Furosemide (Sulfamoyl benzoic acid) • Rosuvastatin (Pyrimidine) 	
	2.4		Antidiabetic Agents	(2L)
			General idea and types of diabetes; Insulin therapy <ul style="list-style-type: none"> • Glibenclamide (Sulphonyl ureas) • Metformin (Biguanides) • Dapagliflozin (Pyranose) • Pioglitazone (Thiazolidinediones) (Synthesis from 2-(5-ethylpyridin-2-yl) ethanol) 	
	2.5		Antiparkinsonism Drugs	(2L)

			Idea of Parkinson's disease. <ul style="list-style-type: none"> • Procyclidine hydrochloride (Pyrrolidines) • Ethopropazine hydrochloride (Phenothiazines) • Levodopa (Amino acids) (Synthesis from Vanillin) 	
	2.6		Drugs for Respiratory System General idea of: Expectorants; Mucolytes; Bronchodilators; Decongestants; Antitussives	(2L)
			<ul style="list-style-type: none"> • Ambroxol (Cyclohexanol) (Synthesis from paracetamol) • Salbutamol (Phenyl ethyl amines) • Oxymetazoline (Imidazolines) • Codeine Phosphate (Opiates) 	

Unit III (Dyes)

3	3.1		Introduction to the dye-stuff Industry	(5L)
		3.1.1	Dyes	
			<p>Definition of dyes, requirements of a good dye i.e. Colour, Chromophore and Auxochrome, Solubility, Linearity, Coplanarity, Fastness, Substantivity, Economic viability.</p> <p>Definition of fastness and its properties and Mordants with examples</p> <p>Explanation of nomenclature or abbreviations of commercial dyes with at least one example suffixes – G, O, R, B, K, L, C, S H, 6B, GK, 6GK,</p> <p>Naming of dyes by colour index (two examples) used in dye industries.</p>	
		3.1.2	Natural and Synthetic Dyes	
			<p>Natural Dyes: Definition and limitations of natural dyes. Examples and uses of natural dyes w.r.t Heena, Turmeric, Saffron, Indigo, Madder, Chlorophyll –names of the chief dyeing material/s in each natural dye [structures not expected],</p> <p>Synthetic dyes: Definition of synthetic dyes, primaries and intermediates. Important milestones in the development of synthetic dyes – Emphasis on Name of the Scientist, dyes and the year of the discovery is required. (structure is not expected)</p>	
	3.2		Substrates for Dyes : Types of fibres	(3L)
		3.2.1	Natural: cellulosic and proteinaceous fibres, examples – wool, silk and cotton structures and names of dyes applied on each of them.	
		3.2.2	Semi – synthetic: definition and examples [structures not expected]	
		3.2.3	Synthetic: Nylon, Polyesters and Polyamides structures and names of dyes applied on each of them	
		3.2.4	Blended fabrics: definition and examples [structures not expected]	
		3.2.5	Binding forces of dyes on substrate: ionic forces, covalent linkages, hydrogen bonding, vander-walls forces	

	3.3		Classification of dyes based on applications and dyeing methods	(7L)
		3.3.1	Dyeing methods	
			Basic Operations involved in dyeing process: i. Preparation of fibres ii. Preparation of dyebath iii. Application of dyes iv. Finishing	
			Dyeing Method of Cotton Fibres: (i) Direct dyeing (ii) Vat dyeing (iii) Mordant dyeing (iv) Disperse dyeing	
		3.3.2	Classification of dyes based on applicability on substrates (examples with structures) (a) Acid Dyes- Orange II, (b) Basic Dyes-methyl violet, (c) Direct cotton Dyes- Benzofast Yellow 5GL (d) Azoic Dyes – Diazo components; Fast yellow G, Fast orange R. Coupling components. Naphthol AS, Naphthol ASG (e) Mordant Dyes-Eriochrome Black A, Alizarin. (f) Vat Dyes- Indanthrene brown RRD, (g) Sulphur Dyes- Sulphur Black T (no structure) (h) Disperse Dyes-Celliton Fast brown 3R, (i) Reactive Dyes- Cibacron Brilliant Red B,	
		3.3.3	Optical Brighteners: General idea, important characteristics of optical brighteners and their classes [Stilbene, Coumarin, Heterocyclic vinylene derivatives, Diaryl pyrazolines, Naphthylamide derivatives] general structure of each class.	

Unit – IV (Dyes)

4	4.1		Colour and Chemical Constitution of Dyes	(4L)
		4.1.1	Absorption of visible light, Colour of wavelength absorbed, Complementary colour.	
		4.1.2	Relation between colour and chemical constitution.	
			(i) Armstrong theory (quinonoid theory) and its limitations. (ii) Witt's Theory: Chromophore, Auxochrome, Bathochromic & Hypsochromic Shift, Hypochromic & Hyperchromic effect (iii) Valence Bond theory, comparative study and relation of colour in the following classes of compounds/dyes: Benzene, Nitrobenzene, Nitroanilines, Nitrophenols, Benzoquinones, Azo, Triphenyl methane, Anthraquinones. (iv) Molecular Orbital Theory.	
	4.2		Unit process and Dye Intermediates	
		4.2.1	A brief idea of Unit Processes	(3L)
			Introduction to primaries and intermediates	

			Unit processes: definition and brief ideas of below unit processes: (a) Nitration (b) Sulphonation (c) Halogenation (d) Diazotization: (3 different methods & its importance) (e) Ammonolysis (f) Oxidation NB: Definition, Reagents, Examples of each unit processes mentioned above with reaction conditions (mechanism is not expected)	
		4.2.2	Preparation of the Following Intermediates	(8L)
			<u>Benzene derivatives</u> : Benzenesulphonic acid; 1,3-Benzenedisulphonic acid; sulphanilic acid; o-, m-, p-chloronitrobenzenes; o-, m-, p-nitroanilines; o-, m-, p-phenylene diamines; Naphthol ASG	
			<u>Naphthalene Derivative</u> : Schaeffer acid; Tobias acid; Naphthionic acid; N.W. acid; cleve-6-acid; H-acid; Naphthol AS	
			<u>Anthracene Derivative</u> : 1-Nitroanthraquinone; 1-Aminoanthraquinone Anthraquinone-2-sulphonic acid; Benzanthrone.	

References (For Units III & IV):

1. Chemistry of Synthetic Dyes, Vol I – VIII, Venkatraman K., Academic Press 1972
2. The Chemistry of Synthetic Dyes and Pigments, Lubs H.A., Robert E Krieger Publishing Company, NY ,1995
3. Chemistry of Dyes and Principles of Dyeing, Shenai V.A., Sevak Publications, 1973

SEMESTER V (PRACTICALS)

(Drugs and Dyes)

COURSE CODE: USC5CH5

CREDITS: 02

1. Estimation of Ibuprofen (back titration method)
2. Estimation of Acid neutralizing capacity of a drug
3. Preparation of Aspirin from salicylic acid.
4. Separation of components of natural pigments by paper chromatography (eg: chlorophyll)

II] Project:

Preparation of Orange II dye (semi-microscale 1.0gms) and its use for dyeing different fabrics

SEMESTER VI (THEORY)

(Drugs and Dyes)

COURSE CODE: USC6CH5

CREDITS: 02

LECTURES: 60

UNIT – I (Drugs)

1	1.1		Drug Discovery, Design and Development	(6L)
		1.1.1	Discovery of a Lead compound: Screening, drug metabolism studies and clinical observation, Lipinski's rule of 5	
		1.1.2	Medicinal properties of compounds from Natural Sources: Anti-infective and anticancer properties of Turmeric (Curcumin)	
		1.1.3	Development of drug: The Pharmacophore identification, modification of structure or functional group, Structure activity relationship (Sulphonamides and Benzodiazepines).	
		1.1.4	Structure modification to increase potency: Homologation, Chain branching and Extension of the structure, Ring chain transformation, Bioisoterism.	
		1.1.5	Computer assisted drug design.	
	1.2		Drug Metabolism: Introduction, Absorption, Distribution, Bio-transformation, Excretion Different types of chemical transformation of drugs with specific examples.	(3L)
	1.3		Chemotherapeutic Agents: Study of the following chemotherapeutic agents with respect to their chemical structure, chemical class, therapeutic uses, side effects and introduction to MDR wherever applicable.	
		1.3.1	Antibiotics and antivirals: Definition, <ul style="list-style-type: none"> • Amoxicillin (β-lactum antibiotics) • Cefpodoxime (Cephalosporins) • Doxycycline (Tetracyclines) • Levofloxacin (Quinolones) (Synthesis from 2,3,4 – Trifluoro -1-nitrobenzene) • Aciclovir/Acyclovir (Purines) 	(2L)
		5.3.2	Antimalarials: Types of malaria; Symptoms; Pathological detection during window period (Life cycle of the parasites not to be discussed) <ul style="list-style-type: none"> • Chloroquine (3-Amino quinolones) • Artemether (Benzodioxepins) Following combination to be discussed: Atremether-Lumefantrine (no structure)	(2L)

	1.3.3	Anthelmintics and AntiFungal agents Drugs effective in the treatment of Nematodes and Cestodes infestations. <ul style="list-style-type: none"> • Diethyl carbamazine (Piperazines) • Albendazole (Benzimidazoles) (Synthesis from 2-Nitroaniline) • Clotrimazole (Imidazole) • Fluconazole (Triazole) (Synthesis from 1- Bromo – 2,4-difluorobenzene) 	(2L)
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UNIT – II(Drugs)
Chemotherapeutic Agents continued.

2	2.1	Antiamoebic Drugs Types of Amoebiasis <ul style="list-style-type: none"> • Metronidazole, Ornidazole, Tinidazole (Imidazole) Synthesis of Metronidazole from glyoxal by Debus-Radziszewski imidazole synthesis route Following combination therapy to be discussed: Ciprofloxacin-Tinidazole	(1L)
	2.2	Antitubercular and Antileprotic Drugs Types of Tuberculosis; Symptoms and diagnosis of Tuberculosis. Types of Leprosy. General idea of Antibiotics used in their treatment. <ul style="list-style-type: none"> • PAS (Amino salicylates) • Isoniazide (Hydrazides) • Pyrazinamide (Pyrazines) • (+) Ethambutol (Aliphatic diamines) (Synthesis from 1- Nitropropane) • Dapsone(Sulphonamides) (Synthesis from 4- Chloronitrobenzene) • Clofazimine (Phenazines) • Bedaquiline (Quinoline) Following combination therapy to be discussed: (i) Rifampin + Ethambutol + Pyrazinamide (ii) Rifampin + Isoniazide + Pyrazinamide	(3L)
	2.3	Anti-Neoplastic Drugs Idea of malignancy; Causes of cancer Brief idea of Immuno Stimulants &Immuno depressants <ul style="list-style-type: none"> • Lomoustine (Nitrosoureas) • Anastrozole(Triazoles) (Synthesis from 3,5-bis (bromo methyl) toluene) • Cisplatin (Chloro Platinum) • Vincristine, Vinblastine, Vindesine) (Vinca alkaloids) (structure not expected) 	(2L)
	2.4	Anti-HIV Drugs Idea of HIV pathogenicity, Symptoms of AIDS <ul style="list-style-type: none"> • AZT/Zidovudine, Lamivudine,DDI (Purines) 	(1L)
	2.5	Drug Intermediates: Synthesis and uses 1. 2,3,6-Triamino-6- hydroxypyrimidine from Guanidine	(2L)

		2. p-[2'-(5-Chloro-2-methoxy benzamido) ethyl]-benzenesulphonamide from Methyl-5-chloro-2-methoxybenzene 3. 3-(p-Chlorophenyl)-3-hydroxypiperidine from 3-Chloroacetophenone 4. p-Acetyl amino benzenesulphonyl chloride from Aniline 5. Epichlorohydrine from propene	
	2.6	Nano particles in Medicinal Chemistry Introduction; Carbon nano particles (structures) and Carbon nano tubes: <ul style="list-style-type: none"> • Functionalization for Pharmaceutical applications • Targeted drug delivery • In vaccine (Foot and mouth disease) • Use in Bio-physical treatment. Gold nano particles in treatment of: Cancer; Parkinsonism; Alzheimer. Silver nano particles: Antimicrobial activity.	(4L)
	2.7	Drugs and Environmental Aspects <ul style="list-style-type: none"> • Impact of Pharma-industry on environment, • International regulation for human experimentation with reference to: "The Nuremberg Code" and "The Helsinki Declaration". 	(2L)

SEMESTER VI

Unit – III (Dyes)

3	3.1	Classification of Dyes based on Chemical Constitution and Synthesis of Selected Dyes (Synthesis of the dyes marked with * is expected)	(12L)
		i) Nitro Dye: Naphthol Yellow S	
		ii) Nitroso Dye: Gambine Y	
		iii) Azo dyes: a) Monoazo dyes: Orange IV *(from sulphanilic acid) & Eriochrome Black T* (from β -naphthol) b) Bisazo dyes: Congo Red* (from nitrobenzene) c) Trisazo Dye: Direct Deep Black EW* (from benzidine)	
		iv) Diphenylmethane dye: Auramine O* (from N,N-dimethyl aniline)	
		v) Triphenylmethane dye: a) Diamine series: Malachite Green* (from benzaldehyde) b) Triamine series: Acid Magenta c) Phenol series: Rosolic acid	
		vi) Heterocyclic Dyes: a) Thiazine dyes: Methylene Blue b) Azine dyes: Safranin T* (from o-toluidine) c) Xanthene Dyes: Eosin* (from phthalic anhydride) d) Oxazine Dyes: Capri Blue e) Acridine Dyes: Acriflavine	
		vii) Quinone Dyes: a) Naphthaquinone: Naphthazarin b) Anthraquinone Dyes: Indanthrene Blue* (from anthraquinone)	
		viii) Indigoid Dyes: Indigo* (from aniline + monochloroacetic acid)	

			ix) Phthalocyanine Dyes: Monostral Fast Blue B	
	3.2		Health and Environmental Hazards of Synthetic Dyes and their Remediation Processes	(3L)
		3.2.1	Impact of the textile and leather dye Industry on the environment with special emphasis on water pollution	
		3.2.2	Health Hazards: Toxicity of dyes w.r.t food colours.	
		3.2.3	Effluent Treatment Strategies: Brief introduction to effluent treatment plants (ETP) Primary Remediation processes:(Physical Processes) Sedimentation, Aeration, Sorption (activated charcoal, fly ash etc.) Secondary Remediation processes: Biological Remediation – Biosorption, bioremediation and biodegradation Chemical Remediation: Oxidation Processes (chlorination), Coagulation-flocculation-Precipitation	

Unit – IV (Dyes)

4	4.1		Non-textile uses of dyes:	(8L)
		4.1.1	Biomedical uses of dyes i) Dyes used in formulations (Tablets, capsules, syrups etc) Indigo carmine, Sunset yellow, Tartrazine ii) Biological staining agents Methylene blue, Crystal violet and Safranin T iii) DNA markers Bromophenol blue, Orange G, Cresol red iv) Dyes as therapeutics Mercurochrome, Acriflavine, Crystal Violet, Prontosil	
		4.1.2	Dyes used in food and cosmetics: i) Properties of dyes used in food and cosmetics ii) Introduction to FDA and FSSAI iii) Commonly used food colours and their limits	
		4.1.3	Paper and leather dyes i) Structural features of paper and leather ii) Dyes applicable to paper and leather	
		4.1.4	Miscellaneous dyes i) Hair dyes ii) Laser dyes iii) Indicators iv) Security inks iv) Coloured smokes and camouflage colours	
	4.2		Pigments	(3L)
			Definition of pigments, examples, properties of pigments, difference between dyes and pigments. Definition of Lakes and Toners	
	4.3		Dyestuff Industry - Indian Perspective	(4L)
		4.3.1	Growth and development of the Indian Dyestuff Industry	
		4.3.2	Strengths, Weaknesses, Opportunities and Challenges of the Dyestuff industry in India	
		4.3.3	Make in India - Future Prospects of the Dye Industry	

SEMESTER VI (PRACTICALS)

COURSE CODE: USC5CH5

CREDITS: 02

1. O-Methylation of β -naphthol.
2. Preparation of Paracetamol from p-aminophenol.
3. Preparation of Fluorescein
4. TLC of a mixture of dyes (safranin-T, Indigo carmine, methylene blue)



Janardan Bhagat Shikshan Prasarak Sanstha's
CHANGU KANA THAKUR
ARTS, COMMERCE & SCIENCE COLLEGE,
NEW PANVEL
(AUTONOMOUS COLLEGE)

Re-accredited 'A+' Grade by NAAC
'College with Potential for Excellence' Status Awarded by UGC
'Best College Award' by University of Mumbai

Syllabus for M.Sc.-I in Chemistry

Programme: M.Sc.

Course: M.Sc.-I Chemistry

Choice Based Credit, Grading and Semester System (60:40)

w.e.f. Academic Year 2019-2020

Janardan Bhagat Shikshan Prasarak Sanstha's
CHANGU KANA THAKUR
ARTS, COMMERCE & SCIENCE COLLEGE, NEW PANVEL
(AUTONOMOUS COLLEGE)

Syllabus for Approval

Sr. No.	Heading	Particulars
1	Title of Course	M.Sc.-I Chemistry
2	Eligibility for Admission	The B.Sc. degree examination of University of Mumbai with chemistry 6 units or 3 units or degree of any other university recognized as equivalent thereto.
3	Passing marks	Minimum D Grade or equivalent minimum marks for passing at the Graduation level.
4	Ordinances/Regulations (if any)	
5	No. of Semesters	One year/Two semester
6	Level	P.G. part-I
7	Pattern	Semester (60:40)
8	Status	Revised
9	To be implemented from Academic year	2019-2020

Name of BOS Chairman: Dr. S. K. Patil

Signature of BOS Chairman:

Preamble of the Syllabus:

Master of Science (M.Sc.) in chemistry is a post-graduate course of department of chemistry, Changu Kana Thakur Arts, Commerce & Science college, New Panvel (Autonomous).

There are two P.G. programmes in Chemistry, namely M.Sc. programme in Organic Chemistry and M.Sc. programme in Analytical Chemistry. Both P.G. programmes are equivalent in all respect for employment and higher studies. Each of these two P.G. programmes shall extend over a period of two academic years comprising of four semesters. The syllabi and scheme of examinations of these two programmes are detailed below. The theory and practicals of courses of two Semesters of the two programmes are same. Chemistry is a fundamental science and has contributed immensely to the improvement of the life of human beings by providing many of human requirements and essentialities. Chemistry is important to the world economy as well. The developments in Chemistry during last few decades are phenomenal. It is also seen that these developments are crossing the traditional vertical boundaries of scientific disciplines; the more inclination is seen towards biological sciences. New branches of chemistry are emerging and gaining importance, such as bioorganic chemistry, materials chemistry, computational chemistry, etc.

The practice of Chemistry at industrial scale also is undergoing radical changes and is more or more based on deep understanding the chemical phenomena. The emerging Chemical Technologies are highly science based. The aid of computers has not only accelerated growth in the practice of Chemistry, but revolutionized the entire field. A chemist cannot isolate himself from other disciplines. Thus, after a long span of more and more specialization in graduate and post-graduate syllabi, a symbiotic interdisciplinary approach now seems to be more relevant.

Objectives of the Course:

1. To develop laboratory competence in relating chemical structure to spectroscopic phenomena.
2. To demonstrate the ability to synthesize, separate and characterize compounds using published reactions, protocols, standard laboratory equipment, and modern instrumentation.
3. To provide the students with sound preparation for requirement of modern industry and provide competency in basic academic research as well as a cohesive, clearly structured overview of Chemistry

Course Outcome:

1. Think critically and analyse chemical problems.
2. Present scientific and technical information resulting from laboratory experimentation in both written and oral formats.
3. Work effectively and safely in a laboratory environment.
4. Use technologies/instrumentation to gather and analyse data.
5. Work in teams as well as independently.
6. Apply modern methods of analysis to chemical systems in a laboratory setting.

M. Sc. Chemistry

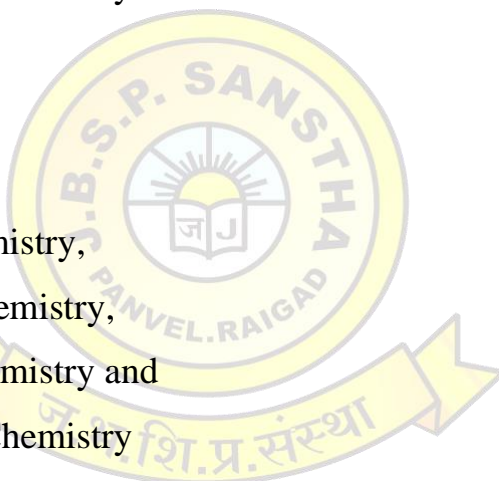
For the subject of chemistry there shall be four papers for 60 lectures each comprising of four units of 15 L each.

Semester-I

1. Paper-I / Physical Chemistry,
2. Paper-II / Inorganic Chemistry,
3. Paper- III / Organic Chemistry and
4. Paper- IV /Analytical Chemistry

Semester-II

1. Paper-I / Physical Chemistry,
2. Paper-II / Inorganic Chemistry,
3. Paper- III/ Organic Chemistry and
4. Paper- IV/ Analytical Chemistry



❖ Scheme of Examination

The performance of the learners shall be evaluated into two parts. The learner's performance shall be assessed by Internal Assessment with 40% marks in the first part and by conducting the Semester End Examinations with 60% marks in the second part. The allocation of marks for the Internal Assessment and Semester End Examinations are as shown below-

A) Internal Assessment: 40 %

40 Marks

Sr. No.	Particular	Marks
01	One periodical class test / online examination to be conducted in the given semester	20 Marks
02	One case study /review / project with presentation based on curriculum to be assessed by the teacher concerned	15 Marks
	Presentation	10 Marks
	Written Document	05 Marks
03	Active participation in routine class instructional deliveries and overall conduct as a responsible learner, mannerism and articulation and exhibit of leadership qualities in organizing related academic activities	05 Marks

Question Paper Pattern

(Periodical Class Test for the Courses at Under Graduate Programmes)

Maximum Marks: 20

Duration: 40 Minutes

Questions to be set: 02

All Questions are Compulsory

Question No.	Particular	Marks
Q-1	Match the Column / Fill in the Blanks / Multiple Choice Questions/ Answer in One or Two Lines (Concept based Questions) (1 Marks / 2 Marks each)	10 Marks
Q-2	Answer in Brief (Attempt any Two of the Three) (5 Marks each)	10 Marks

B) Semester End Examination: 60 %

60 Marks

- Duration: The examination shall be of $2\frac{1}{2}$ hours duration.

Question Paper Pattern

Theory question paper pattern

1. There shall be five questions each of 12 marks.
2. All questions shall be compulsory with internal options.
3. Question may be subdivided into sub-questions a, b, c... and the allocation of marks depends on the weightage of the unit.

❖ Passing Standard

The learners shall have to obtain a minimum of 40% marks in aggregate for each course where the course consists of Internal Assessment and Semester End Examination. The learners shall obtain minimum of 40% marks (i.e. 16 out of 40) in the Internal Assessment and 40% marks in Semester End Examination (i.e. 24 Out of 60) separately, to pass the course and minimum of grade D in each project wherever applicable to pass a particular semester.

❖ Guidelines and Evaluation pattern for project work (100 Marks)

Introduction

Inclusion of project work in the course curriculum of the M.Sc. programme is one of the ambitious aspects in the programme structure. The main objective of inclusion of project work is to inculcate the element of research work challenging the potential of learner as regards to his/ her eager to enquire and ability to interpret particular aspect of the study in his/ her own words. It is expected that the guiding teacher should undertake the counselling sessions and make the awareness among the learners about the methodology of formulation, preparation and evaluation pattern of the project work.

- There are two modes of preparation of project work
 1. Project work based on research methodology in the study area
 2. Project work based on internship in the study area

I	Theory: The Semester End Examination for theory course work will be conducted as per the following scheme.	
	Each theory paper shall be of two and half hour duration.	
	All questions are compulsory and will have internal options.	
	Q-1	From Unit – I (having internal options.) 12 M
	Q-2	From Unit – II (having internal options.) 12M
	Q-3	From Unit – III (having internal options.) 12M
	Q-4	From Unit – IV(having internal options.) 12M
	Q-5	Questions from all the FOUR Units with equal weightage of marks allotted to each Unit. 12 M
II	Practical	The Semester End Examination for Practical course work will be conducted as per the following scheme.
Sr. No.	Particulars of External Practical Examination	Marks%
1	Laboratory Work	80
2	Journal	10
3	Viva	10
	TOTAL	100

**Choice Based Credit ,Grading and Semester System (CBCGS)
To be implemented from the Academic year 2019-2020**

**M.Sc.-I Chemistry
Semester- I**

Course Code	Unit	Topics	Credits	L / Week
PSC1CH1	I	Thermodynamics-I	4	1
	II	Quantum Chemistry		1
	III	Chemical Dynamics-I		1
	IV	Electrochemistry		1
PSC1CH2	I	Chemical Bonding	4	1
	II	Molecular Symmetry and Group Theory		1
	III	Materials Chemistry and Nanomaterials		1
	IV	Characterisation of Coordination Compounds		1
PSC1CH3	I	Physical Organic Chemistry	4	1
	II	Nucleophilic substitution reactions and Aromaticity		1
	III	Stereochemistry		1
	IV	Oxidation and Reduction		1
PSC1CH4	I	Language of Analytical Chemistry	4	1
	II	Quality in Analytical Chemistry		1
	III	Optical Methods		1
	IV	Thermal Methods		1
PSC1CH1 PSC1CH2 PSC1CH3 PSC1CH4	-	Practical Course	8	16

**Choice Based Credit ,Grading and Semester System (CBCGS)
To be implemented from the Academic year 2019-2020**

**M.Sc.-I Chemistry
Semester- II**

Course Code	Unit	Topics	Credits	L / Week
PSC2CH1	I	Chemical Thermodynamics II	4	1
	II	Quantum Chemistry II		1
	III	Chemical Kinetics and Molecular Reaction Dynamics		1
	IV	Solid State Chemistry and Phase Equilibria		1
PSC2CH2	I	Inorganic Reaction Mechanism	4	1
	II	Organometallic Chemistry of Transition metals		1
	III	Environmental Chemistry		1
	IV	Bioinorganic Chemistry		1
PSC2CH3	I	<ul style="list-style-type: none"> Alkylation of Nucleophilic Carbon Intermediates Reaction of carbon nucleophiles with carbonyl groups 	4	1
	II	Reactions and Rearrangements		1
	III	<ul style="list-style-type: none"> Introduction to Molecular Orbital Theory for Organic Chemistry Applications of UV and IR spectroscopy 		1
	IV	NMR spectroscopy and Mass spectrometry		1
PSC2CH4	I	Chromatography	4	1
	II	X-ray spectroscopy, Mass spectrometry, Radioanalytical Methods		1
	III	<ul style="list-style-type: none"> Surface Analytical Techniques Atomic Spectroscopy 		1
	IV	Electroanalytical Methods		1
PSC2CH1 PSC2CH2 PSC2CH3 PSC2CH4	-	Practical Course	8	16

**Proposed Draft Syllabus For
M.Sc. Chemistry
Semester I and II
Choice Based Credit System
(To be implemented from the academic year, 2019-2020)
Semester – I**

Paper I

Physical Chemistry: Course Code: PSC1CH1 [60 L]

Unit - I

Thermodynamics-I [15]

1.1. State function and exact differentials. Maxwell equations, Maxwell thermodynamic Relations; its significance and applications to ideal gases, Joule Thomson experiment, Joule Thomson coefficient, inversion temperature, Joule Thomson coefficient in terms of van der Waals constants. [8L]

1.2. Third law of Thermodynamics, Entropy change for a phase transition, absolute entropies, determination of absolute entropies in terms of heat capacity, standard molar entropies and their dependence on molecular mass and molecular structure, residual entropy. [7L]

[Ref 2 and 1,10,11,12 17]

Unit II

Quantum Chemistry: [15L]

2.1. Classical Mechanics, failure of classical mechanics: Need for Quantum Mechanics.

2.2. Particle waves and Schrödinger wave equation, wave functions, properties of wave functions, Normalization of wave functions, orthogonality of wave functions.

2.3. Operators and their algebra, linear and Hermitian operators, operators for the dynamic variables of a system such as, position, linear momentum, angular momentum, total energy, eigen functions, eigen values and eigen value equation, Schrödinger wave equation as the eigen value equation of the Hamiltonian operator, average value and the expectation value of a dynamic variable of the system, Postulates of Quantum Mechanics, Schrodinger's Time independent wave equation from Schrodinger's time dependent wave equation.

2.4. Application of quantum mechanics to the following systems:

a) Free particle, wave function and energy of a free particle.

b) Particle in a one, two and three dimensional box, separation of variables, Expression for the wave function of the system, expression for the energy of the system, concept of quantization, introduction of quantum number, degeneracy of the energy levels.

c) Harmonic oscillator, approximate solution of the equation, Hermite polynomials, expression for wave function, expression for energy, use of the recursion formula.

[Ref 7, 8 and 9]

Unit III

Chemical Dynamics-I [15L]

3.1.Composite Reactions:

Recapitulation: Rate laws, Differential rate equations Consecutive reactions,

Steady state Approximation, rate determining steps, Microscopic Reversibility and Detailed Balanced Chain reactions-chain initiation processes. Some inorganic mechanisms: formation and decomposition of phosgene, decomposition of ozone, Reaction between Hydrogen and Bromine and some general examples Organic Decompositions: Decomposition of ethane, decomposition of acetaldehyde Gas phase combustion: Reaction between hydrogen and oxygen, Semenov – Hinshelwood and Thompson mechanism, Explosion limits and factors affecting explosion limits.

3.2.Polymerization reactions: Kinetics of stepwise polymerization, Calculation of degree of polymerization for stepwise reaction. Kinetics of free radical chain polymerization, Kinetic chain length and estimation of average no. of monomer units in the polymer produced by chain polymerization.

3.3.Reaction in Gas Phase

Unimolecular Reactions: Lindeman-Hinshelwood theory, Rice-Ramsperger-Kassel (RRK) theory, Rice-Ramsperger-Kassel Marcus (RRKM) theory.

[Ref. 2 and 15, 17, 18]

Unit IV

Electrochemistry [15L]

Recapitulation – basics of electrochemistry.

4.1.Debye-Hückel theory of activity coefficient, Debye-Hückel limiting law and its extension to higher concentration (derivations are expected).

4.2.Electrolytic conductance and ionic interaction, relaxation effect,. Debye-Hückel- Onsager equation (derivation expected). Validity of this equation for aqueous and non- aqueous solution, deviations from Onsager equation, Debye -Falkenhagen effect (dispersion of conductance at high frequencies), Wien effect.

4.3.Batteries: Alkaline fuel cells, Phosphoric acid fuel cells, High temperature fuel cells [Solid –Oxide Fuel Cells (SOFC) and Molten Carbonate Fuel Cells]

4.4.Bio-electrochemistry: Introduction, cells and membranes, membrane potentials, theory of membrane potentials, interfacial electron transfer in biological systems, adsorption of proteins onto metals from solution, electron transfer from modified metals to dissolved protein in solution, enzymes as electrodes, electrochemical enzyme-catalysed oxidation of styrene. Goldmann equation. (derivations are expected)

[Ref: 14 and 16, 17, 18]

[Note: Numerical and theoretical problems from each unit are expected]

References:

1. Peter Atkins and Julio de Paula, Atkin's Physical Chemistry, 7th Edn., Oxford University Press, 2002.
2. K.J. Laidler and J.H. Meiser, Physical Chemistry, 2nd Ed., CBS Publishers and Distributors, New Delhi, 1999.
3. Robert J. Silby and Robert A. Alberty, Physical Chemistry, 3rd Edn., John Wiley and Sons (Asia) Pte.Ltd., 2002.
4. Ira R. Levine, Physical Chemistry, 5th Edn., Tata McGraw-Hill New Delhi, 2002.
5. G.W. Castellan, Physical Chemistry, 3rd Edn., Narosa Publishing House, New Delhi, 1983.
6. S. Glasstone, Text Book of Physical Chemistry, 2nd Edn., McMillan and Co. Ltd., London, 1962
7. B.K. Sen, Quantum Chemistry including Spectroscopy, Kalyani Publishers, 2003.
8. A.K. Chandra, Introductory Quantum Chemistry, Tata McGraw – Hill, 1994.
9. R.K. Prasad, Quantum Chemistry, 2nd Edn., New Age International Publishers, 2000.
10. S. Glasstone, Thermodynamics for Chemists, Affiliated East-West Press, New Delhi, 1964.
11. W.G. Davis, Introduction to Chemical Thermodynamics – A Non – Calculus Approach, Saunders, Philadelphia, 19772.
12. Peter A. Rock, Chemical Thermodynamics, University Science Books, Oxford University Press, 1983.
13. Ira N. Levine, Quantum Chemistry, 5th Edn., Pearson Education (Singapore) Pte.Ltd., Indian Branch, New Delhi, 2000.
14. Thomas Engel and Philip Reid, Physical Chemistry, 3rd Edn., Pearson Education Limited 2013.

15. D.N. Bajpai, Advanced Physical Chemistry, S. Chand 1st Edn., 1992. 16. Bockris, John O'M., Reddy, Amulya K.N., Gamboa-Aldeco, Maria E., Modern Electrochemistry, 2A, Plenum Publishers, 1998.

17. Physical Chemistry by Gurtu and Gurtu

18. A Text book of Physical Chemistry by K L Kapoor Vol 5, 2nd Edn

Physical Chemistry Practical

Paper I

Course Code: PSC1CH1

Non – Instrumental:

1. To determine the heat of solution (ΔH) of a sparingly soluble acid (benzoic /salicylic acid) from solubility measurement at three different temperature.
2. To study the variation of calcium sulphate with ionic strength and hence determine the thermodynamic solubility product of CaSO_4 at room temperature.
3. To investigate the reaction between acetone and iodine.
4. To study the variation in the solubility of Ca(OH)_2 in presence of NaOH and hence to determine the solubility product of Ca(OH)_2 at room temperature.
5. Graph Plotting of mathematical functions –linear, exponential and trigonometry and identify whether functions are acceptable or non-acceptable?

Instrumental:

1. To determine the mean ionic activity coefficient of an electrolyte by e.m.f. measurement.
2. To study the effect of substituent on the dissociation constant of acetic acid conductometrically.
3. To determine pK_a values of phosphoric acid by potentiometric titration with sodium hydroxide using glass electrode.
4. To verify Ostwald's dilution law and to determine the dissociation constant of a weak mono-basic acid conductometrically.

References:

- 1 Practical Physical Chemistry, B. Viswanathan and P.S. Raghavan, Viva Books Private Limited, 2005.
- 2 Practical Physical Chemistry, A.M. James and F.E. Prichard, 3rd Edn., Longman Group Ltd., 1974.

3 Experimental Physical Chemistry, V.D. Athawale and P. Mathur, New Age International Publishers, 2001.

Paper II

Inorganic Chemistry: Course Code: PSC1CH2 (60 L)

Unit I

Chemical Bonding: [15 L]

1.1 Recapitulation of hybridization Derivation of wave functions for sp, sp², sp³ orbital hybridization types considering only sigma bonding.

1.2 Discussion of involvement of d orbitals in various types of hybridizations. Concept of resonance, resonance energy derivation expected. Formal charge with examples.

1.3 Molecular Orbital Theory for Polyatomic species considering σ bonding for SF₆, CO₂, B₂H₆, I₃⁻ molecular species.

1.4 Weak forces of attraction: Hydrogen bonding – concept, types, properties, methods of detection and importance. Van der Waal's forces, ion-dipole, dipole-dipole, London forces.

Unit-II

Molecular Symmetry and Group Theory: [15L]

2.1. Symmetry criterion of optical activity, symmetry restrictions on dipole moment. A systematic procedure for symmetry classification of molecules.

2.2. Concepts of Groups, Sub-groups, Classes of Symmetry operations, Group Multiplication Tables. Abelian and non-Abelian point groups.

2.3. Representation of Groups: Matrix representation of symmetry operations, reducible and irreducible representations. The Great Orthogonality Theorem and its application in construction of character tables for point groups C_{2v}, C_{3v} and D_{2h}, structure of character tables.

2.4. Applications of Group Theory

(a) Symmetry adapted linear combinations (SALC), symmetry aspects of MO theory, sigma bonding in AB_n (Ammonia, CH₄) molecule.

(b) Determination of symmetry species for translations and rotations.

(c) Mulliken's notations for irreducible representations.

(d) Reduction of reducible representations using reduction formula.

(e) Group-subgroup relationships.

(f) Descent and ascent in symmetry correlation diagrams showing relationship between different groups.

Unit–III

Materials Chemistry and Nanomaterials: [15 L]

3.1 Solid State Chemistry

3.1.1. Electronic structure of solids and band theory, Fermi level, K Space and Brillouin Zones.

3.1.2. Structures of Compounds of the type: AB [nickel arsenide (NiAs)], AB₂ [fluorite (CaF₂) and anti-fluorite structures, rutile (TiO₂) structure and layer structure [cadmium chloride and iodide (CdCl₂, CdI₂)].

3.1.3. Methods of preparation for inorganic solids: Ceramic method, precursor method, sol-gel method (applications in Biosensors), microwave synthesis (discussion on principles, examples, merits and demerits are expected)

3.2 Nanomaterials

3.2.1. Preparative methods: Chemical methods, Solvothermal, Combustion synthesis, Microwave, Co-precipitation, Langmuir Blodgett(L-B) method, Biological methods: Synthesis using microorganisms.

3.2.2. Applications in the field of semiconductors, solar cells

Unit - IV

Characterisation of Coordination compounds [15L]

4.1. Formation, thermal studies, Conductivity measurements, electronic spectral and magnetic measurements, IR, NMR and ESR spectroscopic methods.

4.2. Spectral calculations using Orgel and Tanabe-Sugano diagram, calculation of electronic parameters such as Δ , B, C, Nephelauxetic ratio.

4.3. Determination of formation constants of metal complexes (Overall and Stepwise): Comparative studies of Potentiometric and spectral methods.

References :

Unit I

1. B. R. Puri, L. R. Sharma and K. C. Kalia, Principles of Inorganic Chemistry, Milestone Publishers, 2013-2014.

2. W. W. Porterfield, Inorganic Chemistry-A Unified Approach, 2nd Ed., Academic Press, 1993.

3. B. W. Pfennig, Principles of Inorganic Chemistry, Wiley, 2015.
4. C. E. Housecroft and A. G. Sharpe, Inorganic Chemistry, Pearson Education Limited, 2nd Edition 2005.
5. J. Huheey, F. A. Keiter and R. I. Keiter, Inorganic Chemistry—Principles of Structure and Reactivity, 4th Ed., Harper Collins, 1993.
6. P. J. Durrant and B. Durrant, Introduction to Advanced Inorganic Chemistry, Oxford University Press, 1967.
7. R. L. Dekock and H.B.Gray, Chemical Structure and Bonding, The Benjamin Cummings Publishing Company, 1989.
8. G. Miessler and D. Tarr, Inorganic Chemistry, 3rd Ed., Pearson Education, 2004.
9. R. Sarkar, General and Inorganic Chemistry, Books & Allied (P) Ltd., 2001.
10. C. M. Day and J. Selbin, Theoretical Inorganic Chemistry, Affiliated East West Press Pvt. Ltd., 1985.
11. J. N. Murrell, S. F. A. Kettle and J. M. Tedder, The Chemical Bond, Wiley, 1978.
12. G. A. Jeffrey, An Introduction to Hydrogen Bonding, Oxford University Press, Inc., 1997.

Unit II

1. F. A. Cotton, Chemical Applications of Group Theory, 2nd Edition, Wiley Eastern Ltd., 1989.
2. H. H. Jaffe and M. Orchin, Symmetry in Chemistry, John Wiley & Sons, New York, 1996.
3. R. L. Carter, Molecular Symmetry and Group Theory, John Wiley & Sons, New York, 1998.
4. K. V. Reddy. Symmetry and Spectroscopy of Molecules, 2nd Edition, New Age International Publishers, New Delhi, 2009.
5. A. SalahuddinKunju and G. Krishnan, Group Theory and its Applications in Chemistry, PHI Learning, 2012.
6. P. K. Bhattacharya, Group Theory and its Chemical Applications, Himalaya Publishing House. 2014.
7. S. Swarnalakshmi, T. Saroja and R. M. Ezhilarasi, A Simple Approach to Group Theory in Chemistry, Universities Press, 2008.

Unit III

1. Solid State Chemistry Introduction, Lesley E. Smart, Elaine A. Moore, ISBN 0-203-49635-3, Taylor & Francis Group, LLC.

2. Nanomaterials&Nanochemistry, 2007, Catherine Brechignac, Philippe Houdy, Marcel Lahmani, ISBN 978-3-540-72992-1 Springer Berlin Heidelberg New York.
3. Nanomaterials Chemistry, Recent Developments and New Directions C.N.R. Rao, A. Muller, and A.K. Cheetham, ISBN 978-3-527-31664-9, 2007 WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim.
4. Nano-Surface Chemistry, 2001, Morton Rosoff, ISBN: 0-8247-0254-9, Marcel Dekker Inc. New York.
5. The Chemistry of Nanomaterials, CNR Rao, Muller Cheetham, WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim, 2004.
6. Semiconductor Nanomaterials, Challa S.S.R. Kumar, ISBN: 978-3-527-32166-7, WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim, 2010.

Unit IV

1. J. E. Huheey, E. A. Keiter and R. L. Keiter; Inorganic Chemistry: Principles of Structure and Reactivity, Pearson Education, 2006.
2. D. Banerjee, Coordination Chemistry
3. Geary Coordination reviews
4. P.W. Atkins, T. Overton, J. Rourke, M. Weller and F. Armstrong; Shriver & Atkins: Inorganic Chemistry, 4th ed. Oxford University Press, 2006.
5. F. A. Cotton, G. Wilkinson, C. A. Murillo and M. Bochmann; Advanced Inorganic Chemistry, 6th ed. Wiley, 1999,
6. B. Douglas, D. McDaniel and J. Alexander. Concepts and Models of Inorganic Chemistry(3rd edn.), John Wiley & Sons (1994).

Inorganic Chemistry Practical

Paper II

Course Code: PSC1CH2

Inorganic Preparations (Synthesis and Characterization)

- 1) Bis-(tetraethylammonium) tetrachloroCuprate (II) $(\text{Et}_4\text{N})_2[\text{CuCl}_4]$
- 2) Bis-(tetraethylammonium) tetrachloroNickelate (II) $(\text{Et}_4\text{N})_2[\text{NiCl}_4]$
- 3) Bis-(tetraethylammonium) tetrachloroCobaltate (II) $(\text{Et}_4\text{N})_2[\text{CoCl}_4]$
- (Any two from above preparations)
- 4) Tetramminemonocarbonato Cobalt (III) Nitrate $[\text{Co}(\text{NH}_3)_4\text{CO}_3]\text{NO}_3$

5) Bis (ethylenediammine) Copper (II) Sulphate $[\text{Cu(en)}_2]\text{SO}_4$

6) Hydronium dichlorobis(dimethylglyoximate) Cobaltate(III) $\text{H}[\text{Co(dmgH)}_2\text{Cl}_2]$

Instrumentation

1) Determination of equilibrium constant by Slope intercept method for $\text{Fe}^{+3}/\text{SCN}^-$ system

2) Determination of Electrolytic nature of inorganic compounds by Conductance measurement.

Reference:

1. Advanced experiments in Inorganic Chemistry., G. N. Mukherjee., 1st Edn., 2010., U.N.Dhur& Sons Pvt Ltd

2. The Synthesis and Characterization of Inorganic Compounds by William L. Jolly 3. Inorganic Chemistry Practical Under UGC Syllabus for M.Sc. in all India Universities By: Dr Deepak Pant

Paper III

Organic Chemistry: Course Code: **PSC1CH3**

Lectures: 60 L

Unit I

Physical Organic Chemistry: (15 L)

1.1. Thermodynamic and kinetic requirements of a reaction: rate and equilibrium constants, reaction coordinate diagram, transition state (activated complex), nature of activated complex, Hammond postulate, Reactivity vs selectivity, Curtin-Hammett Principle, Microscopic reversibility, Kinetic vs thermodynamic control of organic reactions.

1.2. Determining mechanism of a reaction: Product analysis, kinetic studies, use of isotopes (Kinetic isotope effect – primary and secondary kinetic isotope effect). Detection and trapping of intermediates, crossover experiments and stereochemical evidence.

1.3. Acids and Bases: Factors affecting acidity and basicity: Electronegativity and inductive effect, resonance, bond strength, electrostatic effects, hybridization, aromaticity and solvation. Comparative study of acidity and basicity of organic compounds on the basis of pK_a values, Leveling effect and non-aqueous solvents. Acid and base catalysis – general and specific catalysis with examples.

[Reference Books: 1, 2, 3, 16]

Unit II

Nucleophilic substitution reactions and Aromaticity

2.1. Nucleophilic substitution reactions: (9 L)

2.1.1. Aliphatic nucleophilic substitution: S_N1 , S_N2 , S_Ni reactions, mixed S_N1 and S_N2 and SET mechanisms. S_N reactions involving NGP - participation by aryl rings, α - and π -bonds. Factors affecting these reactions: substrate, nucleophilicity, solvent, steric effect, hard-soft interaction, leaving group. Ambident nucleophiles. S_NcA , S_N1'' and S_N2'' reactions. S_N at sp^2 (vinylic) carbon.

2.1.2. Aromatic nucleophilic substitution: S_NAr , S_N1 , benzyne mechanisms. Ipso, cine, tele and vicarious substitution.

2.1.3. Ester hydrolysis: Classification, nomenclature and study of all eight mechanisms of acid and base catalyzed hydrolysis with suitable examples.

2.2. Aromaticity: (6 L)

2.2.1. Structural, thermochemical, and magnetic criteria for aromaticity, including NMR characteristics of aromatic systems. Delocalization and aromaticity.

2.2.2. Application of HMO theory to monocyclic conjugated systems. Frost-Musulin diagrams. Huckel's $(4n+2)$ and $4n$ rules.

2.2.3. Aromatic and antiaromatic compounds up-to 18 carbon atoms. Homoaromatic compounds. Aromaticity of all benzenoid systems, heterocycles, metallocenes, azulenes, annulenes, aromatic ions and Fullerene (C_{60}).

[Reference Books: 4-15]

Unit-III

Stereochemistry: (15 L)

3.1. Concept of Chirality: Recognition of symmetry elements.

3.2. Molecules with tri- and tetra-coordinate centers: Compounds with carbon, silicon, nitrogen, phosphorous and sulphur chiral centers, relative configurational stabilities.

3.3. Molecules with two or more chiral centers: Constitutionally unsymmetrical molecules: erythro-threo and syn-anti systems of nomenclature. Interconversion of Fischer, Sawhorse, Newman and Flying wedge projections. Constitutionally symmetrical molecules with odd and even number of chiral centers: enantiomeric and meso forms, concept of stereogenic, chirotopic, and pseudoasymmetric centres. R-S nomenclature for chiral centres in acyclic and cyclic compounds.

3.4. Axial and planar chirality: Principles of axial and planar chirality. Stereochemical features and configurational descriptors (R,S) for the following classes of compounds: allenes, alkylidene cycloalkanes, spirans, biaryls (buttressing effect) (including BINOLs and BINAPs), ansa compounds, cyclophanes, trans-cyclooctenes.

3.5. Prochirality: Chiral and prochiral centres; prochiral axis and prochiral plane. Homotopic, heterotopic (enantiotopic and diastereotopic) ligands and faces. Identification using substitution and symmetry criteria. Nomenclature of stereoheterotopic ligands and faces. Symbols for stereoheterotopic ligands in molecules with i) one or more prochiral centres ii) a chiral as well as a prochiral centre, iii) a prochiral axis iv) a prochiral plane v) pro-pseudoasymmetric centre. Symbols for enantiotopic and diastereotopic faces.

[Reference Books: 6-8]

Unit-IV

Oxidation and Reduction: (15 L)

4.1. Oxidation: General mechanism, selectivity, and important applications of the following:

4.1.1. Dehydrogenation: Dehydrogenation of C-C bonds including aromatization of six membered rings using metal (Pt, Pd, Ni) and organic reagents (chloranil, DDQ).

4.1.2. Oxidation of alcohols to aldehydes and ketones: Chromium reagents such as $K_2Cr_2O_7/H_2SO_4$ (Jones reagent), CrO_3 -pyridine (Collin's reagent), PCC (Corey's reagent) and PDC (Cornforth reagent), hypervalent iodine reagents (IBX, Dess-Martin periodinane). DMSO based reagents (Swern oxidation), Corey-Kim oxidation - advantages over Swern and limitations; and Pfitzner-Moffatt oxidation-DCC and DMSO and Oppenauer oxidation.

4.1.3. Oxidation involving C-C bonds cleavage: Glycols using HIO_4 ; cycloalkanones using CrO_3 ; carbon-carbon double bond using ozone, $KMnO_4$, CrO_3 , $NaIO_4$ and OsO_4 ; aromatic rings using RuO_4 and $NaIO_4$.

4.1.4. Oxidation involving replacement of hydrogen by oxygen: oxidation of CH_2 to CO by SeO_2 , oxidation of arylmethanes by CrO_2Cl_2 (Etard oxidation).

4.1.5. Oxidation of aldehydes and ketones: with H_2O_2 (Dakin reaction), with peroxy acid (Baeyer-Villiger oxidation)

4.2. Reduction: General mechanism, selectivity, and important applications of the following reducing reagents:

4.2.1. Reduction of CO to CH_2 in aldehydes and ketones- Clemmensen reduction, Wolff-Kishner reduction and Huang-Minlon modification.

4.2.2. Metal hydride reduction: Boron reagents ($NaBH_4$, $NaCNBH_3$, diborane, 9-BBN, $Na(OAc)_3BH$, aluminium reagents ($LiAlH_4$, DIBAL-H, Red Al, L and K- selectrides).

4.2.3. NH_2NH_2 (diimide reduction) and other non-metal based agents including organic reducing agents (Hantzsch dihydropyridine).

4.2.4. Dissolving metal reductions: using Zn, Li, Na, and Mg under neutral and acidic conditions, Li/Na-liquid NH_3 mediated reduction (Birch reduction) of aromatic compounds and acetylenes.

[Reference Books: 17, 18, 14]

Reference Books:

1. Physical Organic Chemistry, Neil Isaacs
2. Modern Physical Organic Chemistry, Eric V. Anslyn and Dennis A. Dougherty
3. Comprehensive Organic chemistry, Barton and Ollis, Vol 1
4. Organic Chemistry, J. Claydens, N. Greeves, S. Warren and P. Wothers, Oxford University Press.
5. Advanced Organic Chemistry, F.A. Carey and R.J. Sundberg, Part A and B, Plenum Press.
6. Stereochemistry: Conformation and mechanism, P.S. Kalsi, New Age International, New Delhi.
7. Stereochemistry of carbon compounds, E.L Eliel, S.H Wilen and L.N Manden, Wiley.
8. Stereochemistry of Organic Compounds- Principles and Applications, D. Nasipuri. New International Publishers Ltd.
9. March's Advanced Organic Chemistry: Reactions, Mechanisms and Structure, Michael B. Smith, Jerry March, Wiley.
10. Advanced Organic Chemistry: Reactions and mechanism, B. Miller and R. Prasad, Pearson Education.
11. Advanced Organic Chemistry: Reaction mechanisms, R. Bruckner, Academic Press.
12. Understanding Organic Reaction Mechanisms, Adams Jacobs, Cambridge University Press.
13. Writing Reaction Mechanism in organic chemistry, A. Miller, P.H. Solomons, Academic Press.
14. Principles of Organic Synthesis, R.O.C. Norman and J.M Coxon, Nelson Thornes.
15. Advanced Organic Chemistry: Reactions and mechanism, L.G. Wade, Jr., Maya Shankar Singh, Pearson Education.
16. Mechanism in Organic Chemistry, Peter sykes, 6th edition onwards.
17. Modern Methods of Organic Synthesis, W. Carruthers and Iain Coldham, Cambridge University Press.
18. Organic Synthesis, Jagdamba Singh, L.D.S. Yadav, PragatiPrakashan.

Organic Chemistry Practical

Paper III

Course Code: **PSC1CH3**

One step preparations (1.0 g scale)

1. Bromobenzene to p-nitrobromobenzene
2. Anthracene to anthraquinone
3. Benzoin to benzil
4. Anthracene to Anthracene maleic anhydride adduct
5. 2-Naphthol to BINOL
6. p-Benzoquinone to 1,2,4-triacetoxybenzene
7. Ethyl acetoacetate to 3-methyl-1-phenylpyrazol-5-one
8. o-Phenylenediamine to 2-methylbenzimidazole
9. o-Phenylenediamine to 2,3-diphenylquinoxaline
10. Urea and benzil to 5,5-diphenylhydantoin

Use of Computer - Chem Draw-Sketch, ISI – Draw:

Draw the structure of simple aliphatic, aromatic, heterocyclic organic compounds with substituents. Get the correct IUPAC name, Get ^1H NMR and ^{13}C . Students can able to draw the one name reaction and its reaction mechanism.

Learning points:

1. Planning of synthesis, effect of reaction parameters including stoichiometry, and safety aspects including MSDS should be learnt.
2. Purify the product by crystallization. Formation and purity of the product should be checked by TLC
3. Report mass and melting point of the purified product.

Paper IV

Analytical Chemistry: Course Code: **PSC1CH4**

Lectures: 60 L

Unit - I

1.1 Language of Analytical Chemistry [8 L]

1.1.1 Analytical perspective, Common analytical problems, terms involved in analytical chemistry (analysis, determination, measurement, techniques, methods, procedures and protocol)

1.1.2 An overview of analytical methods, types of instrumental methods, instruments for analysis, data domains, electrical and non-electrical domains, detectors, transducers and sensors, selection of an analytical method, accuracy, precision, selectivity, sensitivity, detection limit and dynamic range.

1.1.3 Errors, determinate and indeterminate errors. Types of determinate errors, tackling of errors. 1.1.4 Quantitative methods of analysis: calibration curve, standard addition and internal standard method.

1.2 Quality in Analytical Chemistry: [7 L]

1.2.1 Quality Management System (QMS):

Evolution and significance of Quality Management, types of quality standards for laboratories, total quality management (TQM), philosophy implementation of TQM (reference of Kaizen, Six Sigma approach & 5S), quality audits and quality reviews, responsibility of laboratory staff for quality and problems.

1.2.2 Safety in Laboratories:

Basic concepts of Safety in Laboratories, Personal Protection Equipment (PPE), OSHA, Toxic Hazard (TH) classifications, Hazardous Chemical Processes (including process calorimetry / thermal build up concepts).

1.2.3 Accreditations:

Accreditation of Laboratories, Introduction to ISO series, Indian Government Standards (ISI, Hallmark, Agmark)

1.2.4 Good Laboratory Practices (GLP)

Principle, Objective, OECD guidelines, The US FDA 21CFR58, Klimisch score

Unit- II

Calculations based on Chemical Principles [15 L]

The following topics are to be covered in the form of numerical problems only.

a. Concentration of a solution based on volume and mass units.

b. Calculations of ppm, ppb and dilution of the solutions, concept of mmol.

c. Stoichiometry of chemical reactions, concept of kg mol, limiting reactant, theoretical and practical yield.

d. Solubility and solubility equilibria, effect of presence of common ion.

e. Calculations of pH of acids, bases, acidic and basic buffers.

f. Concept of formation constants, stability and instability constants, stepwise formation constants.

g. Oxidation number, rules for assigning oxidation number, redox reaction in term of oxidation number, oxidizing and reducing agents, equivalent weight of oxidizing and reducing agents, stoichiometry of redox titration (Normality of a solution of a oxidizing / reducing agent and its relationship with molarity).

Unit III

Optical Methods [15 L]

3.1 Recapitulation and FT Technique [3 L]

3.1.1 Recapitulation of basic concepts, Electromagnetic spectrum, Sources, Detectors, sample containers.

3.1.2 Laser as a source of radiation, Fibre optics

3.1.3 Introduction of Fourier Transform

3.2 Molecular Ultraviolet and Visible Spectroscopy [6 L]

NUMERICALS ARE EXPECTED

3.2.1 Derivation of Beer- Lambert's Law and its limitations, factors affecting molecular absorption, types of transitions [emphasis on charge transfer absorption], pH, temperature, solvent and effect of substituents.

Applications of Ultraviolet and Visible spectroscopy:

1) On charge transfer absorption

2) Simultaneous spectroscopy

3) Derivative Spectroscopy

3.2.2 Dual spectrometry – Introduction, Principle, Instrumentation and Applications

3.3 Infrared Absorption Spectroscopy [6 L]

3.3.1 Instrumentation: Sources, Sample handling, Transducers, Dispersive, non-dispersive instrument 05 L

3.3.2 FTIR and its advantages

3.3.3 Applications of IR [Mid IR, Near IR, Far IR]: Qualitative with emphasis on “Finger print” region, Quantitative analysis, Advantages and Limitations of IR

3.3.4 Introduction and basic principles of diffuse reflectance spectroscopy.

Unit - IV

4.1 Thermal Methods: [9 L]

4.1.1 Introduction, Recapitulation of types of thermal methods, comparison between TGA and DTA.

4.1.2 Differential Scanning Calorimetry- Principle, comparison of DTA and DSC, Instrumentation, Block diagram, Nature of DSC Curve, Factors affecting curves (sample size, sample shape, pressure).

4.1.3 Applications - Heat of reaction, Specific heat, Safety screening, Polymers, liquid crystals, Percentage crystallinity, oxidative stability, Drug analysis, Magnetic transition. e.g. Analysis of Polyethylene for its crystallinity.

4.2 Automation in chemical analysis: [6 L]

Need for automation, Objectives of automation, An overview of automated instruments and instrumentation, process control analysis, flow injection analysis, discrete automated systems, automatic analysis based on multilayered films, gas monitoring equipments, Automatic titrators.

References

Unit I 1. Modern Analytical Chemistry by David Harvey, McGraw-Hill Higher Education 2. Principles of Instrumental Analysis - Skoog, Holler and Nieman, 5th Edition, Ch: 1. 3. Fundamentals of Analytical Chemistry, By Douglas A. Skoog, Donald M. West, F. James Holler, Stanley R. Crouch, 9th Edition, 2004, Ch: 5. 4. Undergraduate Instrumental Analysis, 6th Edition, J W Robinson, Marcel Dekker, Ch:1. 5. ISO 9000 Quality Systems Handbook, Fourth Edition, David Hoyle. (Chapter: 3 & 4) (Free download). 6. Quality in the Analytical Laboratory, Elizabeth Pichard, Wiley India, Ch: 5, Ch: 6 & Ch: 7. 7. Quality Management, Donna C S Summers, Prentice-Hall of India, Ch:3. 8. Quality in Totality: A Manager's Guide To TQM and ISO 9000, Parag Diwan, Deep & Deep Publications, 1st Edition, 2000. 9. Quality Control and Total Quality Management - P.L. Jain-Tata McGraw-Hill (2006) Total Quality Management - Bester field - Pearson Education, Ch:5. 10. Industrial Hygiene and Chemical Safety, M H Fulekar, Ch:9, Ch:11 & Ch:15. 11. Safety and Hazards Management in Chemical Industries, M N Vyas, Atlantic Publisher, Ch:4, Ch:5 & Ch:19. 12. Staff, World Health Organization (2009) Handbook: Good Laboratory Practice (GLP) 13. OECD Principles of Good Laboratory Practice (as revised in 1997)". OECD Environmental Health and Safety Publications. OECD. 1. 1998. 14. Klimisch, HJ; Andreae, M; Tillmann, U (1997). "A systematic approach for evaluating the quality of experimental toxicological and ecotoxicological data". doi:10.1006/rtp.1996.1076. PMID 9056496.

Unit II

1. 3000 solved problems in chemistry, Schaums Solved problem series, David E. Goldbers, McGraw Hill international Editions, Chapter 11,15,16,21,22

Unit III

1. D. A. Skoog, F. J. Holler, T. A. Nieman, Principles of Instrumental Analysis, 5th Edition, Harcourt Asia Publisher. Chapter 6, 7.

2. H. H. Willard, L. L. Merritt, J. A. Dean, F. A. Settle, Instrumental Methods of Analysis, 6th Edition, CBS Publisher. Chapter 2.

3. R. D. Braun, Introduction to Instrumental Analysis, McGraw Hill Publisher. Chapter 8.

4. D. A. Skoog, F. J. Holler, T. A. Nieman, Principles of Instrumental Analysis, 5th Edition, Harcourt Asia Publisher. Chapter 13, 14.

5. H. H. Willard, L. L. Merritt, J. A. Dean, F. A. Settle, Instrumental Methods of Analysis, 6th Edition, CBS Publisher. Chapter 2.

6. R. D. Braun, Introduction to Instrumental Analysis, McGraw Hill Publisher. Chapter 5.

7. G. W. Ewing, Instrumental Methods of Chemical Analysis, 5th Edition, McGraw Hill Publisher, Chapter 3.

8. M. Ito, The effect of temperature on ultraviolet absorption spectra and its relation to hydrogen bonding, J. Mol. Spectrosc. 4 (1960) 106-124.

9. A. J. Somnessa, The effect of temperature on the visible absorption band of iodine in several solvents, Spectrochim. Acta. Part A: Molecular Spectroscopy, 33 (1977) 525-528.

10. D. A. Skoog, F. J. Holler, T. A. Nieman, Principles of Instrumental Analysis, 5th Edition, Harcourt Asia Publisher. Chapter 16, 17.

11. R. D. Braun, Introduction to Instrumental Analysis, McGraw Hill Publisher. Chapter 12

12. Z. M. Khoshhesab (2012). Infrared Spectroscopy- Materials Science, Engineering and Technology. Prof. Theophanides Theophile (Ed.). ISBN: 978-953- 51-0537- 4, InTech, (open access)

Unit IV

1. Introduction to instrumental methods of analysis by Robert D. Braun, Mc. Graw Hill (1987): Chapter 27

2. Thermal Analysis-theory and applications by R. T. Sane, Ghadge, Quest Publications

3. Instrumental methods of analysis, 7th Edition, Willard, Merrit, Dean: Chapter 25

4. Instrumental Analysis, 5th Edition, Skoog, Holler and Nieman: Chapter 31

5. Quantitative Chemical Analysis, 6 th Edition, Vogel: Chapter 12
6. Analytical Chemistry by Open Learning: Thermal Methods by James W. Dodd & Kenneth H. Tonge
7. Instrumental methods of analysis, 7 th Edition, Willard, Merrit, Dean: Chapter 26
8. Instrumental Analysis, 5th Edition, Skoog, Holler and Nieman: Chapter 33
9. Introduction to instrumental methods of analysis by Robert D. Braun, Mc. GrawHill (1987): Chapter 28

Analytical Chemistry Practical

Paper IV

Course Code: PSCHP 104

1. To carry out assay of the sodium chloride injection by Volhard's method.

Statistical method.

2. To determine (a) the ion exchange capacity (b) exchange efficiency of the given cation exchange resin.

3. To determine amount of Cr(III) and Fe(II) individually in a mixture of the two by titration with EDTA.

4. To determine the breakthrough capacity of a cation exchange resin.

5. To determine the lead and tin content of a solder alloy by titration with EDTA.

6. To determine amount of Cu(II) present in the given solution containing a mixture of Cu(II) and Fe(II).

7. To determine number of nitro groups in the given compound using TiCl_3 .

References:

1. Quantitative Inorganic Analysis including Elementary Instrumental Analysis by A. I. Vogels, 3rd Ed. ELBS (1964)
2. Vogel's textbook of quantitative chemical analysis, Sixth Ed. Mendham, Denny, Barnes, Thomas, Pearson education
3. Standard methods of chemical analysis, F. J. Welcher
4. Standard Instrumental methods of Chemical Analysis, F. J. Welcher
5. W.W.Scott."Standard methods of Chemical Analysis",Vol.I, Van Nostrand Company,Inc.,1939.

6. E.B.Sandell and H.Onishi,"Spectrophotometric Determination of Traces of Metals",Part-II,4th Ed.,A Wiley IntersciencePublication,New York,1978.

Semester – II

Paper I

Physical Chemistry: Course Code: PSC2CH1

[60 L]

Unit I

Chemical Thermodynamics II [15 L]

1.1. Fugacity of real gases, Determination of fugacity of real gases using graphical method and from equation of state. Equilibrium constant for real gases in terms of fugacity. Gibbs energy of mixing, entropy and enthalpy of mixing.

1.2. Real solutions: Chemical potential in non ideal solutions excess functions of non ideal solutions calculation of partial molar volume and partial molar enthalpy, Gibbs Duhem Margules equation.

1.3. Thermodynamics of surfaces, Pressure difference across curved surface (Laplace equation), vapour pressure of droplets (Kelvin equation), Gibbs adsorption isotherm, BET isotherm (derivations expected).

1.4. Bioenergetics : standard free energy change in biochemical reactions, exergonic, endergonic. Hydrolysis of ATP, synthesis of ATP from ADP.

Unit II

Quantum Chemistry II [15 L]

2.1. Rigid rotor, spherical coordinates Schrödinger wave equation in spherical coordinates, separation of the variables, the ϕ equation, wavefunction, quantum number, the θ equation, wave function, quantization of rotational energy, spherical harmonics.

2.2. Hydrogen atom, the two particle problem, separation of the energy as translational and potential, separation of variables, the R the ϕ * and the θ equations, solution of the reequation, introduction of the four quantum numbers and their interdependence on the basis of the solutions of the three equations, total wave function, expression for the energy, probability density function, distances and energies in atomic units, radial and angular plots., points of maximum probability, expressions for the total wave function for 1s, 2s, 2p and 3d orbitals of hydrogen.

2.3. Application of the Schrödinger equation to two electron system, limitations of the equation, need for the approximate solutions, methods of obtaining the approximate solution of the Schrödinger wave equation.

2.4. Hückel Molecular Orbitals theory for ethylene , 1,3-butadiene and benzene. (Derivation expected)

Unit III

Chemical Kinetics and Molecular Reaction Dynamics [15 L]

3.1. Elementary Reactions in Solution:- Solvent Effects on reaction rates, Reactions between ions- influence of solvent Dielectric constant, influence of ionic strength, Linear free energy relationships Enzyme action

3.2. Kinetics of reactions catalyzed by enzymes -Michaelis-Menten analysis, Lineweaver-Burk and Eadie Analyses.

3.3. Inhibition of Enzyme action: Competitive, Noncompetitive and Uncompetitive Inhibition. Effect of pH, Enzyme activation by metal ions, Regulatory enzymes.

3.4. Kinetics of reactions in the Solid State:- Factors affecting reactions in solids Rate laws for reactions in solid: The parabolic rate law, The first order rate Law, the contracting sphere rate law, Contracting area rate law, some examples of kinetic studies.

(Ref: 7 and 2)

Unit IV

Solid State Chemistry and Phase Equilibria [15 L]

4.1 : Solid State Chemistry

4.1.1. Recapitulation: Structures and Defects in solids.

Types of Defects and Stoichiometry

a) Zero dimensional (point) Defects

b) One dimensional (line) Defects

c) Two dimensional (Planar) Defects

d) Thermodynamics of formation of defects (Mathematical derivation to find concentration of defects and numerical problems based on it)

(Ref: 17, 18 and 19)

4.2 Phase equilibria

4.2.1. Recapitulation: Introduction and definition of terms involved in phase rule.

Thermodynamic derivation of Gibbs Phase rule.

4.2.2. Two component system:

- a) Solid –Gas System : Hydrate formation, Amino compound formation
- b) Solid – Liquid System: Formation of a compound with congruent melting point, Formation of a compound with incongruent melting point . (with suitable examples)

4.2.3. Three component system

Type-I : Formation of one pair of partially miscible liquids

Type-II: Formation of two pairs of partially miscible liquids

Type-III: Formation of three pairs of partially miscible liquids

(Ref: 4, 6, 11, 12 ,13,16, 24)

References

1. Peter Atkins and Julio de Paula, Atkin's Physical Chemistry, 7th Edn., Oxford University Press, 2002.
2. K.J. Laidler and J.H. Meiser, Physical Chemistry, 2nd Ed., CBS Publishers and Distributors, New Delhi, 1999.
3. Robert J. Silby and Robert A. Alberty, Physical Chemistry, 3rd Edn., John Wiley and Sons (Asia) Pte.Ltd., 2002.
4. Ira R. Levine, Physical Chemistry, 5th Edn., Tata McGraw-Hill New Delhi, 2002.
5. G.W. Castellan, Physical Chemistry, 3rd Edn., Narosa Publishing House, New Delhi, 1983.
6. S. Glasstone, Text Book of Physical Chemistry, 2nd Edn., McMillan and Co. Ltd., London, 1962.
7. Principles of Chemical Kinetics, 2nd Ed., James E. House, ELSEVIER, 2007.
8. B.K. Sen, Quantum Chemistry including Spectroscopy, Kalyani Publishers, 2003.
9. A.K. Chandra, Introductory Quantum Chemistry, Tata McGraw – Hill, 1994.
10. R.K. Prasad, Quantum Chemistry, 2nd Edn., New Age International Publishers, 2000.
11. S. Glasstone, Thermodynamics for Chemists, Affiliated East-West Press, New Delhi, 1964.
12. W.G. Davis, Introduction to Chemical Thermodynamics – A Non – Calculus Approach, Saunders, Philadelphia, 1972.
13. Peter A. Rock, Chemical Thermodynamics, University Science Books, Oxford University Press, 1983.

14. Ira N. Levine, Quantum Chemistry, 5th Edn., Pearson Education (Singapore) Pte.Ltd., Indian Branch, New Delhi, 2000.
15. Thomas Engel and Philip Reid, Physical Chemistry, 3rd Edn., Pearson Education Limited 2013.
16. D.N. Bajpai, Advanced Physical Chemistry, S. Chand 1st Edn., 1992.
17. Solid State Chemistry [An Introduction], 3rd Ed., Lesley E. Smart & Elaine A. Moore, Taylor & Francis, 2010.
18. The Physics and Chemistry of Solids, Stephen Elliott, Wiley India, 2010
19. Principles of the Solid State, H.V. Keer, New Age International Publishers, 2011.
20. Solid State Chemistry, D.K. Chakrabarty, New Age International Publishers, 1996.
21. Principles of physical Chemistry, Marrow and Prutton 5th edition
22. Essentials of Physical Chemistry, Arun Bahl, B. S Bahl, G. D. Tulli, S Chand and Co. Ltd, 2012 Edition.
23. Introduction of Solids L.V Azaroff, Tata McGraw Hill.
24. A Text book of physical Chemistry ; Applications of thermodynamics vol III, Mac Millan Publishers India Ltd, 2011
25. New directions in solid state Chemistry, C.N.R. Rao and J Gopalkrishnan, Cambridge University Press.

Physical Chemistry Practical

Paper I

Course Code: PSC2HP 201

Non – instrumental:

1. Polar plots of atomic orbitals such as $1s$, $2p_x$ & $3d_z^2$ orbitals by using angular part of hydrogen atom wave functions.
2. To study the influence of ionic strength on the base catalysed hydrolysis of ethyl acetate.
3. To study phase diagram of three component system water – chloroform /toluene - acetic acid.
4. To determine the rate constant of decomposition reaction of diacetone alcohol by dilatometric method.

Instrumental:

1. To determine the formula of silver ammonia complex by potentiometric method.
2. To determine CMC of sodium Lauryl Sulphate from measurement of conductivities at different concentrations.
3. To determine Hammett constant of m- and p- amino benzoic acid/nitro benzoic acid by pH measurement.
4. To determine the Michaelis – Menten's constant value (K_m) of the enzyme Beta Amylase spectrophotometrically.

References

- 4 Practical Physical Chemistry, B. Viswanathan and P.S. Raghavan, Viva Books Private Limited, 2005.
- 5 Practical Physical Chemistry, A.M. James and F.E. Prichard, 3rd Edn., Longman Group Ltd., 1974.
- 6 Experimental Physical Chemistry, V.D. Athawale and P. Mathur, New Age International Publishers, 2001.

Semester II

Paper II

Inorganic Chemistry: Course Code: PSC2CH2

Unit I

Inorganic Reaction Mechanism: [15 L]

1.1 Rate of reactions, factors affecting the rate of reactions, techniques for determination of rate of reaction (Direct chemical analysis, spectrophotometric method, electrochemical and flow methods).

1.2 Ligand substitution reactions of:

a) Octahedral complexes without breaking of metal-ligand bond (Use of isotopic labelling method)

b) Square planar complexes, trans-effect, its theories and applications. Mechanism and factors affecting these substitution reactions.

1.3 Redox reactions: inner and outer sphere mechanisms, complimentary and non-complimentary reactions.

1.4 Stereochemistry of substitution reactions of octahedral complexes. (Isomerization and racemization reactions and applications.)

Unit II

Organometallic Chemistry of Transition metals: [15 L]

2.1. Eighteen and sixteen electron rule and electron counting with examples.

2.2. Preparation and properties of the following compounds

(a) Alkyl and aryl derivatives transition metal complexes

(b) Carbenes and carbynes of Cr, Mo and W

(c) Alkene derivatives of Pd and Pt

(d) Alkyne derivatives of Pd and Pt

(e) Allyl derivatives of nickel

(f) Sandwich compounds of Fe, Cr and Half Sandwich compounds of Cr, Mo.

2.3 Structure and bonding on the basis of VBT and MOT in the following organometallic compounds:

Zeise's salt, bis(triphenylphosphine)diphenylacetylene platinum(0) $[\text{Pt}(\text{PPh}_3)_2(\text{HC}\equiv\text{CPh})_2]$, diallylnickel(II), ferrocene and bis(arene)chromium(0), tricarbonyl (η^2 -butadiene) iron(0).

Unit III

Environmental Chemistry:[15 L]

3.1. Conception of Heavy Metals: Critical discussion on heavy metals

3.2. Toxicity of metallic species: Mercury, lead, cadmium, arsenic, copper and chromium, with respect to their sources, distribution, speciation, biochemical effects and toxicology, control and treatment.

3.3. Case Studies:

(a) Itai-itai disease for Cadmium toxicity,

(b) Arsenic Poisoning in the Indo-Bangladesh region.

3.4. Interaction of radiation in context with the environment: Sources and biological implication of radioactive materials. Effect of low level radiation on cells- Its applications in diagnosis and treatment, Effect of radiation on cell proliferation and cancer.

Unit IV

Bioinorganic Chemistry:[15 L]

4.1. Biological oxygen carriers; hemoglobin, hemerythrin and hemocyanin- structure of metal active center and differences in mechanism of oxygen binding, Differences between

hemoglobin and myoglobin: Cooperativity of oxygen binding in hemoglobin and Hill equation, pH dependence of oxygen affinity in hemoglobin and myoglobin and its implications.

4.2. Activation of oxygen in biological system with examples of mono-oxygenases, and oxidases- structure of the metal center and mechanism of oxygen activation by these enzymes.

4.3. Copper containing enzymes- superoxide dismutase, tyrosinase and laccase: catalytic reactions and the structures of the metal binding site

4.4. Nitrogen fixation-nitrogenase, hydrogenases

4.5. Metal ion transport and storage: Ionophores, transferrin, ferritin and metallothioneins

4.6. Medicinal applications of cis-platin and related compounds

References

Unit I

1. P. Atkins, T. Overton, J. Rourke, M. Weller and F. Armstrong, Inorganic Chemistry, 5th Ed., Oxford University Press, 2010.
2. D. Banerjee, Coordination Chemistry, Tata McGraw Hill, 1993.
3. W. H. Malik, G. D./Tuli and R. D. Madan, Selected Topics in Inorganic Chemistry, 8th Ed., S. Chand & Company Ltd.
4. M. L. Tobe and J. Burgess, Inorganic Reaction Mechanism, Longman, 1999.
5. S. Asperger, Chemical kinetics and Inorganic Reaction Mechanism, 2nd Ed., Kluwer Academic/ Plenum Publishers, 2002
6. Gurdeep Raj, Advanced Inorganic Chemistry-Vol.II, 12th Edition, Goel publishing house, 2012.
7. B. R. Puri, L. R. Sharma and K. C. Kalia, Principles of Inorganic Chemistry, Milestone Publishers, 2013-2014.
8. F. Basalo and R. G. Pearson, Mechanism of Inorganic Reactions, 2nd Ed., Wiley, 1967.
9. R. Gopalan and V. Ramlingam, Concise Coordination chemistry, Vikas Publishing house Pvt Ltd., 2001.
10. Robert B. Jordan, Reaction Mechanisms of Inorganic and Organometallic Systems, 3rd Ed., Oxford University Press 2008.

Unit II

1. D. Banerjee, Coordination chemistry. Tata McGraw Hill, New Delhi, 1993.

2. R.C Mehrotra and A.Singh, Organometallic Chemistry- A unified Approach, 2nded, New Age International Pvt Ltd, 2000.
3. R.H Crabtree, The Organometallic Chemistry of the Transition Metals, 5th edition, Wiley International Pvt, Ltd 2000.
4. B.Doughlas, D.H McDaniel and J.J Alexander. Concepts and Models of Inorganic Chemistry, 2nd edition, John Wiley and Sons. 1983.
5. Organometallic Chemistry by G.S Sodhi. Ane Books Pvt Ltd.

Unit III

1. Environmental Chemistry 5th edition, Colin Baird Michael Cann, W. H. Freeman and Company, New York, 2012.
2. Environmental Chemistry 7th edition, Stanley E. Manahan, CRC Press Publishers,
3. Environmental Contaminants, Daniel A. Vallero, ISBN: 0-12-710057-1, Elsevier Inc., 2004.
4. Environmental Science 13th edition, G. Tyler Miller Jr. and Scott E. Spoolman, ISBN-10: 0-495-56016-2, Brooks/Cole, Cengage Learning, 2010.
5. Fundamentals of Environmental and Toxicological Chemistry 4th edition, Stanley E. Manahan, ISBN: 978-1-4665-5317-0, CRC Press Taylor & Francis Group, 2013.
6. Living in the Environment 17th edition, G. Tyler Miller Jr. and Scott E. Spoolman, ISBN-10: 0-538-49414-X, Brooks/Cole, Cengage Learning, 2011
7. Poisoning and Toxicology Handbook, Jerrold B. Leikin, Frank P. Paloucek, ISBN: 1-4200-4479-6, Informa Healthcare USA, Inc.
8. Casarett and Doull's Toxicology- The Basic Science of Poisons 6th edition, McGraw-Hill, 2001.

Unit IV

1. R. W. Hay, Bioinorganic Chemistry, Ellis Harwood, England, 1984.
2. I. Bertini, H.B.Gray, S. J. Lippard and J.S. Valentine, Bioinorganic Chemistry, First South Indian Edition, Viva Books, New Delhi, 1998.
3. J. A. Cowan, Inorganic Biochemistry-An introduction, VCH Publication, 1993.
4. S. J. Lippard and J. M. Berg, Principles of Bioinorganic Chemistry, University Science Publications, Mill Valley, Caligronic, 1994.
5. G.N. Mukherjee and A. Das, Elements of Bioinorganic Chemistry, Dhuri& Sons, Calcutta, 1988.

6. J.Chem. Educ. (Special issue), Nov, 1985.
7. E.Frienden, J.Chem. Educ., 1985, 62.
8. Robert R.Crechton, Biological Inorganic Chemistry – An Introduction, Elsevier
9. J. R. Frausto da Silva and R. J. P. Williams The Biological Chemistry of the Elements, Clarendon Press, Oxford, 1991.
10. JM. D. Yudkin and R. E. Offord A Guidebook to Biochemistry, Cambridge University Press, 1980.

Inorganic Chemistry Practical

Paper II

Course Code: **PSCHP 202**

Ores and Alloys

- 1) Analysis of Devarda's alloy
- 2) Analysis of Cu – Ni alloy
- 3) Analysis of Tin Solder alloy
- 4) Analysis of Limestone.

Instrumentation

- 1) Estimation of Copper using Iodometric method Potentiometrically.
- 2) Estimation of Fe³⁺ solution using Ce(IV) ions Potentiometrically

Reference:

1. Advanced experiments in Inorganic Chemistry., G. N. Mukherjee., 1st Edn., 2010., U.N.Dhur& Sons Pvt Ltd
2. The Synthesis and Characterization of Inorganic Compounds by William L. Jolly 3. Inorganic Chemistry Practical Under UGC Syllabus for M.Sc. in all India Universities By: Dr Deepak Pant

Paper III

Organic Chemistry: Course Code: PSC2CH3

Lectures 60 L

Unit-I

1.1. Alkylation of Nucleophilic Carbon Intermediates: (7 L)

1.1.1. Generation of carbanion, kinetic and thermodynamic enolate formation, Regioselectivity in enolate formation, alkylation of enolates.

1.1.2. Generation and alkylation of dianion, medium effects in the alkylation of enolates, oxygen versus carbon as the site of alkylation.

1.1.3. Alkylation of aldehydes, ketones, esters, amides and nitriles.

1.1.4. Nitrogen analogs of enols and enolates- Enamines and Imines anions, alkylation of enamines and imines.

1.1.5. Alkylation of carbon nucleophiles by conjugate addition (Michael reaction).

1.2. Reaction of carbon nucleophiles with carbonyl groups: (8 L)

1.2.1. Mechanism of Acid and base catalyzed Aldol condensation, Mixed Aldol condensation with aromatic aldehydes, regiochemistry in mixed reactions of aliphatic aldehydes and ketones, intramolecular Aldol reaction and Robinson annulation.

1.2.2. Addition reactions with amines and iminium ions; Mannich reaction.

1.2.3. Amine catalyzed condensation reaction: Knoevenagel reaction.

1.2.4. Acylation of carbanions.

[Reference Books: 1-11]

Unit II

Reactions and Rearrangements: (15 L)

Mechanisms, stereochemistry (if applicable) and applications of the following:

2.1. Reactions: Baylis-Hilman reaction, McMurry Coupling, Corey-Fuchs reaction, Nef reaction, Passerini reaction.

2.2. Concerted rearrangements: Hofmann, Curtius, Lossen, Schmidt, Wolff, Boulton-Katritzky.

2.3. Cationic rearrangements: Tiffeneau-Demjanov, Pummerer, Dienone-phenol, Rupe, Wagner-Meerwein.

2.4. Anionic rearrangements: Brook, Neber, Von Richter, Wittig, Gabriel-Colman, Payne.

[Reference Books: 19-22]

Unit-III

3.1. Introduction to Molecular Orbital Theory for Organic Chemistry: (7 L)

3.1.1. Molecular orbitals: Formation of σ - and π -MOs by using LCAO method. Formation of π MOs of ethylene, butadiene, 1, 3, 5-hexatriene, allylcation, anion and radical. Concept of nodal planes and energies of π -MOs

3.1.2. Introduction to FMOs: HOMO and LUMO and significance of HOMO-LUMO gap in absorption spectra as well as chemical reactions. MOs of formaldehyde: The effect of electronegativity perturbation and orbital polarization in formaldehyde. HOMO and LUMO (π and π^* orbitals) of formaldehyde. A brief description of MOs of nucleophiles and electrophiles. Concept of „donor-acceptor“ interactions in nucleophilic addition reactions on formaldehyde. Connection of this HOMO-LUMO interaction with „curved arrows“ used in reaction mechanisms. The concept of hardness and softness and its application to electrophiles and nucleophiles. Examples of hard and soft nucleophiles/electrophiles. Identification of hard and soft reactive sites on the basis of MOs.

3.1.3. Application of FMO concepts in (a) S_N2 reaction, (b) Lewis acid base adducts (BF_3-NH_3 complex), (c) ethylene dimerization to butadiene, (d) Diels-Alder cycloaddition, (e) regioselective reaction of allylcation with allyl anion (f) addition of hydride to formaldehyde.

3.2. Applications of UV and IR spectroscopy: (8 L)

3.2.1. **Ultraviolet spectroscopy:** Recapitulation, UV spectra of dienes, conjugated polyenes (cyclic and acyclic), carbonyl and unsaturated carbonyl compounds, substituted aromatic compounds. Factors affecting the position and intensity of UV bands – effect of conjugation, steric factor, pH, and solvent polarity. Calculation of absorption maxima for above classes of compounds by Woodward-Fieser rules (using Woodward-Fieser tables for values for substituents).

3.2.2. **Infrared spectroscopy:** Fundamental, overtone and combination bands, vibrational coupling, factors affecting vibrational frequency (atomic weight, conjugation, ring size, solvent and hydrogen bonding). Characteristic vibrational frequencies for alkanes, alkenes, alkynes, aromatics, alcohols, ethers, phenols, amines, nitriles and nitro compounds. Detailed study of vibrational frequencies of carbonyl compounds, aldehydes, ketones, esters, amides, acids, acid halides, anhydrides, lactones, lactams and conjugated carbonyl compounds.

Unit-IV

NMR spectroscopy and Mass spectrometry (15 L)

4.1. Proton magnetic resonance spectroscopy: Principle, Chemical shift, Factors affecting chemical shift (Electronegativity, H-bonding, Anisotropy effects). Chemical and magnetic equivalence, Chemical shift values and correlation for protons bonded to carbon and other nuclei as in alcohols, phenols, enols, carboxylic acids, amines, amides. Spin-spin coupling, Coupling constant (J), Factors affecting J, geminal, vicinal and long range coupling (allylic and aromatic). First order spectra, Karplus equation.

4.2. ^{13}C NMR spectroscopy: Theory and comparison with proton NMR, proton coupled and decoupled spectra, off-resonance decoupling. Factors influencing carbon shifts, correlation of chemical shifts of aliphatic, olefin, alkyne, aromatic and carbonyl carbons.

4.3. Mass spectrometry: Molecular ion peak, base peak, isotopic abundance, metastable ions. Nitrogen rule, Determination of molecular formula of organic compounds based on isotopic abundance and HRMS. Fragmentation pattern in various classes of organic compounds (including compounds containing hetero atoms), McLafferty rearrangement, Retro-Diels-Alder reaction, ortho effect.

4.4. Structure determination involving individual or combined use of the above spectral techniques.

[Reference Books: 13-18]

References:

1. Organic Chemistry, J. Claydens, N. Greeves, S. Warren and P. Wothers, Oxford University Press.
2. Advanced Organic Chemistry, F.A. Carey and R.J. Sundberg, Part A, page no. 713-769, and B, Plenum Press.
3. March's Advanced Organic Chemistry: Reactions, Mechanisms and Structure, Michael B. Smith, Jerry March, Wiley.
4. Organic Chemistry, R.T. Morrison, R.N. Boyd and S.K. Bhattacharjee, Pearson Publication (7th Edition)
5. Advanced Organic Chemistry: Reactions and mechanism, B. Miller and R. Prasad, Pearson Education.
6. Advanced Organic Chemistry: Reaction mechanisms, R. Bruckner, Academic Press.
7. Understanding Organic Reaction Mechanisms, Adams Jacobs, Cambridge University Press.
8. Writing Reaction Mechanism in organic chemistry, A. Miller, P.H. Solomons, Academic Press.
9. Principles of Organic Synthesis, R.O.C. Norman and J.M Coxon, Nelson Thornes.
10. Advanced Organic Chemistry: Reactions and mechanism, L.G. Wade, Jr., Maya Shankar Singh, Pearson Education.
11. Mechanism in Organic Chemistry, Peter Sykes, 6th
12. Molecular Orbital and Organic chemical reactions, Ian Fleming Reference Edition, Wiley

13. Introduction to Spectroscopy, Donald L. Pavia, Gary M. Lampman, George S. Kriz, Thomson Brooks.
14. Spectrometric Identification of Organic Compounds, R. Silverstein, G.C Bassler and T.C. Morrill, John Wiley and Sons.
15. Organic Spectroscopy, William Kemp, W.H. Freeman & Company.
16. Organic Spectroscopy-Principles and Applications, Jagmohan, Narosa Publication.
17. Organic Spectroscopy, V.R. Dani, Tata McGraw Hill Publishing Co.
18. Spectroscopy of Organic Compounds, P.S. Kalsi, New Age International Ltd.
19. Organic Reaction Mechanisms, V.K. Ahluwalia, R.K. Parasher, Alpha Science International, 2011.
20. Reactions, Rearrangements and Reagents by S. N. Sanyal
21. Name Reactions, Jie Jack Li, Springer
22. Name Reactions and Reagents in Organic Synthesis, Bradford P. Mundy, M.G. Ellerd, and F.G. Favalaro, John Wiley & Sons.

Organic Chemistry Practical

Paper III

Course Code: PSC2CH3

Separation of Binary mixture using micro-scale technique

1. Separation of binary mixture using physical and chemical methods.
2. Characterization of one of the components with the help of chemical analysis and confirmation of the structure with the help of derivative preparation and its physical constant.
3. Purification and determination of mass and physical constant of the second component.

The following types are expected:

- (i) Water soluble/water insoluble solid and water insoluble solid,
- (ii) Non-volatile liquid-Non-volatile liquid (chemical separation)
- (iii) Water-insoluble solid-Non-volatile liquid.

Minimum three mixtures from each type and a total of ten mixtures are expected.

Reference:

1. Systematic Qualitative organic analysis, H. Middleton (Orient Longman)

2. A Handbook of Organic Analysis, H.T. Clark (Orient Longman)
3. Systematic Identification of organic compounds, R.L. Shriner (John Wiley, New York)
4. Practical Organic Chemistry by Mann and Saunders.
5. Advance Practical Organic Chemistry, N.K. Vishnoi, Vikas Publication

Paper IV

Analytical Chemistry: Course Code: PSC2CH4

[60 L]

Unit I

Chromatography [15 L]

1.1 Recapitulation of basic concepts in chromatography: Classification of chromatographic methods, requirements of an ideal detector, types of detectors in LC and GC, comparative account of detectors with reference to their applications (LC and GC respectively), qualitative and quantitative analysis.[2 L]

1.2 Concept of plate and rate theories in chromatography: efficiency, resolution, selectivity and separation capability. Van Deemter equation and broadening of chromatographic peaks. Optimization of chromatographic conditions.[5 L]

1.3 Gas Chromatography: Instrumentation of GC with special reference to sample injection systems – split/splitless, column types, solid/ liquid stationary phases, column switching techniques, temperature programming, Thermionic and mass spectrometric detector, Applications. [3 L]

1.4 High Performance Liquid Chromatography (HPLC): Normal phase and reversed phase with special reference to types of commercially available columns (Use of C8 and C18 columns). Diode array type and fluorescence detector, Applications of HPLC.Chiral and ion chromatography. [5 L]

Unit II

2.1 X-ray spectroscopy: principle, instrumentation and applications of X-ray fluorescence, absorption and diffraction spectroscopy. [4 L]

2.2 Mass spectrometry: recapitulation, instrumentation, ion sources for molecular studies, electron impact, field ionization, field absorption, chemical ionization and fast atom bombardment sources. Mass analyzers: Quadrupole, time of flight and ion trap. Applications.[6 L]

2.3 Radioanalytical Methods – recapitulation, isotope dilution method, introduction, principle, single dilution method, double dilution method and applications. [5 L]

Unit III

3.1 Surface Analytical Techniques – [9 L]

Introduction, Principle, Instrumentation and Applications of:

3.1.1 Scanning Electron Microscopy (SEM)

3.1.2 Scanning Tunneling Microscopy (STM)

3.1.3 Electron Spectroscopy (ESCA and Auger)

3.2 Atomic Spectroscopy [6 L]

3.2.1 Advantages and Limitations of AAS

3.2.2 Atomic Spectroscopy based on plasma sources – Introduction, Principle, Instrumentation and Applications.

Unit IV

Electroanalytical Methods (Numericals are Expected)

4.1 Ion selective potentiometry and Polarography: [10 L]

Ion selective electrodes and their applications (solid state, precipitate, liquid –liquid, enzyme and gas sensing electrodes), ion selective field effect transistors, biocatalytic membrane electrodes and enzyme based biosensors.

Polarography: Ilkovic equation, derivation starting with Cottrell equation, effect of complex formation on the polarographic waves.

4.2 Electrogravimetry: Introduction, principle, instrumentation, factors affecting the nature of the deposit, applications.[3 L]

4.3 Coulometry: Introduction, principle, instrumentation, coulometry at controlled potential and controlled current [2 L]

References:

Unit I

1. Instrumental Analysis, Skoog, Holler & Crouch

2 HPLC Practical and Industrial Applications, 2 nd Ed., Joel K. Swadesh, CRC Press

Unit II 1.Essentials of Nuclear Chemistry, H J Arnika, New Age Publishers (2005) 2. Fundamentals of Radiochemistry D. D. Sood , A. V. R. Reddy and N. Ramamoorthy 3. Principles of Instrumental Analysis - Skoog, Holler and Nieman, 5th Edition, Ch: 12 4. Principles of Instrumental Analysis - Skoog, Holler and Nieman, 5th Edition, Ch: 20

Unit III

1. Instrumental Analysis by Douglas A. Skoog - F. James Holler - Crouch, Publisher: Cengage; Edition, (2003), ISBN-10: 8131505421, ISBN-13: 978-8131505427
2. Physical Principles of Electron Microscopy, An Introduction to TEM, SEM, and AEM
3. Authors: Ray F. Egerton, ISBN: 978-0- 387-25800- 3 (Print) 978-0- 387-26016- 7 (Online)
4. Modern techniques of surface science by D.P. Woodruff, T.A. Delchar, Cambridge Univ. Press, 1994.
5. Introduction to Scanning Tunneling Microscopy by C. J. Chen, Oxford University Press, New York, 1993.
6. 5. Transmission Electron Microscopy: A text book for Material Science, David B Williams and C., Barry Carter, Springer
7. Modern Spectroscopy, by J.M. Hollas, 3rd Edition (1996), John Wiley, New York
8. Principles of Instrumental Analysis – Skoog, Holler, Nieman, 5th ed., Harcourt College Publishers, 1998.
9. Instrumental Analysis by Douglas A. Skoog - F. James Holler - Crouch, Publisher: Cengage; Edition (2003), ISBN10: 8131505421, ISBN-13: 978-8131505427

Unit IV

1. Principles of Instrumental Analysis – Skoog, Holler, Nieman, 5th Edition, Harcourt College Publishers, 1998. Chapters - 23, 24, 25.
2. Analytical Chemistry Principles – John H Kennedy, 2nd edition, Saunders College Publishing (1990).
3. Modern Analytical Chemistry David Harvey; McGraw Hill Higher education publishers, (2000).
4. Vogel's Text book of quantitative chemical analysis, 6th edition, Pearson Education Limited, (2007).
5. Electrochemical Methods Fundamentals and Applications, Allen J Bard and Larry R Faulkner, John Wiley and Sons, (1980).
6. Instrumental Methods of Analysis Willard, Merrit, Dean and Settle, 7th edition, CBS publishers.

Analytical Chemistry Practical

Paper IV

Course Code: **PSC2CH4**

1. To determine percentage purity of sodium carbonate in washing soda pH metrically.
2. To determine amount of Ti(III) and Fe(II) in a mixture by titration with Ce(IV) potentiometrically.
3. To determine the percentage purity of a sample (glycine/sodium benzoate/primary amine) by titration with perchloric acid in a non aqueous medium using glass calomel system potentiometrically.
4. To determine the amount of nitrite present in the given water sample colorimetrically.
5. To determine the amount of Fe(II) and Fe(III) in a mixture using 1,10-phenanthroline spectrophotometrically.
6. Simultaneous determination of Cr(VI) and Mn(VII) in a mixture spectrophotometrically.
7. To determine the percentage composition of HCl and H₂SO₄ on weight basis in a mixture of two by conductometric titration with NaOH and BaCl₂.
8. To determine amount of potassium in the given sample of fertilizers using flame photometer by standard addition method.

References

1. Quantitative Inorganic Analysis including Elementary Instrumental Analysis by A. I. Vogels, 3rd Ed. ELBS (1964)
2. Vogel's textbook of quantitative chemical analysis, Sixth Ed. Mendham, Denny, Barnes, Thomas, Pearson education
3. Standard methods of chemical analysis, F. J. Welcher
4. Standard Instrumental methods of Chemical Analysis, F. J. Welcher
5. W.W.Scott."Standard methods of Chemical Analysis",Vol.I, Van Nostrand Company, Inc.,1939.
6. E.B. Sandell and H.Onishi,"Spectrophotometric Determination of Traces of Metals", Part-II, 4th Ed.,A Wiley Interscience Publication, New York,1978

UNIVERSITY OF MUMBAI



Janardan Bhagat Shikshan Prasarak Sanstha's

Changu Kana Thakur

Arts, Commerce and Science College, New Panvel (Autonomous)

Re-accredited A⁺ Grade by NAAC

'College with Potential for Excellence' Status Awarded by UGC

'Best College Award' by University of Mumbai

Programme: M.Sc.

(Choice Based Credit System)

Course: Organic Chemistry

**Syllabus for Semester III and
IV**

~~(To be implemented from the Academic Year 2020-2021)~~

Janardan Bhagat Shikshan Prasarak Sanstha's

Changu Kana Thakur

Arts, Commerce and Science College, New Panvel (Autonomous)

Draft Syllabus

Syllabus for the M.Sc. Semester III and IV

Credit Based Semester and Grading System

To be implemented from the academic year 2020-2021

SEMESTER III

Course Code	Unit	Topics	Credits	L/Week
PSCHO 301	I	Organic Reaction Mechanisms	4	1
	II	Pericyclic Reactions		1
	III	Stereochemistry-I		1
	IV	Photochemistry		1
PSCHO 302	I	Name reactions with mechanism and application	4	1
	II	Radicals in Organic Synthesis		1
	III	Enamines, Ylides and α -C-H functionalization		1
	IV	Metals / Non-metals in organic synthesis		1
PSCHO 303	I	Natural products-I	4	1
	II	Natural products-II		1
	III	Advanced Spectroscopic Techniques-I		1
	IV	Advanced Spectroscopic Techniques -II		1
PSCHO EC-I 304	I	Drug discovery, design and development	4	1
	II	Drug design, development and synthesis		1
	III	Biogenesis and biosynthesis of natural products		1
	IV	Green chemistry		1
PSCHO EC-II 304	I	Drug discovery, design and development	4	1
	II	Drug design, development and synthesis		1
	III	Biogenesis and biosynthesis of natural products		1
	IV	Green chemistry		1
PSCHO 3P1	Practicals		4	8
PSCHO 3P2	Practicals		4	8

SEMESTER IV

Course Code	Unit	Topics	Credits	L/Week
PSCHO 401	I	Physical Organic Chemistry	4	1
	II	Supramolecular Chemistry		1
	III	Stereochemistry-II		1
	IV	Asymmetric Synthesis		1
PSCHO 402	I	Designing Organic Synthesis-I	4	1
	II	Designing Organic Synthesis-II		1
	III	Electro-organic chemistry and selected methods of organic synthesis		1
	IV	Transition and rare earth metals in organic synthesis		1
PSCHO 403	I	Natural products-III	4	1
	II	Natural products-IV		1
	III	Heterocyclic compounds-I		1
	IV	Heterocyclic compounds-II		1
PSCHO OC-I 404	I	Introduction to Intellectual Property	4	1
	II	Trade Secrets		1
	III	Introduction to Cheminformatics		1
	IV	Applications		1
PSCHO OC-II 404	I	Print	4	1
	II	Data Analysis		1
	III	Methods of scientific research and writing scientific papers		1
	IV	Chemical Safety & Ethical Handling of Chemicals		1
PSCHO 4P1	Practicals		4	8
PSCHO 4P2	Practicals		4	8

M. Sc. Organic Chemistry
Semester III
Course Code - PSCHO 301
Paper I- Theoretical Organic Chemistry-I

Unit 1	Organic Reaction Mechanisms	15 L
1.1	Organic reactive intermediates: Methods of generation, structure, stability and important reactions involving carbanions, carbocations, nitrenes, carbenes, arynes and ketenes.	7L
1.2	Neighbouring group participation: Mechanism and effects of anchimeric assistance, NGP by unshared/ lone pair electrons, π -electrons, aromatic rings, σ -bonds with special reference to norbornyl and bicyclo[2.2.2]octyl cation systems (formation of non-classical carbocation)	4L
1.3	Role of FMOs in organic reactivity: Reactions involving hard and soft electrophiles and nucleophiles.	1L
1.4	Pericyclic reactions: Recapitulation Explanations for Woodward-Hoffmann Rules <ul style="list-style-type: none"> • The Aromatic Transition structures [Huckel and Mobius] • Frontier Orbitals • Correlation Diagrams, FMO and PMO approach Molecular orbital symmetry, Frontier orbital of ethylene, 1,3-butadiene, 1,3,5-hexatriene and allyl system.	3L
Unit 2	Pericyclic reactions	15L
2.1	Cycloaddition reactions: Supra and antarafacial additions, $4n$ and $4n+2$ Systems. Diels-Alder reactions (Diene, Dienophile, FMO approach, stereochemistry, endo rule, Intramolecular Diels-Alder reactions, regioselectivity/effect of substituents, Trapping of reactive intermediates), retro-Diels-Alder reaction. 2+2 Cycloadditions: Photocycloadditions, Ketenes, 1,3-Dipolar cycloadditions and cheletropic reactions	7L
2.2	Electrocyclic reactions: Conrotatory and disrotatory motions, torquoselectivity, $(4n)$ π and $(4n+2)$ π electrons and allyl systems. Synthesis of endiandric acid A from an acyclic polyene.	3L
2.3	Sigmatropic rearrangements: H-shifts and C-shifts, supra and antarafacial migrations, Alder 'ene' Reaction, Cope (including oxy-Cope and aza-Cope), Claisen and Sommelet-Hauser rearrangements. Synthesis of Citral from 3-methylbut-2-en-1-ol and 3-methylbut-2-enal.	5L
Unit 3	Stereochemistry-I	15L
3.1	Conformational analysis of medium rings: Eight to ten membered rings and their unusual properties, I-strain, transannular reactions	3L
3.2	Stereochemistry of fused ring and bridged ring compounds: decalins, hydrindanes, perhydroanthracenes, steroids, and Bredt's rule.	5L
3.3	Anancomeric systems, Effect of conformation on reactivity of cyclohexane derivatives in the following reactions (including mechanism): electrophilic addition, elimination, molecular rearrangements, reduction of cyclohexanones (with LiAlH_4 , selectride and MPV reduction) and oxidation	5L

	of cyclohexanols.	
3.4	Stereospecific and Stereoselective reactions with specific examples	2L
Unit 4	Photochemistry	15L
4.1	Principles of Photochemistry: Recapitulation, Excited states and their properties, modes of dissipation of energy (Jablonski diagram), electronic energy transfer: photosensitization and quenching process, experimental set up for photochemical reactions.	3L
4.2	Photochemistry of carbonyl compounds: $\pi \rightarrow \pi^*$, $n \rightarrow \pi^*$ transitions, Norrish- I and Norrish-II cleavages, Paterno-Buchi reaction. Photoreduction, calculation of quantum yield, photochemistry of enones, photochemical rearrangements of α , β -unsaturated ketones and cyclohexadienones. Photo Fries rearrangement, Barton reaction.	7L
4.3	Photochemistry of olefins: cis-trans isomerizations, dimerizations, hydrogen abstraction, addition and Di- π - methane rearrangement including oxa- di- π --methane and aza-di- π --methane. Photochemical Cross-Coupling of Alkenes, Photodimerisation of alkenes.	3L
4.4	Photochemistry of arenes: 1, 2-, 1, 3- and 1, 4- additions. Photocycloadditions of aromatic Rings.	1L
4.5	Singlet oxygen and photo-oxygenation reactions. Photochemically induced Radical Reactions	1L

Course Code- PSCHO 302

Paper II - Synthetic Organic Chemistry -I

Unit 1	Name reactions with mechanism and application	15 L
1.1	Mukaiyama esterification, Mitsunobu reaction, Darzen's Glycidic Ester synthesis, Ritter reaction, Yamaguchi esterification, Peterson olefination.	5L
1.2	Domino reactions: Characteristics; Nazarov cyclization	3L
1.3	Multicomponent reactions: Strecker Synthesis, Ugi 4CC, Biginelli synthesis, Hantzsch synthesis, Pictet-Spengler synthesis	5L
1.4	Click Reactions: Characteristics; Huisgen 1,3-Dipolar Cycloaddition	2L
Unit 2	Radicals in organic synthesis	
2.1	Introduction: Generation, stability, reactivity and structural and stereochemical properties of free radicals, Persistent and charged radicals, Electrophilic and nucleophilic radicals.	3L
2.2	Radical Initiators: azobisisobutyronitrile (AIBN) and dibenzoyl peroxide.	1L
2.3	Characteristic reactions: Free radical substitution, addition to multiple bonds. Radical chain reactions, Radical halogenation of hydrocarbons (Regioselectivity), radical cyclizations, autoxidations: synthesis of cumene hydroperoxide from cumene.	4L
2.4	Radicals in synthesis: Inter and intra molecular C-C bond formation via mercuric hydride, tin hydride, thiol donors. Cleavage of C-X, C-Sn, C-Co, C-S, O-O bonds. Oxidative coupling, C-C bond formation in aromatics: $S_{RN}Ar$ reactions	4L
2.5	Hunsdiecker reaction, Pinacol coupling, McMurry coupling, Sandmeyer reaction, Acyloin condensation.	3L
Unit 3	Enamines, Ylides and α-C-H functionalization	15 L

3.1	Enamines: Generation & application in organic synthesis with mechanistic pathways, Stork enamine reaction. Reactivity, comparison between enamines and enolates. Synthetic reactions of enamines including asymmetric reactions of chiral enamines derived from chiral secondary amines.	4L
3.2	Phosphorus, Sulfur and Nitrogen Ylides: Preparation and their synthetic applications along with their stereochemical aspects. Wittig reaction, Horner-Wadsworth-Emmons Reaction, Barton-Kellogg olefination.	6L
3.3	α-C-H functionalization: By nitro, sulfoxide, sulfone and phosphonate groups: generation of carbanions by strong bases (LDA/n-butyl lithium) and applications in C-C bond formation. Bamford-Stevens reaction, Julia olefination and its modification, Seyferth–Gilbert homologation, Steven's rearrangement.	5L
Unit 4	Metals / Non-metals in organic synthesis	15L
4.1	Mercury in organic synthesis: Mechanism and regiochemistry of oxymercuration and demercuration of alkenes, mercuration of aromatics, transformation of aryl mercurials to aryl halides. Organomercurials as carbene transfer reagents.	3L
4.2	Organoboron compounds: Mechanism and regiochemistry of hydroboration of alkenes and alkynes, asymmetric hydroboration using chiral boron reagents, 9-BBN hydroboration, oxazaborolidine (CBS catalyst) and	3L

- functional group reduction by diborane.
- 4.3 Organosilicons:** Salient features of silicon governing the reactivity of organosilicons, preparation and important bond-forming reactions of alkyl silanes, alkenyl silanes, aryl silanes and allyl silanes. β -silyl cations as intermediates. Iodotrimethylsilane in organic synthesis. **3L**
- 4.4 Silyl enol ethers:** Application: As nucleophiles (Michael reaction, Mukaiyama aldol reaction), in ring contraction reactions. **2L**
- 4.5 Organotin compounds:** Preparation of alkenyl and allyl tin compounds; application in C-C bond formation, in replacement of halogen by H at the same C atom. **2L**
- 4.6 Selenium in organic synthesis:** Preparation of selenols/selenoxide, selenoxide elimination to create unsaturation, selenoxide and seleno acetals as α -C-H activating groups **2L**

Course code - PSCHO 303

Paper III- Natural products and Spectroscopy

Unit 1	Natural products-I	15 L
1.1	Carbohydrates: Introduction to naturally occurring sugars: Deoxysugars, aminosugars, branched sugars. Structure elucidation of lactose and D-glucosamine (synthesis not expected). Structural features and applications of inositol, starch, cellulose, chitin and heparin.	5L
1.2	Natural pigments: General structural features, occurrence, biological importance and applications of: carotenoids, anthocyanins, quinones, flavones, pterins and porphyrins (chlorophyll). Structure elucidation of β -carotene and Cyanin (with synthesis). Synthesis of ubiquinone from 3, 4, 5-trimethoxy methyl benzoate. Synthesis of cinerolone, jasmolone, allethrolone	5L
1.3	Terpenoids: Occurrence, classification, structure elucidation, Stereochemistry, spectral data and synthesis of zingiberene. Synthesis of cinerolone, jasmolone, allethrolone	3L
1.4	Alkaloids: Occurrence and physiological importance of morphine and atropine. Structure elucidation, spectral data and synthesis of coniine.	2L
Unit 2	Natural products-II	15L
2.1	Multi-step synthesis of natural products: Synthesis of the following natural products with special reference to reagents used, stereochemistry and functional group transformations: <ul style="list-style-type: none"> a) Woodward synthesis of Reserpine from benzoquinone b) Corey synthesis of Longifolene from resorcinol c) Gilbert-Stork synthesis of Griseofulvin from phloroglucinol d) Corey's Synthesis of Caryophyllene from 2-Cyclohexenone and Isobutylene e) Synthesis of Juvabione from Limonene f) Woodward synthesis of Strychnine 	10L
2.2	Prostaglandins: Classification, general structure and biological importance. Structure elucidation of PGE ₁ .	2L
2.3	Insect Growth Regulators: General idea, structures of JH ₂ and JH ₃ .	1L
2.4	Plant Growth Regulators: Structural features and applications of arylacetic acids, gibberellic acids and triacontanol. Synthesis of triacontanol (synthesis of stearyl magnesium bromide and 12-bromo-1-tetrahydropyranyloxydodecane expected)	2L
Unit 3	Advanced Spectroscopic Techniques-I	15 L

3.1	Proton NMR spectroscopy: Recapitulation, chemical and magnetic equivalence of protons, First order, second order, Spin system notations (A ₂ , AB, AX, AB ₂ , AX ₂ , AMX and A ₂ B ₂ -A ₂ X ₂ spin systems with suitable examples). Long range coupling (Allylic coupling, 'W' coupling and Coupling in aromatic and heteroaromatic systems), Temperature effects, Simplification of complex spectra, nuclear magnetic double resonance, chemical shift reagents.	7L
3.2	¹³C-NMR spectroscopy: Recapitulation, equivalent and non-equivalent carbons (examples of aliphatic and aromatic compounds), ¹³ C- chemical shifts, calculation of ¹³ C- chemical shifts of aromatic carbons, heteronuclear coupling of carbon to ¹⁹ F and ³¹ P.	4L

3.3	Spectral problems based on UV, IR, ^1H NMR and ^{13}C NMR and Mass Spectroscopy.	4L
Unit 4	Advanced Spectroscopic Techniques-II	15L
4.1	Advanced NMR techniques: DEPT experiment, determining number of Attached hydrogens (methyl/methylene/methine and quaternary carbons), two dimensional spectroscopic techniques, COSY and HETCOR spectra, NOE and NOESY techniques.	10L
4.2	Spectral problems based on UV, IR, ^1H NMR, ^{13}C NMR (Including 2D technique) and Mass spectroscopy	5L

Course code - PSCHO EC-I 304
Paper IV- Medicinal, Biogenesis and Green Chemistry

Unit 1	Drug discovery, design and development	15 L
1.1	Introduction, important terms used in medicinal chemistry: receptor, therapeutic index, bioavailability, drug assay and drug potency. General idea of factors affecting bioactivity: Resonance, inductive effect, bioisosterism, spatial considerations. Basic pharmacokinetics: drug absorption, distribution, metabolism (biotransformation) and elimination. Physical and chemical parameters like solubility, lipophilicity, ionization, pH, redox potential, H-bonding, partition coefficient and isomerism in drug distribution and drug-receptor binding.	7L
1.2	Procedures in drug design: Drug discovery without a lead: Penicillin, Librium. Lead discovery: random screening, non-random (or targeted) screening. Lead modification: Identification of the pharmacophore, Functional group modification. Structure-activity relationship, Structure modification to increase potency and therapeutic index: Homologation, chain branching, ring-chain transformation, bioisosterism, combinatorial synthesis (basic idea).	8L
Unit 2	Drug design, development and synthesis	15L
2.1	Introduction to quantitative structure activity relationship studies. QSAR parameters: - steric effects: The Taft and other equations; Methods used to correlate regression parameters with biological activity: Hansch analysis- A linear multiple regression analysis	5L
2.2	Introduction to modern methods of drug design and synthesis- computer aided molecular graphics based drug design, drug design via enzyme inhibition (reversible and irreversible), bioinformatics and drug design.	3L
2.3	Concept of prodrugs and soft drugs. (a) Prodrugs: Prodrug design, types of prodrugs, functional groups in prodrugs, advantages of prodrug use. (b) Soft Drugs: concept and properties. remdesivir and hydroxychloroquine	3L
2.4	Synthesis and application of the following drugs: Fluoxetine, cetirizine, esomeprazole, fluconazole, zidovudine, methotrexate, diclofenac, labetalol and Favipiravir Remdesivir: Structure and applications	4L
Unit 3	Biogenesis and biosynthesis of natural products	15 L
3.1	Primary and secondary metabolites and the building blocks, general pathway of amino acid biosynthesis.	3L
3.2	Acetate pathway: Biosynthesis of malonylCoA, saturated fatty acids, prostaglandins from arachidonic acid, aromatic polyketides	4L
3.3	Shikimic Acid pathway: Biosynthesis of shikimic acid, aromatic amino acids, cinnamic acid and its derivatives, lignin and lignans, benzoic acid and its derivatives, flavonoids and isoflavonoids.	4L
3.4	Mevalonate pathway: Biosynthesis of mevalonic acid, monoterpenes-geranyl cation and its derivatives, sesquiterpenes-farnesyl cation and its derivatives and diterpenes.	4L
Unit 4	Green chemistry	15L
4.1	Introduction, basic principles of green chemistry. Designing a green synthesis: Green starting materials, green reagents, green solvents and	1L

	reaction conditions, green catalysts.	
4.2	Use of the following in green synthesis with suitable examples:	9L
	a) Green reagents: dimethylcarbonate, polymer supported reagents.	
	b) Green catalysts: Acid catalysts, oxidation catalysts, basic catalysts, phase transfer catalysts [Aliquat 336, benzyltrimethyl ammonium chloride (TMBA), Tetra-n-butyl ammonium chloride, crown ethers], biocatalysts.	
	c) Green solvents: water, ionic liquids, deep eutectic solvents, supercritical carbon dioxide.	
	d) Solid state reactions: solid phase synthesis, solid supported synthesis	
	e) Microwave assisted synthesis: reactions in water, reactions in organic solvents, solvent free reactions.	
	f) Ultrasound assisted reactions.	
4.3	Comparison of traditional processes versus green processes in the syntheses of ibuprofen, adipic acid, 4-aminodiphenylamine, p-bromotoluene and benzimidazole.	3L
4.4	Green Catalysts: Nanocatalyst, Types of nanocatalysts, Advantages and Disadvantages of Nanocatalysts, Idea of Magnetically separable nanocatalysts.	2L

Course code - PSCHO EC-II 304

Paper IV- Bioorganic Chemistry

Unit 1	Biomolecules-I	15 L
1.1	Amino acids, peptides and proteins: Chemical and enzymatic hydrolysis of proteins to peptides, amino acid sequencing. Secondary structure of proteins, forces responsible for holding of secondary structures, α - helix, β -sheets, super secondary structure. Tertiary structure of protein: folding and domain structure. Quaternary structure.	2L
1.2	Nucleic acids: Structure and function of physiologically important nucleotides (c-AMP, ADP, ATP) and nucleic acids (DNA and RNA), replication, genetic code, protein biosynthesis, mutation	3L
1.3	Structure: Purine & pyrimidine bases, ribose, deoxyribose, nucleosides and nucleotides (ATP, CTP, GTP, TTP, UTP) formation of polynucleotides strand with its shorthand representation.	3L
1.4	RNAs (various types in prokaryotes and eukaryotes) m- RNA and r- RNA— general account, t- RNA-clover leaf model, Ribozymes.	2L
1.5	DNA: Physical properties – Effect of heat on physical properties of DNA (Viscosity, buoyant density and UV absorption), Hypochromism, Hyperchromism and Denaturation of DNA. Reactions of nucleic acids (with DPA and Orcinol).	2L
1.6	Chemical synthesis of oligonucleotides: Phosphodiester, Phosphotriester, Phosphoramidite and H- phosphonate methods including solid phase approach	3L
Unit 2	Biomolecules-II	15L
2.1	Chemistry of enzymes: Introduction, nomenclature, classes and general types of reactions catalyzed by enzymes. Properties of enzymes: a) enzyme efficiency/ catalytic power b) enzyme specificity; Fischer's 'lock and key'	6L

	and Koshland 'induced fit' hypothesis. Concept and identification of active site.	
2.2	Factors affecting enzyme kinetics: Substrate concentration, enzyme concentration, temperature, pH, product concentration etc. Reversible and Irreversible inhibition.	4L
2.3	Mechanism of enzyme action: transition-state theory, orientation and steric effect, acid-base catalysis, covalent catalysis, strain or distortion. Mechanism of chymotrypsin catalyzed hydrolysis of a peptide bond	5L
Unit 3	Biomolecules - III	15 L
3.1	Chemistry of coenzymes. Structure, mechanism of action and bio-modeling studies of the following coenzymes: nicotinamide adenine dinucleotide, flavin adenine dinucleotide, thiamine pyrophosphate, pyridoxal phosphate, Vitamin B12, biotin, lipoic acid, Coenzyme A.	12L
3.2	Oxidative phosphorylation, chemiosmosis, rotary model for ATP synthesis and role of cytochrome in oxygen activation.	3L
Unit 4	Biomolecules – IV	15L
4.1	Role of main enzymes involved in the synthesis and breakdown of glycogen.	2L
4.2	Enzyme catalyzed organic reactions: Hydrolysis, hydroxylation, oxidation and reduction.	6L
4.3	Enzymes in organic synthesis. Fermentation: Production of drugs/drug intermediates by fermentation. Production of chiral hydroxy acids, vitamins, amino acids, β -lactam antibiotics. Synthesis of chemicals via microbial transformation, synthesis of L-ephedrine. Chemical processes with isolated enzymes in free form (hydrocyanation of mphenoxybenzaldehyde) and immobilized form (production of 6-aminopenicillanic acid).	7L

Semester III: Practicals

Course code: PSCHO3P1

Separation of a ternary mixture of organic compounds and identification including derivative preparations using micro-scale technique (Minimum 8 experiments)

1. Separation of a ternary mixture (S-S-S, S-S-L, S-L-L and L-L-L) (for solid mixture: water insoluble/ soluble including carbohydrates) based upon differences in the physical and the chemical properties of the components.
2. Identification of the two components (indicated by the examiner) using micro-scale technique.
3. Preparation of derivatives (any one of separated compound).

Course code: PSCHO3P2

Single step organic preparation (1.0 g scale) involving purification by Steam distillation / Vacuum distillation or Column chromatography (Minimum 8 experiments)

1. Preparation of acetanilide from aniline and acetic acid using Zn dust. (Purification by column chromatography)
2. Preparation of 1-nitronaphthalene from naphthalene. (Purification by steam distillation)
3. Preparation of acetyl ferrocene from ferrocene. (Purification by column

chromatography)

4. Preparation of 3-nitroaniline from 1,3-dinitrobenzene. (Purification by column chromatography)
5. Preparation of benzyl alcohol from benzaldehyde. (Purification by vacuum distillation).
6. Preparation of methyl salicylate from salicylic acid. (Purification by vacuum distillation).
7. Preparation of 4-methylacetophenone from toluene. (Purification by vacuum distillation).
8. Preparation of phenyl acetate from phenol. (Purification by vacuum distillation)
9. Preparation of 2-chlorotoluene from *o*-toluidine. (Purification by steam distillation)
10. Preparation of fluorenone from fluorene. (Purification by column chromatography)
11. Preparation of dimethylphthalate from phthalic anhydride. (Purification by vacuum distillation)

Semester IV
Course Code - PSCHO 401
Paper I- Theoretical Organic Chemistry-II

Unit 1	Physical Organic Chemistry	15 L
1.1	Structural effects and reactivity: Linear free energy relationship (LFER) in determination of organic reaction mechanism: The Hammett equation, Substituent constant (σ) and σ values, Reaction constants (ρ), reactions with positive and negative ρ values, Nonlinear Hammett plots (concave upwards and downwards deviations)	9L
1.2	Uses of Hammett equation, deviations from Hammett equation. Dual parameter correlations, Inductive substituent constants, Calculation of k values, Taft equation, Solvent effects, Grunwald-Winstein equation, Dimroth's ET parameter, Spectroscopic correlations, Thermodynamic implications.	6L
Unit 2	Supramolecular chemistry	15L
2.1	Principles of molecular associations and organizations as exemplified in biological macromolecules like nucleic acids, proteins and enzymes.	3L
2.2	Synthetic molecular receptors: receptors with molecular cleft, molecular, tweezers, receptors with multiple hydrogen sites.	3L
2.3	Structures and properties of crown ethers, cryptands, cyclophanes, calixarenes, rotaxanes and cyclodextrins. Synthesis of crown ethers, cryptands and calixarenes	5L
2.4	Molecular recognition and catalysis, molecular selfassembly. Supramolecular Polymers, Gels and Fibres.	4L
Unit 3	Stereochemistry- II	15L
3.1	Racemization and resolution of racemates including conglomerates: Mechanism of racemization, methods of resolution: mechanical, chemical, kinetic and equilibrium asymmetric transformation and through inclusion compounds with stereospecific reactions.	3L
3.2	Determination of enantiomer and diastereomer composition: enzymatic method, chromatographic methods. Methods based on NMR spectroscopy: use of chiral derivatising agents (CDA), chiral solvating agents (CSA) and Lanthanide shift reagents (LSR).	3L
3.3	Correlative method for configurational assignment: chemical, optical rotation, and NMR spectroscopy.	4L
3.4	Molecular dissymmetry and chiroptical properties: Linearly and circularly polarized light. Circular birefringence and circular dichroism. ORD and CD curves. Cotton effect and its applications. The octant rule and the axial α -haloketone rule with applications.	5L
Unit 4	Asymmetric Synthesis	15L
4.1	Principles of asymmetric synthesis: Introduction, the chiral pool in Nature, methods of asymmetric induction – substrate, reagent and catalyst controlled reactions	3L
4.2	Synthesis of L-DOPA [Knowles's Monsanto process]. Asymmetric reactions with mechanism: Aldol and related reactions, Cram's rule, Felkin-Anh model, Sharpless enantioselective epoxidation, hydroxylation,	9L

	aminohydroxylation, Diels-Alder reaction, reduction of prochiral carbonyl compounds and olefins.	
4.3	Use of chiral auxiliaries in diastereoselective reductions, asymmetric amplification. Use of chiral BINOLs, BINAPs and chiral oxazolines asymmetric transformations	3L

Course Code- PSCHO 402

Paper II- Synthetic Organic Chemistry-II

Unit 1	Designing Organic Synthesis-I	15 L
1.1	Protecting groups in Organic Synthesis: Protection and deprotection of the hydroxyl, carbonyl, amino and carboxyl functional groups and its applications.	3L
1.2	Concept of umpolung (Reversal of polarity): Generation of acyl anion equivalent using 1,3-dithianes, methyl thiomethyl sulfoxides, cyanide ions, cyanohydrin ethers, nitro compounds and vinylated ethers.	3L
1.3	Introduction to Retrosynthetic analysis and synthetic planning: Linear and convergent synthesis; Disconnection approach: An introduction to synthons, synthetic equivalents, disconnection approach, functional group interconversions (FGI), functional group addition (FGA), functional group removal (FGR) importance of order of events in organic synthesis, one and two group C-X disconnections (1,1; 1,2; 1,3 difunctionalized compounds), selective organic transformations: chemoselectivity, regioselectivity, stereoselectivity, enantioselectivity	9L

Unit 2	Designing Organic Synthesis-II	15L
2.1	General strategy: choosing a disconnection-simplification, symmetry, high yielding steps, and recognisable starting material.	3L
2.2	One group C-C Disconnections: Alcohols (including stereoselectivity), carbonyls (including regioselectivity), Alkene synthesis, use of acetylenes and aliphatic nitro compounds in organic synthesis.	6L
2.3	Two group C-C Disconnections: 1,2- 1,3- 1,4- 1,5- and 1,6-difunctionalized compounds, Diels-Alder reactions, α , β -unsaturated compounds, control in carbonyl condensations, Michael addition and Robinson annelation.	6L
Unit 3	Electro-organic chemistry and Selected methods of Organic synthesis	15L
3.1	Electro-organic chemistry: Introduction: Electrode potential, cell parameters, electrolyte, working electrode, choice of solvents, supporting electrolytes. Cathodic reduction: Reduction of alkyl halides, aldehydes, ketones, nitro compounds, olefins, arenes, electro-dimerization. Anodic oxidation: Oxidation of alkylbenzene, Kolbe reaction, Non-Kolbe oxidation, Shono Oxidation	7L
3.2	Selected Methods of Organic synthesis Applications of the following in organic synthesis: <ul style="list-style-type: none"> <input type="checkbox"/> Crown ethers, cryptands, micelles, cyclodextrins, catenanes. <input type="checkbox"/> Organocatalysts: Proline, Imidazolidinone. <input type="checkbox"/> Pd catalysed cycloaddition reactions: Stille reaction, Saegusa-Ito oxidation to enones, Negishi coupling. <input type="checkbox"/> Use of Sc(OTf)₃ and Yb(OTf)₃ as water tolerant Lewis acid catalyst in aldol condensation, Michael reaction, Diels-Alder reaction, Friedel – Crafts reaction. 	8L
Unit 4	Transition and rare earth metals in organic synthesis	15L
4.1	Introduction to basic concepts: 18 electron rule, bonding in transition metal complexes, C-H activation, oxidative addition, reductive elimination, migratory insertion.	3L
4.2	Palladium in organic synthesis: π -bonding of Pd with olefins, applications in C-C bond formation, carbonylation, alkene isomerisation, cross-coupling of organometallics and halides. Representative examples: Heck reaction, Suzuki-Miyaura coupling, Sonogashira reaction and Wacker oxidation. Heteroatom coupling for bond formation between aryl/vinyl groups and N, S, or P atoms.	5L
4.3	Olefin metathesis using Grubb's catalyst.	1L
4.4	Application of Ni, Co, Fe, Rh, and Cr carbonyls in organic synthesis.	4L
4.5	Application of samarium iodide including reduction of organic halides, aldehydes and ketones, α -functionalised carbonyl and nitro compounds.	1L
4.6	Application of Ce (IV) in synthesis of heterocyclic quinoxaline derivatives and its role as a de-protecting agent.	1L

Course Code- PSCHO 403

Paper II- Natural products and Heterocyclic Chemistry

Unit 1	Natural products-III	15 L
1.1	Steroids: General structure, classification. Occurrence, biological role, important structural and stereochemical features of the following: corticosteroids, steroidal hormones, steroidal alkaloids, sterols and bile acids.	5L
1.2	Synthesis of 16-DPA from cholesterol and plant sapogenin.	2L
1.3	Synthesis of the following from 16-DPA: androsterone, testosterone, oestrone, oestriol, oestradiol and progesterone.	5L
1.4	Insect pheromones: General structural features and importance. Types of pheromones (aggregation, alarm, releaser, primer, territorial, trail, sex pheromones etc.), advantage of pheromones over conventional pesticides. Synthesis of bombykol from acetylene, disparlure from 6-methylhept-1-ene, grandisol from 2-methyl-1, 3-butadiene.	3L

Unit 2	Natural products-IV	15L
2.1	Vitamins: Classification, sources and biological importance of vitamin B ₁ , B ₂ , B ₆ , folic acid, B ₁₂ , C, D ₁ , E (α -tocopherol), K ₁ , K ₂ , H (β - biotin). Synthesis of the following: Vitamin A from β -ionone and bromoester moiety. Vitamin B ₁ including synthesis of pyrimidine and thiazole moieties Vitamin B ₂ from 3, 4-dimethylaniline and D(-) ribose Vitamin B ₆ from: 1) ethoxyacetylacetone and cyanoacetamide, 2) ethyl ester of N-formyl-DL-alanine (Harris synthesis) Vitamin E (α -tocopherol) from trimethylquinol and phytol bromide Vitamin K ₁ from 2-methyl-1, 4-naphthaquinone and phytol	6L
2.2	Antibiotics: Classification on the basis of activity. Structure elucidation, spectral data of penicillin-G and chloramphenicol. Synthesis of chloramphenicol (from benzaldehyde and β -nitroethanol) penicillin-G and phenoxymethylpenicillin from D-penicillamine and t-butyl phthalimide malonaldehyde (synthesis of D-penicillamine and t-butyl phthalimide malonaldehyde expected).	6L
2.3	Naturally occurring insecticides: Sources, structure and biological properties of pyrethrums (pyrethrin I), rotenoids (rotenone). Synthesis of pyrethrin I.	2L
2.4	Synthesis of exaltone and muscone.	1L
Unit 3	Heterocyclic compounds-I	15L
3.1	Heterocyclic compounds: Introduction, classification, Nomenclature of heterocyclic compounds of monocyclic (3-6 membered) (Common, systematic (Hantzsch-Widman) and replacement nomenclature)	3L
3.2	Structure and nucleophilic ring opening reactions of aziridines, oxiranes, oxetanes and azetidines	2L
3.3	Structure, reactivity, synthesis and reactions of pyridine, pyridine N-oxide, pyridazine, pyrimidine, pyrazine, pyrrole, pyrazoles, Imidazoles, thizoles and oxazoles	10L
Unit 4	Heterocyclic compounds-II	15L
4.1	Nomenclature of heterocyclic compounds of bicyclic/tricyclic (5-6 Membered) fused heterocycles (up to three hetero atoms). (Common, systematic (Hantzsch-Widman) and replacement nomenclature)	3L
4.2	Structure, reactivity, synthesis and reactions of quinoline, isoquinoline, indole, coumarines, purines, benzimidazoles, benzthiazoles, quinoxaline, cinnoline and quinazoline	12 L

Course Code- PSCHO OC-I 404

Paper IV- Intellectual Property Rights & Cheminformatics

Unit 1		15 L
1.1	Introduction to Intellectual Property: Historical Perspective, Different types of IP, Importance of protecting IP.	2L
1.2	Patents: Historical Perspective, Basic and associated right, WIPO, PCT system, Traditional Knowledge, Patents and Health care-balancing promoting innovation with public health, Software patents and their importance for India.	5L

1.3	Industrial Designs: Definition, How to obtain, features, International design registration.	2L
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1.4	Copyrights: Introduction, How to obtain, Differences from Patents.	2L
1.5	Trade Marks: Introduction, How to obtain, Different types of marks—Collective marks, certification marks, service marks, trade names etc.	2L
1.6	Geographical Indications: Definition, rules for registration, prevention of illegal exploitation, importance to India.	2L
Unit 2		15L
2.1	Trade Secrets: Introduction and Historical Perspectives, Scope of Protection, Risks involved and legal aspects of Trade Secret Protection.	2L
2.2	IP Infringement issue and enforcement: Role of Judiciary, Role of law enforcement agencies-Police, Customs etc.	2L
2.3	Economic Value of Intellectual Property: Intangible assests and their valuation, Intellectual Property in the Indian context – Various Laws in India Licensing and Technology transfer.	5L
2.4	Different International agreements:	6L
	a. World Trade Organization (WTO): <ol style="list-style-type: none"> 1. General Agreement on Tariffs and Trade (GATT), Trade Related Intellectual Property Rights (TRIPS) agreement 2. General Agreement on Trade Related Services (GATS) Madrid Protocol. 3. Berne Convention 4. Budapest Treaty 	
	b. Paris Convention WIPO and TRIPS, IPR and Plant Breeders Rights, IPR and Biodiversity.	
Unit 3		15L
3.1	Introduction to Cheminformatics: History and evolution of cheminformatics, Use of Cheminformatics, Prospects of cheminformatics, Molecular modeling and structure elucidation.	5L
3.2	Representation of molecules and chemical reactions: Nomenclature, Different types of notations, SMILES coding, Matrix representations, Structure of Molfiles and Sdfiles, Libraries and toolkits, Different electronic effects, Reaction classification.	5L
3.3	Searching Chemical Structures: Full structure search, sub-structure search, basic ideas, similarity search, three dimensional search methods, basics of computation of physical and chemical data and structure descriptors, data visualization.	5L
Unit 4	Applications:	15L
	Prediction of Properties of Compound, Linear Free Energy Relations, Quantitative Structure – Property Relations, Descriptor Analysis, Model Building, Modeling Toxicity, Structure – Spectra correlations, Prediction NMR, IR and Mass spectra, Computer Assisted Structure elucidations, Computer assisted Synthesis Design, Introduction to drug design, Target Identification and Validation, Lead Finding and Optimization, analysis of HTS data, Virtual Screening, Design of Combinatorial Libraries, Ligand based and Structure based Drug design, Application of Cheminformatics in Drug Design.	

Course Code- PSCHO OC-II 404
Paper IV- Research Methodology

Unit 1		15 L
1.1	Print: Primary, Secondary and Tertiary sources. Journals: Journal abbreviations, abstracts, current titles, reviews, monographs, dictionaries, text-books, current contents, Introduction to Chemical Abstracts and Beilstein, Subject Index, Substance Index, Author Index, Formula Index, and other Indices with examples.	5L
1.2	Digital: Web sources, E-journals, Journal access, TOC alerts, Hot articles, Citation Index, Impact factor, H-index, E-consortium, UGC infonet, E-books, Internet discussion groups and communities, Blogs, preprint servers, Search engines, Scirus, Google Scholar, ChemIndustry, Wiki-databases, ChemSpider, Science Direct, SciFinder, Scopus.	5L
1.3	Information Technology and Library Resources: The Internet and World wide web, Internet resources for Chemistry, finding and citing published information.	5L
Unit 2	DATA ANALYSIS The Investigative Approach: Making and recording Measurements, SI units and their use, Scientific methods and design of experiments. Analysis and Presentation of Data: Descriptive statistics, choosing and using statistical tests, Chemometrics, Analysis of Variance (ANOVA), Correlation and regression, curve fitting, fitting of linear equations, simple linear cases, weighted linear case, analysis of residuals, general polynomial fitting, linearizing transformations, exponential function fit, r and its abuse, basic aspects of multiple linear regression analysis	15L
Unit 3	METHODS OF SCIENTIFIC RESEARCH AND WRITING 3.1 SCIENTIFIC PAPERS: Reporting practical and project work, Writing literature surveys and reviews, organizing a poster display, giving an oral presentation. 3.2 Writing Scientific Papers: Justification for scientific contributions, bibliography, description of methods, conclusions, the need for illustration, style, publications of scientific work, writing ethics, avoiding plagiarism	15L
Unit 4	CHEMICAL SAFETY & ETHICAL HANDLING OF CHEMICALS Safe working procedure and protective environment, protective apparel, emergency procedure, first aid, laboratory ventilation, safe storage and use of hazardous chemicals, procedure for working with substances that pose hazards, flammable or explosive hazards, procedures for working with gases at pressures above or below atmospheric pressure, safe storage and disposal of waste chemicals, recovery, recycling and reuse of laboratory	15L

chemicals, procedure for laboratory disposal of explosives, identification, verification and segregation of laboratory waste, disposal of chemicals in the sanitary sewer system, incineration and transportation of hazardous chemicals.

Semester IV: Practicals

Course code: PSCHO 4P1

Two steps preparations (Minimum 8 experiments)

1. Acetophenone → Acetophenone phenyl hydrazine → 2-phenyl indole.
2. 2-naphthol → 1-phenyl azo-2-naphthol → 1-amino-2-naphthol.
3. Cyclohexanone → cyclohexanone oxime → Caprolactum.
4. Hydroquinone → hydroquinone diacetate → 2,5-dihydroxyacetophenone.
5. 4-nitrotoluene → 4-nitrobenzoic acid → 4-aminobenzoic acid.
6. *o*-nitroaniline → *o*-phenylene diamine → Benzimidazole.
7. Benzophenone → benzophenone oxime → benzanilide.
8. *o*-chlorobenzoic acid → N-phenyl anthranilic acid → acridone.
9. Benzoin → benzil → benzilic acid.
10. Phthalic acid → phthalimide → anthranilic acid.
11. Resorcinol → 4-methyl-7-hydroxy coumarin → 4-methyl-7-acetoxy Coumarin
12. Anthracene → anthraquinone → anthrone

Course code: PSCHO 4P2

Session-I:

Combined spectral identification: Interpretation of spectral data of organic compounds (UV, IR, PMR, CMR and Mass spectra).

A student will be given UV, IR, PMR, CMR, and Mass spectra of a compound from which preliminary information should be reported within first half an hour of the examination without referring to any book/reference material. The complete structure of the compound may then be elucidated by referring to any standard text-book/reference material etc
(Minimum 8 spectral analysis)

Session-II: Project evaluation



Janardan Bhagat Shikshan Prasarak Sanstha's
CHANGU KANA THAKUR
ARTS, COMMERCE & SCIENCE COLLEGE,
NEW PANVEL (AUTONOMOUS)
Re-accredited 'A⁺' Grade by NAAC
'College with Potential for Excellence' Status Awarded by UGC
'Best College Award' by University of Mumbai

Programme: M.Sc.
Course: M.Sc.-II
Analytical Chemistry
Choice Based Credit, Grading and Semester System (60:40)
w.e.f. Academic Year 2020-2021

M. Sc. Analytical Chemistry

For the subject of analytical chemistry there shall be four papers for 60 lectures each comprising of four units of 15 L each.

Semester-III

1. Paper-I / Quality in Analytical Chemistry
2. Paper-II / Advanced Instrumental Techniques
3. Paper- III / Bio-analytical Chemistry and Food Analysis
4. Paper- IV (Elective course-1)/ Environmental and Certain Industrially Important Materials
(Elective course-2)/ Pharmaceutical and Organic Analysis

Semester-II

1. Paper-I / Quality in Analytical Chemistry
2. Paper-II / Advanced Instrumental Techniques
3. Paper- III/ Selected Topics in Analytical Chemistry
4. Paper- IV (Optional course-1)/ Intellectual Property Rights & Cheminformatics
(Optional course-2)/ Research Methodology

Choice Based Credit ,Grading and Semester System (CBCGS)
To be implemented from the Academic year 2020-2021

M.Sc.-II Analytical Chemistry
Semester- III

Course Code	Unit	Topics	Credits	L / Week
PSC3QAC	I	Quality in Analytical Chemistry-I	4	1
	II	Quality in Analytical Chemistry-II		1
	III	Chromatographic Techniques-I		1
	IV	Chromatographic Techniques-II		1
PSC3AIT	I	Spectral Methods -I	4	1
	II	Spectral Methods -II		1
	III	Electroanalytical Methods		1
	IV	Miscellaneous Techniques		1
PSC3BCF	I	Bio-analytical Chemistry	4	1
	II	Immunological Methods		1
	III	Food analysis-I		1
	IV	Food analysis-II		1
PSC3ENC	I	Air Pollution	4	1
	II	Water Quality Standards		1
	III	Other Types of Pollution		1
	IV	Industrial Materials		1
PSC3POA	I	Pharmaceutical Analysis	4	1
	II	Drugs		1
	III	Forensic Analysis		1
	IV	Cosmetics Analysis		1
PSC3QAP PSC3AIP PSC3BCP PSC3ENP/ PSC3POP	-	Practical Course	8	16

Choice Based Credit ,Grading and Semester System (CBCGS)
To be implemented from the Academic year 2020-2021
M.Sc.-II Analytical Chemistry
Semester- IV

Course Code	Unit	Topics	Credits	L / Week
PSC4QAC	I	Separation Science	4	1
	II	Separation, Analysis and Standardization of Herbal based products		1
	III	Green Chemistry		1
	IV	Advanced Techniques		1
PSC4AIT	I	Spectral Methods -III	4	1
	II	Spectral Methods -IV		1
	III	Radiochemical and Thermal Methods		1
	IV	Hyphenated Techniques		1
PSC4STA	I	Effluent Treatment	4	1
	II	Solid Waste Management		1
	III	Plastics and Polymers		1
	IV	Metallurgy		1
PSC4IPR	I	Introduction to Intellectual Property Rights-I	4	1
	II	Introduction to Intellectual Property Rights-II		1
	III	Introduction to Chemoinformatics		1
	IV	Application of Chemoinformatics		1
PSC4REM	I	Resources	4	1
	II	Data Analysis		1
	III	Methods of Scientific Research and Writing		1
	IV	Chemical Safety and Ethical Handling of Chemicals		1
PSC4QAP PSC4AIP PSC4STP	-	Practical Course	8	16
PSC4IPP/ PSC3REP		Project Evaluation / Industrial Internship		

Choice Based Credit, Grading and Semester System (CBCGS)
(To be implemented from the Academic year 2020-2021)

	M.Sc. ANALYTICAL CHEMISTRY SEMESTER – III PSC3QAC Quality in Analytical Chemistry	
UNIT 1	Quality In Analytical Chemistry - I	
	<p>1.1 Sampling: Definition, types of sample, sampling plan, quality of sample, subsampling, Sampling of raw materials, intermediates and finished products. Sample preparations – dissolution technology and decomposition, storage of samples. Pre-treatment of samples: soil, food and cosmetics. (8L)</p> <p>1.2 Selection of the Method: sources of methods, factors to consider when selecting a method, performance criteria for methods used, reasons for incorrect analytical results, method validation, and quality by design (PAT). (7L)</p>	
UNIT II	Quality In Analytical Chemistry - II	15
	<p>2.1 Measurement of uncertainty: Definition and evaluation of uncertainty, putting uncertainty to use, interpretation of results and improving the quality of results. (4L)</p> <p>2.2 Signal to noise: Signal to noise ratio, sources of noise in instrumental analysis. Signal to noise enhancement, hardware devices for noise reduction, software methods for noise reduction. (6L)</p> <p>2.3 Pharmaceutical Legislation: introduction to drug acts, drug rules (schedules), concept of regulatory affairs in pharmaceuticals, review of GLP and GMP and their regulations for analytical labs, roles and responsibilities of personnel, appropriate design and placement of laboratory equipment, requirements for maintenance and calibration. (5L)</p>	
UNIT III	Chromatographic Techniques -I	15
	<p>3.1 Ion exchange chromatography: Ion exchange equilibria, breakthrough capacity, inorganic ion exchangers, synthetic ion exchangers, chelating resins and their applications for separation of inorganic and organic compounds. (8L)</p> <p>3.2 Ion chromatography: Principle, instrumentation with special reference to separation and suppressor columns, applications. (2L)</p> <p>3.3 Exclusion chromatography : Theory, instrumentation and applications of gel permeation chromatography, retention behavior, inorganic molecular sieves, determination of molecular weight of polymers, (5L)</p>	
UNIT IV	Chromatographic Techniques -II	15
	4.1 Supercritical fluid Chromatography: Theory, concept of critical state of matter and supercritical state, types of supercritical fluids, instrumentation, applications to environmental, food, pharmaceuticals and polymeric analysis.	

	(8L)	
	4.2 Affinity Chromatography: principle, instrumentation and applications (4L) Optimum pressure liquid chromatography (OPLC) (3L)	

SEMESTER-III
PSC3AIT
Advance Instrumental Techniques

UNIT I	Spectral Methods I	15
	<p>1.1 Surface Analytical Techniques: Preparation of the surface, difficulties involved in the surface analysis. (1L) Principle, instrumentation and applications of Transmission Electron Microscopy (2L)</p> <p>1.2 Principle, instrumentation and applications of the following:</p> <p>a. Secondary Ion mass spectroscopy. (4L)</p> <p>b. Low-Energy Ion Scattering and Rutherford Backscattering (5L)</p> <p>c. Atomic Emission Spectroscopy- electrical discharge sources (2L)</p>	
UNIT II	Spectral Methods – II	15
	<p>Principle, Instrumentation, and Applications of</p> <p>2.1 Electron Spin Resonance Spectroscopy (ESR) (5L)</p> <p>2.2 Mossbauer's Spectroscopy (5L)</p> <p>2.3 Particle-Induced X-Ray Emission (5L)</p>	
UNIT III	Electroanalytical Methods	15
	<p>Advanced Electroanalytical Techniques:-</p> <p>3.1 Current Sampled (TAST) Polarography, Normal and Differential Pulse Polarography (3L)</p> <p>3.2 Potential Sweep methods- Linear Sweep Voltammetry and Cyclic voltammetry. (3L)</p> <p>3.3 Potential Step method- Chronoamperometry (2L)</p> <p>3.4 Controlled potential technique- Chronopotentiometry (2L)</p> <p>3.5 Stripping Voltammetry- anodic, cathodic, and adsorption (2L)</p> <p>3.6 Chemically and electrolytically modified electrodes and ultra-microelectrodes in voltammetry (3L)</p>	
UNIT IV	Miscellaneous Techniques	15
	<p>Principle, Instrumentation and Applications of:</p> <p>4.1 Chemiluminescence techniques (3L)</p> <p>4.2 Chiroptical Methods : ORD, CD (5L)</p> <p>4.3 Photoacoustic spectroscopy (3L)</p> <p>4.4 Spectroelectrochemistry (4L)</p>	

SEMESTER – III**PSCH3BCF****Bioanalytical Chemistry and Food Analysis**

UNIT I	Bioanalytical chemistry	15
	1.1 Body Fluids 1.1.1 Composition of body fluids and detection of abnormal levels of glucose, creatinine, uric acid in blood, protein, ketone bodies and bilirubin in urine leading to diagnosis of diseases. (5L) 1.1.2 Physiological and nutritional significance of vitamins (water soluble and fat soluble) and minerals. (5L) 1.1.3 Analytical techniques (including microbiological techniques) for vitamins. (5L)	
UNIT II	Immunological Methods	15
	2.1 General processes of immune response, antigen-antibody reactions, precipitation reactions, radio, enzyme and fluoro-immuno assays.(8L)	
	2.2 Human Nutrition: Biological values and estimation of enzymes, carbohydrates, proteins, essential amino acids and lipids.(7L)	
UNIT III	Food Analysis - I	15
	3.1 Fuel value of food and importance of food nutrients (2L)	
	3.2 3.2.1 General idea about Food processing and preservation; 3.2.2 Food Additives: Legislation, Chemical preservatives, fortifying agents, emulsifiers, texturizing agents, flavours, colours, artificial sweeteners, enzymes. 3.2.3 Analysis of food for additives: Determination of SO ₂ , nitrate and nitrites; determination of ascorbic acid; identification and determination of saccharine and identification of colors in food, natural colours (5L)	
	3.3 Food Contaminants– Trace metals and pesticide residues, contaminants from industrial wastes (polychlorinated biphenyls, dioxins), toxicants formed during food processing (aromatic hydrocarbons, nitrosamines), veterinary drug residues and melamine contaminants. (8L)	
UNIT IV	Food Analysis - II	15
	4.1 4.1.1 Food packaging – Introduction, types of packing materials, properties and industrial requirements.(2L) 4.1. 2 Processing and Quality requirements of Milk and milk products (cheese, butter and ice cream), vegetables and fruits, meat and meat products. (6L)	
	4.2. Analysis of Milk – Fat content, proteins, acidity, bacteriological quality and milk adulterants.(2L)	
	4.3 Analysis of Oils and Fats – acid value, sap value, iodine value. Determination of rancidity and antioxidants.(2L)	
	4.4 Analysis of spices (cloves, cinnamon, pepper, mustard) Determination of volatile oils and fixed oils.(3L)	

SEMESTER-III

PSC3ENC

Environmental and Certain Industrially Important Materials

UNIT I	Air Pollution	15
	<p>1.1 Sources, classification, pollutants and permissible limits.(2L)</p> <p>1.2 Sampling methods for air, flow gas, Industrial Exhaust, stack samples etc. (2L)</p> <p>1.3 Importance of automobile exhaust control and its limits(2L)</p> <p>1.4 Sampling and analysis of: Particulate matter, aerosols, ammonia and organic vapors. (3L)</p> <p>1.5 Carbon credit and global issues related to air pollution.(3L)</p> <p>1.6 Greenhouse gases and their substitutes. (1L)</p> <p>1.7 Environmental Legislation: role of pollution control boards, article 48A and 51A, Motor Vehicle Act and method of analysis with respect to PUC. (2L)</p>	
UNIT II	Water Quality Standards	15
	<p>2.1 Water: quality and requirements of potable water, direct and indirect pollutants for potable water reservoirs, quality of potable water from natural sources. (6L)</p> <p>2.2 Bore well water quality and analytical parameters. Quality of bottled mineral water (3L)</p> <p>2.3 Process of purification of bore well water to bottled mineral water. (2L)</p> <p>2.4 Regulatory requirements for packaged drinking water (4L)</p>	
UNIT III	Other Types Of Pollution	15
	<p>3.1 Soil pollution and Soil Analysis : sources of soil pollution and their control, sampling of soil, determination of water holding capacity, determination total nitrogen, ammonia and nitrates, fertility of soil and effect of pollution on it, synthetic fertilizers and their long term effect on soil quality. (6L)</p> <p>3.2 Noise Pollution : sources, effects, methods of measurements and control measures.(2L)</p>	

	<p>3.3 Thermal Pollution: definition, source, impact, control measures, working of cooling towers and cooling ponds, involved economy. (3L)</p> <p>3.4 Radioactive pollutants: source, exposure hazards, precautions in handling and safety, Long term effects. (2L)</p> <p>3.5 Environmental Audits: concept of audit, authorities, evaluation methodology, benefits and certification (2L)</p>	
UNIT IV	Industrial Materials	15
	<p>4.1 Insecticides, Pesticides: definition, classification of insecticides pesticides. Biodegradation of insecticides and pesticides (5L).</p> <p>4.2 Soaps and Detergents: classification and composition, qualitative analysis, quantitative analysis of detergents- alkalinity, active ingredients and oxygen releasing capacity. Biodegradable detergents (5L)</p> <p>4.3 Petrochemical products: crude oils, fuels, and calorific values, fractional distillation process and fractions, properties of fuel, composition of fuel, flashpoint, fire point, corrosion test, carbon residue and impact on environment. (5L)</p>	

PSC3POA

Pharmaceutical and Organic Analysis

UNIT I	Pharmaceutical Analysis	15
	<p>1.1 General idea regarding the Pharmaceutical Industry, definition and classification of drugs, introduction to pharmaceutical formulations and novel drug delivery system, classification of dosage forms. Role of FDA in pharmaceutical industries.(7L)</p> <p>Standardization and quality control of raw material and finished product Assay as per IP i) adrenaline, ii) Cephalexin, iii) ferrous fumarate, iv) paracetamol. (8L)</p>	
UNIT II	Drugs	15
	<p>2.1 Analysis of compounds based on functional groups, instrumental methods for analysis of drugs, proximate assays, assays of enzyme containing substances, biological and microbiological assays and tests. (8L)</p> <p>2.2 Limit tests, Sources of impurities and impurity profiling solubility tests, disintegration tests, stability studies, bioequivalence and bioavailability studies.(7L)</p>	
UNIT III	Forensic Science	15
	3.1 Analytical Chemistry in Forensic Science: General idea.(2L)	

	<p>3.2 Forensic Analysis:</p> <p>3.2.1 Blood: Blood preservation blood stain analysis.)</p> <p>3.2.2 DNA profiling DNA typing procedures-RFLP, PCR, MVRPCR, Dot-blot, AMP-FLP, STR, other methods, paternity testing,</p> <p>3.2.3 Hair analysis: Structure and composition of hair, morphological examination, Chemical analysis of hair components and components remaining on or in hair.)</p> <p>3.2.4 Alcohol in body fluids: Sampling and sample preservation, analysis - GC, IR, enzymatic and other methods (5L)</p> <p>3.3 Analytical Toxicology: Isolation, identification and determination of:</p> <p>3.3.1 Narcotics: Heroin, morphine and cocaine.</p> <p>3.3.2 Stimulants: Amphetamines and caffeine.</p> <p>3.3.3 Depressants: Benzodiazepines, Barbiturates.</p> <p>3.3.4 Hallucinogens: LSD and Cannabis.</p> <p>3.3.5 Metabolites of drugs in blood and urine of addicts.</p> <p>3.3.6 Viscera, stomach wash, vomit and postmortem blood for poisons like – cyanide, arsenic, mercury, insecticides and pesticides. (8L)</p>	
UNIT IV	Cosmetic Analysis	15
	<p>4.1 Cosmetics: Introduction. Evaluation of cosmetic materials, raw materials and additives. Formulation, standards and methods of analysis.(2L)</p> <p>4.2 Deodorants and antiperspirants: Al, Boric acid, chlorides, sulphates, and methanamine. (3L)</p>	
	4.3 Face powder: Ti, Fe, oxides of Ti, Fe and Al (total).(2L)	

	4.4 Hair tonic: 2,5-diaminotoluene, potassium borates, sodium perborate, pyrogallol, resorcinol, salicylic acid, dithioglycollic acid (in permanent wavers)(4L)	
	4.5 Creams and Lotions: Types of emulsions, chloroform soluble materials, glycerol, pH emulsion, ash analysis, nonvolatile matter (IR spectroscopy) (3L)	
	4.6 Lipsticks: General analysis, lakes and fillers, trichloroethylene-acetone soluble contents.(1L)	

SEMESTER-III PRACTICALS

PSC3QAP

1. Determination of the pK value of an indicator.
2. Determination of copper and bismuth in mixture by photometric titration.
3. Estimation of strong acid, weak acid and salt in the given mixture conductometrically.
4. Analysis of mixture of carbonate and bicarbonate (present in ppm range) using pHmetry.
5. Determination of copper by extractive photometry using diethyldithiocarbamate.

PSC3AIP

1. Estimation of drugs by non aqueous titration: Pyridoxine hydrochloride, Sulphamethoxazole.
2. Determination of percentage purity of methylene blue indicator.
3. Estimation of cholesterol and Uric acid in the given sample of blood serum
4. Estimation of fluoride in a tooth paste.
5. Determination of silica by molybdenum blue method.

PSC3BCP

1. Total reducing sugars before and after inversion in honey using: (a) Cole's Ferricyanide (b) Lane - Eynon method.
2. Analysis of lactose in milk
3. Estimation of Caffeine in tea
4. Estimation of Vitamin C in lemon Juice/squash by Dichlorophenol-indophenol method
5. Iodine value of oil / fat
6. Estimation of micronutrient from food by AAS (any two elements such as Fe, Cu, Zn, Mo, B, Mn)

PSC3ENP/ PSC3POP

1. To analyze Pyrolusite for: Fe by colorimetry and / or Mn by volumetry.
2. Analysis of Nicrome alloy for Ni (complexometry)
3. Analysis of Bauxite for Ti by colorimetry / Al by gravimetry / Fe (volumetry)
4. Analysis of water sample: Total hardness and salinity.
5. Analysis of water sample: Acidity and sulphate(Benzidine method).

NOTE:

1. The candidate is expected to submit a journal certified by the Head of the Department / institution at the time of the practical examination.
2. A candidate will not be allowed to appear for the practical examination unless he / she produces a certified journal or a certificate from the Head of the institution/department stating that the journal is lost and the candidate has performed the required number of experiments satisfactorily.
3. The list of the experiments performed by the candidate should be attached with such certificate.
4. Use of non-programmable calculator is allowed both at the theory and the practical examination.

SEMSTER-IV**PSC4QAC****Quality In Analytical Chemistry**

UNIT I	Separation Science	15
	<p>1.1 Membrane separation processes: operating principles and applications of microfiltration, ultra-filtration, reverse osmosis, dialysis and electro-dialysis. (8L)</p> <p>1.2 Applications of Solvent extraction in Analytical Chemistry- recapitulation of solvent extraction, roles of solvent extraction in analytical chemistry, solvent extraction in sample preparation and pretreatment steps, solvent extraction as a means of analytical determination (7L)</p>	
UNIT II	Separation, Analysis and Standardization of Herbal based products.	15
	<p>2.1 Herbs as a raw material: Defination of herb, herbal medicine, herbal Medicinal products, herbal drug preparation. Sources of herbs. Selection, identification and authentication of herbal materials, drying and processing of herbal raw materials,drying and processing of herbal raw material.(6L)</p> <p>2.2Extraction of herbal materials: Choice of solvent for extraction, methods used for extraction and principles involved in extraction.(3L)</p> <p>2.3 Standardization of herbal formulation and herbal extracts: Standardization of herbal extract as per WHO cGMP guidelines, Physical, Chemical,Spectral and toxilological standardization,qualitative and quantitative esimations.(6L)</p>	

UNIT III	Green Chemistry	15
	<p>3.1 Principle and concepts of green chemistry: sustainable development and green chemistry, atom economy, examples of atom economic and atom uneconomic reactions, reducing toxicity (4L)</p> <p>3.2 Organic solvents: environmentally benign solutions, solvent free systems, supercritical fluids (only introduction) Ionic liquids as catalysts and solvents (4L)</p> <p>3.3 Emerging Green Technologies: photochemical reactions (advantages and challenges), examples. Chemistry using microwaves, sonochemistry and electrochemical synthesis. (4L)</p> <p>3.4 Designing Greener Processes: Inherently Safer Designs (ISD), Process intensification (PI) in-process monitoring. (3L)</p>	
UNIT IV	Advanced Techniques	15
	<p>4.1 Electrophoresis: introduction, factors affecting migration rate, supporting media (gel, paper, cellulose, acetate, starch, polyacrylamide, agarose, sephedax and thin layers) (2L)</p> <p>4.2 Techniques of Electrophoresis: low and high voltage, sds-page, continuous electrophoresis, capillary electrophoresis, zone, gel, isoelectric focusing, isotaechophoresis and miceller electro kinetic capillary chromatography, instrumentation, detection and applications. (8L)</p> <p>4.3 Introduction to Nanotechnology: One dimensional nano materials (nanofilms, nanolayers), two dimensional nanomaterials (nanotubes, nanowires), three dimensional nanomaterials (nanoparticles and quantum dots); consequences of the nanoscale, (morphology, electronic structure, optical properties), Applications of UV-Vis, IR and Raman, X-ray diffraction, SEM, TEM and XPS, probe analysis (AFM) in characterization of nanomaterials. (5L)</p>	

SEMESTER-IV**PSC4AIT****Advanced Instrumental Techniques**

UNIT I	Spectral Methods III	15
	<p>NMR Spectroscopy</p> <p>1.1 Theory and Instrumentation- recapitulation, FTNMR, 2D NMR,- FID signal generation mechanism, Techniques in 2D NMR- homo nuclear correlation spectroscopy (COSY), total correlation spectroscopy (TOCSY), heteronuclear correlation (HETCOR) (9L)</p> <p>1.2 Radio waves in imaging- principle instrumentation and applications of MRI (3L)</p> <p>1.3 Application of NMR to other nuclei C^{13}, P^{31} and F^{19} spectroscopy (3L)</p>	
UNIT-II	Spectral Methods IV	15
	<p>2.1 Mass spectrometry: recapitulation, correlation of mass spectra with molecular structure- interpretation of mass spectra, analytical information derived from mass spectra- molecular identification, metastable peaks, Fragmentation Reactions (9L)</p> <p>2.2 Raman spectroscopy: Principle Theory Instrumentation , techniques(SERS and Resonance Raman) and Applications of Raman spectroscopy (6L)</p>	
UNIT III	Radiochemical And Thermal Methods	15
	<p>3.1 Activation analysis- NAA ,radiometric titrations and radio-release methods(7L)</p> <p>3.2 Thermal analysis- Principle, Interfacing , instrumentation and Applications of</p> <p>(a) Simultaneous Thermal Analysis- TG-DTA and TG-DSC</p> <p>(b) Evolved gas analysis- TG-MS and TG-FTIR (8L)</p>	
UNIT IV	Hyphenated Techniques	15
	<p>4.1 concept of hyphenation, need for hyphenation, possible hyphenations. (2 L)</p> <p>4.2 Interfacing devices and applications of GC – MS, ICP -MS, GC - IR, Tandem Mass Spectrometry, LC – MS: HPLC-MS, CE-MS. (13L)</p>	

SEMESTER – IV
PSC3STA
Selected Topics in Analytical Chemistry

UNIT I	Effluent Treatment	15
	1.1 Effluent treatment plant general construction and process flow charts(3L) 1.2 Treatment and disposal of Sewage.(3L) 1.3. Effluent parameters for metallurgical industry.(2L) 1.4 Permissible limits for metal (example Cr, As, Pb, Cd etc) traces in the effluent.(2L) 1.5 Recovery of metals from effluent, modern methods – Electrodialysis, Electrodeposition and Ion Exchange etc.(3L) 1.6 Recycle and reuse of process and treated (effluent) water(2L)	
UNIT – II	Solid Waste Management	15
	2.1 Solid waste management: objectives, concept of recycle, reuse and recovery (3L) 2.2 Methods of solid waste disposal.(2L) 2.3 Treatment and disposal of sludge / dry cake (3L) 2.4 Managing non-decomposable solid wastes(2L) 2.5 Bio- medical waste : Introduction , Classification and methods of disposal (5L)	
UNIT – III	Plastics and Polymers	15
	3.1 Classification of plastic, determination of additives, molecular weight distribution, analysis of plastic and polymers based on styrene, vinyl chloride, ethylene, acrylic and cellulosic plastics. (5L) 3.2 Metallic impurities in plastic and their determination, (2L) 3.3 Impact of plastic on environment as pollutant.(2L) 3.4 Paints and pigments: Types of paints pigments, determination of volatile and non - volatile components, Flash point (significance and method of determination), separation and analysis of pigments, binders and thinners.(3L) 3.5 Role of Organo silicones in paints and their impact on environment.(3L)	
UNIT – IV:	Metallurgy	15
	4.1 Ores and minerals: Dressing of ores, pollution due to metallurgical processes (ore dressing, calcination, smelting) (3L) 4.2 Chemical analysis of ores for principal constituents : Galena, Pyrolusite, Bauxite, Hematite, Monazite (4L) 4.3 Alloys: definition, analysis of Cupronickel, Magnesium, Steel And Stainless Steel, Bronze, Gun metal.(4L) 4.4 Techniques of purification: Zone refining, analysis of high purity materials like silicon , vacuum fusion and extraction techniques. (4L)	

SEMESTER – IV**PSC4IPR****Intellectual Property Rights & Cheminformatics**

UNIT I	Introduction to Intellectual Property-I	15
	<p>1.1 : Historical Perspective, Different types of IP, Importance of protecting IP.(2L)</p> <p>1.2: Patents: Historical Perspective, Basic and associated right, WIPO, PCT system, Traditional Knowledge, Patents and Health care-balancing promoting novation with public health, Software patents and their importance for India (5L)</p> <p>1.3: Industrial Designs: Definition, How to obtain, features, International design registration.(2L)</p> <p>1.4: Industrial Designs: Definition, How to obtain, features, International design registration.(2L)</p> <p>1.5: Trade Marks: Introduction, How to obtain, Different types of marks – Collective marks, certification marks, service marks, trade names etc. (2L)</p> <p>1.6: Geographical Indications: Definition, rules for registration, prevention of illegal exploitation, importance to India. (2L)</p>	
UNIT – II	Introduction to Intellectual Property-II	15
	<p>2.1 Trade Secrets: Introduction and Historical Perspectives, Scope of Protection, Risks involved and legal aspects of Trade Secret Protection.[2L]</p> <p>2.2 IP Infringement issue and enforcement: Role of Judiciary, Role of law enforcement agencies – Police, Customs etc. [2L]</p> <p>2.3 Economic Value of Intellectual Property: Intangible assests and their valuation, Intellectual Property in the Indian context – Various Laws in India Licensing and Technology transfer. [5L]</p> <p>2.4 Different International agreements: (a) World Trade Organization (WTO): [5L] (i) General Agreement on Tariffs and Trade (GATT), Trade Related Intellectual Property Rights (TRIPS) agreement (ii) General Agreement on Trade Related Services (GATS); Madrid Protocol. (iii) Berne Convention (iv) Budapest Treaty (b) Paris Convention [6L] WIPO and TRIPS, IPR and Plant Breeders Rights, IPR and Biodiversity</p>	
UNIT – III	Introduction to Chemoinformatics	15
	<p>3.1 History and evolution of cheminformatics, Use of Cheminformatics, Prospects of cheminformatics, Molecular modeling and structure elucidation.[5L]</p> <p>3.2 Representation of molecules and chemical reactions: Nomenclature, Different types of notations, SMILES coding, Matrix representations, Structure of Molfiles and Sdfiles, Libraries and toolkits, Different electronic effects, Reaction classification. [5L]</p> <p>3.3 Searching Chemical Structures: Full structure search, sub-structure search, basic ideas, similarity search, three dimensional search methods,</p>	

	basics of computation of physical and chemical data and structure descriptors, data visualization. [5L]	
UNIT – IV	Applications of Chemoinformatics	15
	Prediction of Properties of Compound, Linear Free Energy Relations, Quantitative Structure – Property Relations, Descriptor Analysis, Model Building, Modeling Toxicity, Structure – Spectra correlations, Prediction NMR, IR and Mass spectra, Computer Assisted Structure elucidations, Computer assisted Synthesis Design, Introduction to drug design, Target, Identification and Validation, Lead Finding and Optimization, analysis of HTS data, Virtual Screening, Design of Combinatorial Libraries, Ligand based and Structure based Drug design, Application of Cheminformatics in Drug Design.	

SEMESTER – IV
PSC4REM
Research Methodology

UNIT I	Resources	15
	<p>1.1 Print: Primary, Secondary and Tertiary sources.</p> <p>1.2 Journals: Journal abbreviations, abstracts, current titles, reviews, monographs, dictionaries, text-books, current contents,</p> <p>1.3 Introduction to Chemical Abstracts and Beilstein, Subject Index, Substance Index, Author Index, Formula Index, and other Indices with examples.[5L].</p> <p>1.4 Digital: Web sources, E-journals, Journal access, TOC alerts, Hot articles, Citation Index, Impact factor, H-index, E-consortium, UGC infonet, E-books,</p> <p>Internet discussion groups and communities, Blogs, preprint servers, Search engines, Scirus, Google Scholar, ChemIndustry, Wiki-databases, ChemSpider, Science Direct, SciFinder, Scopus. [5L]</p> <p>Information Technology and Library Resources: Internet and World wide web, Internet resources for Chemistry, finding and citing published information. [5L]</p>	
UNIT – II	Data Analysis	15
	<p>2.1 The Investigative Approach: Making and recording Measurements, SI units and their use, Scientific methods and design of experiments.</p> <p>2.2 Analysis and Presentation of Data: Descriptive statistics, choosing and using statistical tests, Chemometrics, Analysis of Variance (ANOVA), Correlation and regression, curve fitting, fitting of linear equations, simple linear cases, weighted linear case, analysis of residuals, general polynomial fitting, linearizing transformations, exponential function fit, r and its abuse, basic aspects of multiple linear regression analysis.</p>	
UNIT – III	Methods of Scientific Research and Writing	15
	<p>3.1 Scientific papers: Reporting practical and project work, Writing literature surveys and reviews, organizing a poster display, giving an oral presentation.</p> <p>3.2 Writing Scientific Papers: Justification for scientific contributions, bibliography, description of methods, conclusions, the need for illustration, style, publications of scientific work, writing ethics, avoiding plagiarism.</p>	
UNIT – IV	Chemical Safety & Ethical Handling of Chemicals	15
	<p>Safe working procedure and protective environment, protective apparel, emergency procedure, first aid, laboratory ventilation, safe storage and use of hazardous chemicals, procedure for working with substances that pose hazards, flammable or explosive hazards, procedures for working with gases at pressures above or below atmospheric pressure, safe storage and disposal of waste chemicals, recovery, recycling and reuse of laboratory chemicals, procedure for laboratory disposal of explosives, identification, verification and segregation of laboratory waste, disposal of chemicals in the sanitary sewer system, incineration and transportation of hazardous chemicals..</p>	

PRACTICALS

PSC4QAP

1. Determination of pK value of H_3PO_4 potentiometrically
2. Estimation of Na^+ in dairy whitener by flame photometry
3. Spectrophotometric determination of pH of buffer solution.
4. Fe^{2+} spectrophotometrically by H_2O_2 method
5. To analyze Bronze for Zn by complexometric method

PSC4AIP

1. Analysis of Aspirin/paracetamol as per IP with respect to identification, ash and assay
2. Analysis of detergents: Active detergent matter, alkalinity and Oxygen releasing capacity
3. Determination of the purity of crystal violet
4. Estimation of Ca in Ca-pentathionate/calcium lactate tablets
5. Canned food: Limits test for tin/zinc

PSC4STP

1. Analysis of Calcium, Iron and phosphorous in milk.
2. Determination of SAP value of oil.
3. Estimation of Aldehyde in lemon grass oil / Cinnamon oil
4. Estimation of Glucose by Folin-Wu method
5. Analysis of water sample : Mn^{2+}

PSC4IPP/PSC4REP

Project Evaluation/ Industrial Internship

UNIVERSITY OF MUMBAI



**Revised Syllabus for T.Y.B.Sc.
Program: B.Sc.
Course: Microbiology (USMB)**

(Credit Based Semester and Grading System with
effect from the academic year 2018 – 2019)

Unit II: Study of few diseases (wrt. Cultural characteristics of the etiological agent, pathogenesis & clinical features, laboratory diagnosis, treatment and prevention only)		15 L	15
2.1 Study of skin infections		7 L	
2.1.1	Pyogenic skin infections caused by <i>Pseudomonas</i> and <i>S. aureus</i>		
2.1.2	Leprosy		
2.1.3	Fungal infections- Candidiasis		
2.1.4	Viral Infections- Herpes simplex		
2.2 Study of gastrointestinal tract infections		8 L	
2.2.1	Infections due to Enteropathogenic <i>E.coli</i> strains		
2.2.2	Enteric fever- <i>Salmonella</i>		
2.2.3	Shigellosis		
2.2.4	Rotavirus diarrhoea		
2.2.5	Dysentery due to <i>Entamoeba histolytica</i>		
Unit III: General Immunology – I		15 L	15
3.1. Organs and tissues of the immune system:		4 L	
3.1.1	Primary lymphoid organs - structure and function of Thymus and Bone marrow		
3.1.2	Secondary lymphoid organs – structure and function of Spleen, Lymph node, Mucosa associated lymphoid tissues, Bronchus associated lymphoid tissue, Gut associated lymphoid tissue, Cutaneous associated lymphoid tissue		
3.2 Antigens		5 L	
3.2.1	Immunogenicity versus antigenicity: Concepts - Immunogenicity, Immunogen, Antigenicity, Antigen, Haptens. Haptens as valuable research and diagnostic tools		
3.2.2	Factors that influence immunogenicity - Foreignness, Molecular size, Chemical composition, Heterogeneity, Susceptibility of antigen to be processed and presented, Contribution of the biological system to immunogenicity Genotype of the recipient, Immunogen dosage, Route of administration		
3.2.3	Adjuvants		
3.2.4	Epitopes / antigen determinants - General concept, Characteristic properties of B - cell epitopes, concepts of sequential and non-sequential epitopes (with only one example each). Properties of B - cell and T - cell epitopes. Comparison of antigen recognition by T cells and B cells		
3.2.5	Types of antigens – heterophile antigens, isophile antigens, sequestered antigens, super antigens, bacterial and viral antigens		
3.3 Immunoglobulins		6 L	
3.3.1	Immunoglobulins – basic structure of Immunoglobulins, heterodimer; types of heavy and light chains; constant and		

pathogens in a logical fashion. This includes our innate ability to defend against microorganisms (innate immunity); should this first line of defense fail, how we can fight infections (acquired immunity); if we react excessively, what price we pay (hypersensitivity); the role of immunohematology in blood transfusion and very importantly, can we prevent pathogens from infecting us (vaccination).

LEARNING OUTCOMES:

- Give details of the virulence factors and morphological and cultural features of the pathogen
- Correlate these virulence factors with the pathogenesis and clinical features of the disease
- Comment on the mode of transmission, and modes of prophylaxis of these diseases
- Given a few key clinical features, identify the likely causative agent.
- Comment on the methods of diagnosis of the disease.
- Understand the structure and role of T and B cells in generating adaptive immunity and thereby study effector responses in both Humoral & Cell Mediated Immunity
- Acquire an understanding of the role of immune system in disease:
- Understand the activation of complement system
- Apply the concept of immunity to prevention of disease by development of vaccines

MEDICAL MICROBIOLOGY & IMMUNOLOGY: PART - II

(USMB-602): DETAIL SYLLABUS

Title		Lectures / Semester	Notional Periods
Unit I: Study of a Few Diseases with Emphasis on Cultural Characteristics of the Etiological Agent, Pathogenesis, Laboratory Diagnosis and Prevention.		15 L	15
1.1	Study of vector-borne infections - Malaria	2 L	
1.2	Study of sexually transmitted infectious diseases	8 L	
1.2.1	Syphilis		
1.2.2	AIDS		
1.2.3	Gonorrhoea		
1.3	Study of central nervous system infectious diseases	5 L	
1.3.1	Tetanus		
1.3.2	Polio		
1.3.3	Meningococcal meningitis		

BIOPROCESS TECHNOLOGY: PART-I (USMB-504)

LEARNING OBJECTIVES

Bioprocess Technology I course is designed to develop the learner's ability to study the techniques used in the different phases of industrial microbiology such as strain improvement, basic fermentation equipment & its sterilization aspects. It gives an in depth focus of the different types of fermenters used in industry for production of different products, and also emphasizes its process parameters. It includes the principles and describes the main steps and processes in the industrial production of beverages and enzymes.

Industrial microbiology becomes an important application based paper covering microbial fermentations. Thus, it becomes a laboratory to market scenario where the entire products reach. The learner is provided with the details of productions of important traditional fermentation products like wine, beer, vinegar and enzymes.

Thus, this paper readies the learner to understand and apply the knowledge of fermentation technology and related products.

This course aims to enable graduates to enter industry with an appropriate level of understanding of the need for both the science and business aspects to be achievable to make a viable product and enhance their entrepreneur skills.

LEARNING OUTCOMES: The students should be able to

- Describe the applications of microbes and its strain improvement in Industrial Microbiology.
- Apply kinetic formula to determine growth and productivity parameters of batch continuous, fed batch and solid substrate fermentations
- Describe the design of bioreactors for different applications and its process parameters
- Design media, growth conditions and techniques for producing and recovering different types of products of commercial value.
- Learner will be well –versed with the containment and levels of containment.

BIOPROCESS TECHNOLOGY: PART-I

(USMB-504): DETAIL SYLLABUS

Title	Lectures / Semester	Notional Periods
Unit I: Upstream Processing – I	15 L	15
1.1 Introduction	3 L	
1.1.1 An introduction to fermentation processes		
1.1.2 The range of fermentation processes		
1.1.3 The Component parts of a fermentation process		
1.2 Screening methods	3 L	
1.2.1 Primary and secondary screening		

LEARNING OUTCOMES:

- Understand the actual process involved in fermentations of important products.
- To apply the knowledge of applications of animal and plant tissue culture techniques.
- Learn the applications of immobilized enzymes in various fields.
- Understand the working of important instruments used in biochemical analysis and bioassay.
- Learn the salient features of quality management and regulatory procedures.

At the end of the course the learner will also acquire the following practical skills

- Techniques involved in running a bioassay, immobilization of cells & sterility testing
- Preliminary techniques in animal & plant tissue culture.

BIOPROCESS TECHNOLOGY: PART-II

(USMB-504): DETAIL SYLLABUS

Title	Lectures / Semester	Notional Periods
Unit I: Downstream Processing	15 L	15
1.1 Recovery and purification	10 L	
1.1.1 Introduction		
1.1.2 Methods of DSP: Precipitation, Filtration, Centrifugation, Cell Disruption, Liquid-Liquid Extraction, Solvent Recovery, Chromatography, Membrane Processes, Drying, Crystallization, Whole Broth Processing		
1.2 Effluent treatment – Introduction, Dissolved oxygen concentration as indicator of water quality, The strength of fermentation effluents, Treatment process (Physical, chemical and biological)	5 L	
Unit II: Advances in Bioprocess Technology	15 L	15
2.1 Animal biotechnology	5 L	
2.1.1 Primary cell culture and established cell lines		
2.1.2 Basic principles		
2.1.3 Growth media		
2.1.4 Cell viability		
2.1.5 Scale up of cultured cells and tissue		
2.1.6 Applications of cell culture: Vaccines, somatic cell fusion, valuable products.		
2.2 Plant tissue culture		
2.2.1 Introduction	5 L	

2.2.2	Requirements for in vitro culture, Methods of plant cell and tissue culture		
2.2.3	Types of cultures of plant materials: explants, callus, organogenesis, root culture, shoot culture, micropropagation, suspension culture, protoplast culture, protoplast fusion and somatic hybridization.		
2.2.4	Applications: production of disease resistant plants, production of virus free plant, In vitro selection of cell lines for disease resistance, micropropagation, secondary metabolites from cell culture, transgenic plants for crop improvement		
2.3	Immobilized enzyme and cells	5 L	
2.3.1	Introduction and Definitions		
2.3.2	Methods		
2.3.3	Immobilized Enzyme Reactors		
2.3.4	Applications		
Unit III: Quality Assurance, Quality Control, Instrumentation and Bioassay		15 L	15
3.1	Quality assurance and quality control	4 L	
3.1.1	Definitions, Chemical and pharmaceutical products		
3.1.2	Variables of batch process		
3.1.3	Q.A and Q.C wrt.- Raw materials, method of manufacturing, in process items, finished products, label and labeling, packaging materials		
3.1.4	Control of microbial contamination during manufacturing		
3.2	Sterilization control and assurance	2 L	
3.3	Instrumentation: Principles, working and application of	3 L	
3.3.1	Spectrophotometry: UV, Visible & IR		
3.3.2	AAS & AES (Flame photometry)		
3.4	Bioassay	3 L	
3.4.1	Introduction		
3.4.2	Types: Diffusion, End Point, Turbidometric, Metabolic Response, Enzymatic		
3.5	Intellectual property rights	3 L	
3.5.1	Genesis, Role of WTO and TRIPS		
3.5.2	Overview of patent system		
3.5.3	Requirements for patentability		
3.5.4	Patent Categories		
3.5.5	Preliminary steps for patent applications		
3.5.6	Patent Procedures		
3.5.7	For biotech and microbiological products		

- evolution of a specific protein in bacteria, predicting function of unknown protein from a new organism based on its homology)
- c. Six frame translation of given nucleotide sequence
- d. Restriction analysis of given nucleotide sequence
- e. Pair-wise alignment and multiple alignment of a given protein sequences
- f. Formation of phylogenetic tree
- 6. Animal cell culture (Demo)

Course Code: USMBP07

[Practicals Based on USMB602, Credits -1.5, Lectures-60, Notional Periods-15]

1. Demonstration of malarial parasite in blood films (Demo)
2. Selection and testing of antibiotics using the Kirby-Bauer method
3. Determination of MBC of an antibiotic.
4. Blood grouping – Direct & Reverse typing
5. Coomb's Direct test
6. Determination of Isoagglutinin titer
7. Demonstration experiments - Widal, VDRL

Course Code: USMBP08

[Practicals Based on USMB603; Credits-1.5, Lectures- 60, Notional Periods-15]

1. Detection of PHB producing bacteria
2. To study catabolite repression by diauxic growth curve.
3. Protein estimation by Lowry's method
4. Estimation of uric acid
5. Qualitative and Quantitative assay of Protease
6. Qualitative detection of Lipase
7. Study of breakdown of amino acids – Lysine decarboxylase and Deaminase activity
8. Study of Lithotrophs – Nitrosification and Nitrification

Course Code: USMBP08

[Practicals Based on USMB604, Credits -1.5, Lectures- 60, Notional Periods-15]

1. Bioassay of an antibiotic (Ampicillin / Penicillin)
2. Bioassay of Cyanocobalamin.
3. Perform immobilization of yeast cells for invertase activity - making of beads, Determination of activity and count by haemocytometer and viable count.
4. Plant tissue culture – Callus culture (Demo).
5. Sterility testing of injectable.
6. Chemical estimation of Penicillin
7. Estimation of phenol.
8. Industrial Visit



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Program: B. Sc.

Revised Syllabus of S.Y.B.Sc. Microbiology

Choice Based Credit, Grading and Semester System

w.e.f. Academic Year 2020-21

Paper/ Unit	Title	Lecture/ Week	Total lectures
Paper II	Introduction to fermentation technology and Applied Microbiology	03	(45)
U1	Introduction to fermentation Technology		(15)
	A. Screening <ol style="list-style-type: none"> a. Primary screening- <ol style="list-style-type: none"> i. crowded plate technique ii. Auxanography iii. Enrichment culture techniques. iv. Use of indicator dye b. Secondary screening. 		03
	B. Fermentation media <ol style="list-style-type: none"> a. Characteristics of ideal fermentation medium. b. Types of fermentation media c. Raw material <ol style="list-style-type: none"> i. Carbon source ii. Nitrogenous material iii. Growth factors iv. Precursors v. Buffers vi. Antifoam d. Media sterilization and contamination e. Screening for production media. 		04
	C. Preparation of inoculum		01
	D. Types of fermentation- Aerobic, anaerobic, surface submerged, solid substrate, Batch, continuous.		04
	E. Fermenter design <ol style="list-style-type: none"> 1. Factors involve in fermenter design 2. Parts of fermenter <ol style="list-style-type: none"> a. Material used for fermenter b. Impeller, baffles, inoculum port, sparger, sampling point, pH control device, temperature control system, foam control device, bottom drainage system. 3. Fermenter configuration <ol style="list-style-type: none"> a. Batch fermenter b. Continuous fermenter 		03
U2	Introduction to Food and Dairy Microbiology		(15)
	A. Important Microorganisms in Food Microbiology: General characteristics of the enlisted organisms to be studied wrt spoilage and transmission of infection/intoxication (no clinical features and structural details) <ol style="list-style-type: none"> a. Spoilage -causing microorganisms <ol style="list-style-type: none"> a. Yeast & Molds: <i>Saccharomyces</i>, <i>Aspergillus</i> & <i>Penicillium</i> 		04

	<p>b. Bacteria: <i>Bacillus</i>, <i>Clostridium</i>, <i>Flavobacterium</i>, <i>Pseudomonas</i></p> <p>b. Food-borne Illness associated Microorganisms: Classification of Food-borne diseases (Schematic).</p> <p>Bacteria responsible for food -borne intoxication and infections-overview/tabulation. Examples of non-bacterial food-borne pathogens</p> <p>Details of :</p> <p>a) Staphylococcus food intoxication (organism, enterotoxin, incidence, foods involved, prevention of outbreaks)</p> <p>b) Salmonellosis (organism, source, incidence, foods involved, outbreak-conditions & prevention)</p>		
	<p>B. General Principles of Food Preservation:</p> <p>a. Preservation using High temperature (including TDT, D, F, Z values, 12D concept), principle of canning</p> <p>b. Low temperature</p> <p>c. Drying</p> <p>d. Food preservatives (organic acids & their salts, Sugar & salt)</p> <p>e. Ionizing radiations</p>		03
	<p>C. Microbial flora of milk, normal and abnormal flora, their sources and changes induced them.</p> <p>Milk borne pathogens.</p>		02
	<p>D. Microbiological Quality of Milk & Milk Products: SPC, coliform count, LPC, thermophilic, psychrophilic counts and RPT (RRT, MBRT, DMC)</p>		03
	<p>E. Milk product-</p> <p>a) Butter,</p> <p>b) Cheese (types and production of cheddar cheese and cottage cheese),</p> <p>c) Yogurt (Types and production).</p> <p>d) Other milk products and names of organisms associated with them.</p>		03
U3	Fresh Water and Sewage Microbiology	1	(15)
	<p>A. Fresh water environments and micro-organisms found in Springs, rivers and streams, Lakes , marshes and bogs</p>		3
	<p>B. Potable water: Definition, water purification ,water quality standards and pathogens transmitted through water</p>		2
	<p>C. Microbiological analysis of water:</p> <p>Indicator organisms and their detection in water- Total Coliforms, Fecal Coliforms and <i>E. coli</i>, Fecal <i>Streptococci</i>, <i>Clostridium perfringens</i></p>		2
	<p>D. Modern Waste Water treatment: Primary, Secondary and Tertiary Treatment</p>		1
	<p>E. The nature of wastewater and Monitoring of waste water treatment process(BOD,COD)</p>		2
	<p>F. Removal of Pathogens by Sewage treatment Processes.</p>		1

Paper/ Unit	Title	Credits	Lecture/ Week	Total lectures
Paper III SEM IV	Advances Analytical Techniques, Soft Skills and Applications of Microbiology	02		
U1	Introduction to Bioinformatics, Nano biotechnology, Biofilm and Biosensor		1	
	A. Introduction to Bioinformatics <ul style="list-style-type: none"> • Definition, aims, tasks and applications of Bioinformatics. • Database, tools and their uses - • Nucleic acid sequence databases- EMBL, DDBJ, GenBank, • Protein sequence databases-PIR, SWISS-PROT, TrEMBL • Different terminologies – Transcriptomics, Metabolomics, Pharmacogenomics, Phylogenetic tree, Annotation, • Sequence alignment—(global, local), FASTA, BLAST. • Genomics, Proteomics 			05
	B. Nano biotechnology Introduction of Nano biotechnology & application in drug and gene delivery Types of nanomaterials- nanoparticles, nanocapsules, nanotubes, liposomes, nanogels, Dendrimers, Gold nanoparticles.(Definition and applications)			05
	C. Biofilms and biosensors with applications: Biosensors: Introduction, design, working and applications of biosensors Biofilms: Introduction of biofilms, Types of biofilms, Mechanism of formation of biofilms and applications of biofilms.			05
U2	Analytical Techniques: Chromatography, Spectroscopy and Basic centrifugation		1	
	A.Chromatography <ul style="list-style-type: none"> • Introduction to chromatography, • Types of chromatography <ul style="list-style-type: none"> ○ Paper chromatography: Principle, circular, ascending and descending Paper Chromatography, ○ Separation of amino acids by Paper Chromatography. 			08

	<ul style="list-style-type: none"> ○ Thin layer chromatography: principle, preparation of TLC plates, procedure for TLC, preparative TLC, 2D TLC [one paragraph], HPTLC-[1 page], Separation of sugars by TLC. • Column chromatography : Introduction & principle • Exclusion chromatography, gel chromatography 			
	B. Spectroscopy <ul style="list-style-type: none"> • Properties of light • Beer's and Lambert's law • UV-visible spectroscopy <ul style="list-style-type: none"> ○ Principal ○ Working ○ Construction 			04
	C. Centrifugation <ul style="list-style-type: none"> • Basic principles of sedimentation, • types of rotors, • Types of centrifuge and its applications. • Care, maintainance and safety aspects of centrifuges 			03
U3	Research Fundamentals, Hypothesis Writing, Study designs, Report writing and presentation		1	
	A. Perception of Research Meaning of research P M Cook's definition of Research General characteristics of research Functions of research Specific characteristics of research Objectives of research Classification of research Steps of action research Characteristics of an investigator Difference between action research and fundamental research			05
	B. Hypothesis Writing			02
	C. Scientific Writing The research report Need of research report General format of research report Mechanics of report writing Writing research abstract: Need of an Abstract Format of an abstract and Characteristics of a good abstract Writing research papers: Format of a research paper, Advantages of a research paper			05
	D. Presentation skills (Poster and Oral)			03



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Program: B.Sc.

**Revised Syllabus of T.Y.B.Sc. (Applied Component
Biotechnology) Microbiology**

Choice Based Credit, Grading and Semester System

w.e.f. Academic Year 2020-21



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Revised Syllabus for
Program: B.Sc. Biotechnology
F.Y. B.Sc. Biotechnology
Choice based Credit & Grading system (60:40)

(To be implemented from the academic year (2019-2020))

F.Y. B.Sc. Biotechnology

Semester -I				
Course Code	Course Type	Course Title	Credits	Lectures / Week
UBT1BCH	Core Subject	Basic Chemistry	2	3
UBT1ACH	Core Subject	Analytical Chemistry	2	3
UBT1BEC	Core Subject	Biodiversity and Ecology	2	3
UBT1BMI	Core Subject	Basic Microbiology	2	3
UBT1IBC	Core Subject	Introduction to Biotechnology and Cell Biology	2	3
UBT1GEN	Core Subject	Genetics	2	3
	Elective Subject	FC/PE/NCC/NSS	2	3
UBT1PR1	Core Subject Practicals	Practicals of UBT1BCH and UBT1ACH	2	3
UBT1PR2	Core Subject Practicals	Practicals of UBT1BEC and UBT1BMI	2	3
UBT1PR3	Core Subject Practicals	Practicals of UBT1IBC and UBT1GEN	2	3

F.Y. B.Sc. Biotechnology

Semester -II				
Course Code	Course Type	Course Title	Credits	Lectures /Week
UBT2BIC	Core Subject	Biochemistry	2	3
UBT2BOC	Core Subject	Bioorganic Chemistry	2	3
UBT2PAP	Core Subject	Plant and Animal Physiology	2	3
UBT2MOB	Core Subject	Molecular Biology	2	3
UBT2TCG	Core Subject	Tissue Culture and Good Laboratory Practices	2	3
UBT2EIB	Core Subject	Enzymology, Immunology and Biostatistics	2	3
	Elective Subject	FC/PE/NCC/NSS	2	3
UBT2PR1	Core Subject Practicals	Practicals of UBT2BIC and UBT2BOC	2	3
UBT2PR2	Core Subject Practicals	Practicals of UBT2PAP and UBT2MOB	2	3
UBT2PR3	Core Subject Practicals	Practicals of UBT2TCG and UBT2EIB	2	3

SEMESTER I

Basic Microbiology

Course Code	Title	Credits	Lectures
UBT1BMI	Basic Microbiology	2	
Course Objectives: To acquaint students with basic techniques in Staining and Sterilization. Learning Outcome: To impart the knowledge of growth of microorganisms.			
Unit I Microscopy and Stains	Microscope- Simple and Compound: Principle. Parts, Functions and Applications. Dark Field and Phase Contrast Microscope. Stains and Staining Solutions- Definition of Dye and Chromogen. Structure of Dye and Chromophore. Functions of Mordant and Fixative. Natural and Synthetic Dyes. Simple Staining, Differential Staining and Acid Fast Staining with specific examples.		15 Lectures
Unit II Sterilization Techniques	Definition: Sterilization and Disinfection. Types and Applications: Dry Heat, Steam under pressure, Gases, Radiation, and Filtration. Chemical Agents and their Mode of Action - Aldehydes, Halogens, Quaternary Ammonium Compounds, Phenol and Phenolic Compounds, Heavy Metals, Alcohol, Dyes, and Detergents, Ideal Disinfectant. Examples of Disinfectants and Evaluation of Disinfectant.		15 Lectures
Unit III Nutrition, Cultivation and Enumeration of Microorganisms	Morphological classification, Bacteria, Endospore formation Nutritional Requirements: Carbon, Oxygen, Hydrogen, Nitrogen, Phosphorus, Sulphur and Growth Factors. Classification of Different Nutritional Types of Organisms. Design and Types of Culture Media. Simple Medium, Differential, Enriched, Selective and Enrichment Media. Concept of Isolation and Methods of Isolation. Pure Culture Techniques Growth and Enumeration: Growth Phases, Growth Curve. Arithmetic Growth and Growth Yield. Measurement of Growth. Chemostat and Turbidostat. Enumeration of Microorganisms- Direct and Indirect Methods. Preservation of Cultures- Principle and Methods. Cryogenic Preservation- Advantages and Limitations		15 Lectures

SEMESTER I

Introduction to Biotechnology and Cell Biology

Course Code	Title	Credits	Lectures
UBT1IBC	Introduction to Biotechnology and Cell Biology	2	
Course Objectives: To acquaint students with various fields of Biotechnology Cell Biology Learning Outcome: To impart the knowledge of biotechnology, cell structure functions and regulation of cell division and cell cycles.			
Unit I Scope and Introduction to Biotechnology	History & Introduction to Biotechnology Definition of Biotechnology, Traditional and Modern Biotechnology. Branches of Biotechnology- Plant, Animal Biotechnology, Marine Biotechnology, Agriculture, Healthcare, Industrial Biotechnology, Pharma-Biotechnology, Environmental Biotechnology. Biotechnology Research in India, Biotechnology Institutions in India (Public and Private Sector) Biotech Success Stories, Biotech Policy Initiatives. Biotechnology in context of Developing World Public Perception of Biotechnology.		15 Lectures
Unit II Structure of Prokaryotic and Eukaryotic Cell.	Ultra-structure of Prokaryotic Cell: Cell theory, Concept of Cell Shape and Size, Detail Structure of Slime Layer, Capsule, Flagella, Pilli, Cell Wall (Gram Positive and Negative), Cell Membrane, Cytoplasm and Genetic Material Storage Bodies and Spores Ultra-structure of Eukaryotic Cell: Plasma membrane, Cytoplasmic Matrix, Microfilaments, Intermediate Filaments, and Microtubules Organelles of the Biosynthetic-Endoplasmic Reticulum & Golgi Apparatus. Lysosome, Eucaryotic Ribosomes, Mitochondria, and Chloroplasts. Nucleus –Nuclear Structure, Nucleolus External Cell Coverings: Cilia And Flagella Comparison of Prokaryotic And Eukaryotic Cells.		15 Lectures
Unit III Cell cycle, cell death and cell renewal	Eukaryotic cell cycle, restriction point, and checkpoints. Cell division: Meiosis and Mitosis Apoptosis and necrosis -brief outline. Salient features of a transformed cell.		15 Lectures

SEMESTER II

Tissue Culture and Good Laboratory Practices

Course Code	Title	Credits	Lectures
UBT2TCG	Tissue Culture and Good Laboratory Practices	2	
Course Objectives: To acquaint students with tissue culture and good laboratory practices. Learning Outcome: To impart the knowledge of plant and animal tissue culture and make the students aware about good laboratory practices and biosafety guidelines.			
Unit I Plant Tissue Culture	Cell Theory, Concept of Cell Culture, Cellular Totipotency. Organization of Plant Tissue Culture Laboratory : Equipments and Instruments . Aseptic Techniques: Washing of Glassware, Media Sterilization, Aseptic Workstation, Precautions to maintain Aseptic Conditions. Culture Medium: Nutritional requirements of the explants, PGR's () and their in-vitro roles, Media Preparation. Callus Culture Technique: Introduction, Principle and Protocols		15 Lectures
Unit II Animal Tissue Culture	Basics of Animal Tissue Culture , Introduction to Cell Culture Techniques, Equipment and Sterilization Methodology. Media used in Animal Tissue Culture, Growth Factors and Growth Parameters. General Metabolism and Growth Kinetics Primary Cell Cultures: Establishment and Maintenance of Primary Cell Cultures of Adherent and Non-Adherent Cell Lines with examples. Application of Cell Cultures		15 Lectures
Unit III Good Laboratory Practices and Biosafety Guidelines	Concept of GLP, Objectives, Practicing GLP, Guidelines to GLP; Documentation of Laboratory work, Preparation of SOPs, Decontamination and Disposal, Safety measures in Laboratory- Common safety symbols, General Work Procedure, Emergency Procedure, Apparel in the Laboratory, Chemical Handling.		15 Lectures

SEMESTER II
Enzymology, Immunology and Biostatistics

Course Code	Title	Credits	Lectures
UBT2EIB	Enzymology, Immunology and Biostatistics	2	
Course Objectives: To acquaint students with concepts in Enzymes, vitamins, Immunology and Biostatistics Learning Outcome: To impart the skills in Enzyme Kinetics, Immunological Techniques and Biostatistics			
Unit I Enzymes and Vitamins	Enzymes: Definition, Classification, Nomenclature, Chemical Nature, Properties of Enzymes, Active Sites, Enzyme Specificity, Effect of pH, Temperature, Substrate Concentration on Enzyme Activity, Enzyme Kinetics, Michaelis-Menten Equation. Vitamins: Fat Soluble and water soluble vitamins: Sources, biochemical applications and associated diseases.		15 Lectures
Unit II Immunology	Overview of Immune Systems, Cell and Organs involved T and B cells. Innate Immunity, Acquired Immunity, Local and Herd Immunity, Humoral and Cellular Immunity - Factors Influencing and Mechanisms of each. Antigens and Antibodies: Types of Antigens, General Properties of Antigens, Haptens and Superantigens Discovery and Structure of Antibodies (Framework region) Classes of Immunoglobulins, Antigenic Determinants.		15 Lectures
Unit III Biostatistics	Definition & Importance of Statistics in Biology Types of Data, Normal and Frequency Distribution Representation of Data and Graphs (Bar Diagrams, Pie Charts and Histogram, Polygon and Curve) Types of Population Sampling, Measures of Central Tendency, (For Raw, Ungroup & Group Data) Mean, Median, Mode Measures of Dispersion: Range, Variance, Coefficient of Variance. Standard Deviation, Standard Error.		15 Lectures



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Revised Syllabus for

Program: B.Sc. Biotechnology

S.Y. B.Sc. Biotechnology

Choice based Credit & Grading system (60:40)

(To be implemented from the academic year (2020-2021))

S.Y. B.Sc. Biotechnology

Semester -III				
Course Code	Course Type	Course Title	Credits	Lectures / Week
UBT3BPH	Core Subject	Biophysics	2	3
UBT3APC	Core Subject	Applied Chemistry-I	2	3
UBT3IMM	Core Subject	Immunology	2	3
UBT3CBC	Core Subject	Cell Biology and Cytogenetics	2	3
UBT3MOB	Core Subject	Molecular Biology	2	3
UBT3BPT	Skill Enhancement Elective	Bioprocess Technology	2	3
UBT3RSM	General Elective	Research Methodology	2	3
UBT3PR1	Core Subject Practical	Practical of UBT3BPH and UBT3APC	2	6
UBT3PR2	Core Subject Practical	Practical of UBT3IMM and UBT3CBC	2	6
UBT3PR3	Core Subject and Skill Enhancement Elective Practical	Practical of UBT3MOB and UBT3BPT	2	6

S.Y. B.Sc. Biotechnology

Semester -IV				
Course Code	Course Type	Course Title	Credits	Lectures /Week
UBT4BIC	Core Subject	Biochemistry	2	3
UBT4APC	Core Subject	Applied Chemistry-II	2	3
UBT4MEM	Core Subject	Medical Microbiology	2	3
UBT4ENB	Core Subject	Environmental Biotechnology	2	3
UBT4BBI	Core Subject	Biostatistics and Bioinformatics	2	3
UBT4MOD	Skill Enhancement Elective	Molecular Diagnostics	2	3
UBT4END	General Elective	Entrepreneurship Development	2	3
UBT4PR1	Core Subject Practical	Practical of UBT4BIC and UBT4APC	2	6
UBT4PR2	Core Subject Practical	Practical of UBT4MEM and UBT4ENB	2	6
UBT4 PR3	Core Subject and Skill Enhancement Elective Practical	Practical of UBT4 BBI and UBT4 MOD	2	6

	<ul style="list-style-type: none"> vectors, replacement vectors, Cosmids, Phagemids, Vectors for Plant and Animal Cells, Shuttle Vectors, YAC Vectors, Expression Vectors Gene cartridges 		
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SEMESTER-III

Paper-VI BIOPROCESS TECHNOLOGY (UBT3BPT)

Course Objective:

- The objective of this course is to understand the basics skills applied in Fermentation Technology and build a foundation for more advanced studies in Bioprocess Technology.

Learning Outcome: By the end of the course the student will be able to:

- Develop an understanding of the various aspects of Bioprocess Technology.
- Develop skills associated with screening of Industrially Important Strains.
- Understand principles underlying design of Fermenter and Fermentation Process.

Unit	Title	Credits	Lectures
UNIT I Microorganisms in Industrial Processes	Types of Microorganisms used in Industrial Processes: <ul style="list-style-type: none"> Bacteria, Actinomycetes, Fungi and Algae. Screening and Maintenance of Strains: <ul style="list-style-type: none"> Primary Screening and Secondary Screening; Cultivation; Preservation of Industrially Important Microbial Strains. 	2	15
UNIT II Fermentor and Fermentation Processes	Design of a Fermentor: <ul style="list-style-type: none"> Stirred Tank Fermentor- Basic Design; Parts of a Typical Industrial Fermentor. Fermentation Media: <ul style="list-style-type: none"> Components; Design and Optimization. Sterilization: <ul style="list-style-type: none"> Sterilization of Fermentor and Fermentation Media. Process Parameters: <ul style="list-style-type: none"> pH, Temperature, Aeration, Agitation, Foam Types of Fermentation: <ul style="list-style-type: none"> Surface and Submerged; Batch and Continuous, Aerobic and Anaerobic. Product Isolation and Purification. Study of Representative Fermentation Processes: Outline of Penicillin and Ethanol Production by Fermentation along with flow diagram.		15
UNIT III In-vivo and In-vitro Assay of	Assay of Industrial Products: <ul style="list-style-type: none"> Chemical and Biological; Types and Subtypes; Kinetics. Advantages and Disadvantages. Half-Life Determination of Pharmacological 		15

Industrial Products	Products. • Overview of Bioavailability and Bioequivalence Studies		
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SEMESTER-III
Paper-VII RESEARCH METHODOLOGY (UBT3RSM)

Course Objective: The objective of this course is to develop Research Aptitude, Logical Thinking and Reasoning.

Learning Outcome: By the end of the course the student will be able to:

- Understand basic principles of Research Methodology and identify a Research Problem.
- Understand a general definition of Research Design.
- Understand process of Scientific Writing.
- Identify the overall Process of Designing a Research Study from its inception to its Report.

Unit	Title	Credits	Lectures
UNIT I Introduction to Research Methodology and Research Problem	<ul style="list-style-type: none"> • Meaning of Research; Objectives of Research; • Motivation in Research; Types of Research; Research Process; Criteria of Good Research; What is a Research Problem? Selecting the Problem; Necessity of Defining the Problem; Technique Involved in Defining a Problem. Developing a Research Plan, Types of Data and Data collection Methods, Case Study Method 	2	15
UNIT II Research Design, Interpretation and Report Writing	<ul style="list-style-type: none"> • Meaning of Research Design; Need for Research Design; Features of a Good Design; Important Concepts Relating to Research Design; Different Research Designs; Basic Principles of Experimental Designs; • Interpretation and Report Writing • Meaning of Interpretation, Why Interpretation? Technique of Interpretation, Precautions in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports • Oral Presentation 		15
UNIT III Introduction to Scientific Writing	<ul style="list-style-type: none"> • Introduction and Process of Scientific Writing : • Types of Scientific writing, Process of Scientific Writing: Thinking, Planning, Rough Drafts and Revising Contents. 		15

	<ul style="list-style-type: none"> • How to write a research paper and research project proposal? , • Abstract Writing, Main content, • Hour- glass Model of Research paper writing, Review of Literature, Bibliography, • Ethics in Scientific writing and research Publication: Plagiarism-Introduction to Plagiarism, Examples of Plagiarism 		
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PRACTICALS

SEMESTER III		
Course Code	Title	Credits
UBT3PR1 (Practical of UBT3BPH and UBT3APC)	<ol style="list-style-type: none"> 1. Study of Absorption Spectra of Colored Compounds (CuSO₄, KMnO₄). 2. Verification of Beer-Lambert's Law. 3. Extraction of Plasmid DNA and Separation by Agarose Gel Electrophoresis. 4. Determination of Purity of Plasmid DNA using UV Spectrophotometry. 5. Study of the Structure and Function of an Electron Microscope (Visit /Video Demonstration - including Sample Preparation and Staining). 6. Demonstration of Structure and Working of a Fluorescence Microscope (Stained Preparation). 7. Electrophoresis of Proteins by PAGE and SDS-PAGE. 8. Purification of any TWO Organic Compounds by Recrystallization Selecting Suitable Solvent. 9. Organic Estimations: Acetone, Amide, Benzoic Acid. 10. Organic Preparations : <ol style="list-style-type: none"> a. Acetylation of Primary Amine (Preparation of Acetanilide). b. Base Catalyzed Aldol Condensation (Synthesis of Dibenzalpropanone). 	2
UBT3PR2 (Practical of UBT3IMM and UBT3CBC)	<ol style="list-style-type: none"> 1. Complement Fixation Test (CFT). 2. Passive Agglutination- RA Factor Test. 3. Immunoelectrophoresis. 4. ELISA (Kit-based) - HEPALISA. 5. DOT-ELISA. 6. Western Blotting - Demonstration. 7. Flow Cytometry - Lab Visit. 	2

	<ul style="list-style-type: none"> Bioaugmentation and Biostimulation. Monitoring the Efficacy of Bioremediation. 		
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SEMESTER-IV

Paper-V BIOINFORMATICS and BIOSTATISTICS (UBT4BBI)

Course Objective: The objective of this course is learning and understanding basic concepts of Bioinformatics and Biostatistics.

Learning Outcome: By the end of the course the student will be able to:

- Gain an understanding of the basic concepts of Bioinformatics and Biostatistics.
- Understand the tools used in Bioinformatics.
- Apply the various Statistical Tools for Analysis of Biological Data.

Unit	Title	Credits	Lectures
UNIT I Introduction to Computers and Biological Databases	Computer Basics: <ul style="list-style-type: none"> Organization of a Computer; I/O Units; Computer Memory; Processor; Binary Arithmetic, Architecture; Operating System. Internet Basics: <ul style="list-style-type: none"> Connecting to the Internet, E-mail, FTP, www, Difference between www and Internet. Biological Databases: <ul style="list-style-type: none"> Classification of Databases - Raw and Processed Databases; Primary (NCBI), Secondary (PIR) and Tertiary or Composite (KEGG) Databases; Structure and Sequence Databases. Specialized Databases - Protein Pattern Databases; Protein Structure and Classification Databases (CATH/SCOP). Genome Information Resources: <ul style="list-style-type: none"> DNA Sequence Databases Specialized Genomic Resources. Protein Databases based on Composition, Motifs and Patterns. Protein Structure Visualization Software: <ul style="list-style-type: none"> RasMol, Cn3D, Jmol 	2	15 Lectures
UNIT II BLAST and Sequence Alignment	BLAST and Sequence Alignment: <ul style="list-style-type: none"> BLAST and its Types; Retrieving Sequence using BLAST. Pairwise Alignment: <ul style="list-style-type: none"> Identity and Similarity; Global and Local Alignment; Pairwise Database Searching. Multiple Sequence Alignment: <ul style="list-style-type: none"> Goal of Multiple Sequence Alignment; Computational Complexity; Manual 		15 Lectures

	Methods; Simultaneous Methods; Progressive Methods; Databases of Multiple Alignment; Secondary Database Searching, MSA and Phylogenetic Trees.		
UNIT III Biostatistics	Theory and Problems based on: Correlation analysis- <ul style="list-style-type: none"> Coefficient of correlation: Direct, Short-cut method, Spearman's Rank Correlation coefficient, Scatter Diagram Theory and Problems based on: Regression analysis- <ul style="list-style-type: none"> Regression coefficients, Regression lines (Linear Regression X on Y and Y on X). Steps in Testing Statistical Hypothesis Parametric Tests <ul style="list-style-type: none"> Z Test – Single Mean and Two Means, t-Test – Single Mean, Paired and Unpaired; Non-Parametric Tests-Chi-Square Test.		15 Lectures

SEMESTER-IV

Paper-VI MOLECULAR DIAGNOSTICS (UBT4MOD)

Course Objective: The objective of this course is learning and understanding Molecular Techniques and utilizing these techniques in Diagnosis. Learning Outcome: By the end of the course the student will be able to: <ul style="list-style-type: none"> Gain an understanding of the basic Principles used in Molecular Diagnosis. Gain critical thinking and analytical skills to understand new Diagnostic Methods. Apply the knowledge and skills gained in the course should be useful in developing new Diagnostic Kits. 			
Unit	Title	Credits	Lectures
UNIT I Basics of Molecular Diagnostics	<ul style="list-style-type: none"> Overview of Molecular Diagnostics Characterization and analysis of Nucleic Acids and Proteins: <ul style="list-style-type: none"> Extraction, Isolation and Detection of DNA, RNA and Proteins; Restriction Endonucleases and Restriction Enzyme Mapping. Hybridization Techniques: <ul style="list-style-type: none"> Southern, Northern, Western and FISH; Markers, Probes and its Clinical Applications. 	2	15 Lectures
UNIT II Nucleic Acid Amplification Methods	Target amplification: <ul style="list-style-type: none"> PCR - General Principle; Components of a Typical PCR Reaction; Experimental Design; Primer Designing; Control of PCR Contamination and Mispriming; PCR Product Clean-up and Detection. 		15 Lectures

	PCR Types: <ul style="list-style-type: none"> Reverse Transcriptase and Real Time PCR. Probe amplification: <ul style="list-style-type: none"> Ligase Chain Reaction 		
UNIT III Molecular Biology based Diagnostics	DNA Polymorphism and Identification: <ul style="list-style-type: none"> RFLP and Parentage Testing; RFLP and Sickle-Cell Anaemia. Molecular Diagnostics for Infectious Diseases <ul style="list-style-type: none"> Molecular Testing for Neisseria, Molecular Diagnosis for HIV-1; Genetic Counselling and Molecular Diagnosis <ul style="list-style-type: none"> Genetic Testing- Need and Uses; genetic Counselling. Ethical, Social and Legal Issues to Molecular Genetic Testing		15 Lectures

SEMESTER-IV

Paper-VII ENTREPRENEURSHIP DEVELOPMENT (UBT4END)

Course Objective: To develop and systematically apply an Entrepreneurial way of thinking that will allow identification and creation of Business Opportunities. Learning Outcome: By the end of the course the student will be able to: <ul style="list-style-type: none"> Develop an understanding of the systematic process and to select and screen a Business idea. Design strategies for successful implementation of ideas. Write a Business Plan. Understand different forms of Intellectual Property protection 			
Unit	Title	Credits	Lectures
UNIT I Introduction to Entre- preneurship Development	Concept of Entrepreneur; <ul style="list-style-type: none"> Entrepreneurship; Need and Importance; Factors Influencing Entrepreneurship; Essentials of a Successful Entrepreneur 	2	15 Lectures
UNIT II Setting-up, Planning of an Enterprise and Bio business	Setting-up of an Enterprise <ul style="list-style-type: none"> Location of Enterprise; Real Estate and Human Resource Planning, Financial Planning; Role of Government and Financial Institutions in Entrepreneurship Development; Raising Money from Venture Capitalists, Government Grants Preparation of a Business Plan Innovation & entrepreneurship in Bio-business		15 Lectures

	<ul style="list-style-type: none"> • Introduction and scope in Bio-entrepreneurship, types of bio-industries and competitive dynamics between the sub-industries of the bio sector 		
UNIT III Intellectual Property Rights (IPR)	<ul style="list-style-type: none"> • What is Intellectual Property? • Types of IPR, Patents, Copyright, Trademarks, Trade secret, Geographical indications, Traditional knowledge and Protection of undisclosed information. • Registered (Industrial) design, Brand, Logo, Regulatory Affairs, Corporate Law, IPR generation and Protection. • Patenting Biotechnological Inventions. 		15 Lectures

PRACTICALS

SEMESTER III		
Course Code	Title	Credits
UBT4PR1 (Practicals of UBT4BIC and UBT4APC)	<ol style="list-style-type: none"> 1. Determination of Lactate Dehydrogenase (LDH) Activity in Blood Serum. 2. Determination of Total, LDL and HDL Cholesterol in Serum. 3. Organ Function Tests: Liver (SGPT, SGOT); Kidney (Urea from Serum). 4. Estimation of Uric acid and Creatinine in Urine. 5. Qualitative Detection of Ketone Body in Urine. 6. Isolation of Mitochondria and Demonstration of ETC using a Marker Enzyme. 7. Separation of Binary (Solid-Solid) Mixture (Min 4 Compounds). 8. Identification of Organic Compound of Known Chemical Type (Min 4 Compounds). 9. HPLC analysis and interpretation of any one secondary metabolite from plants 10. Analysis of essential oils from any plant source using GC. 11. HPTLC fingerprint analysis of any one medicinally important plant. 12. Chemical and Biological Synthesis of Silver Nanoparticles and its characterisation by UV- Vis Spectrophotometer. 	2

UNIVERSITY OF MUMBAI



Revised Syllabus for T.Y.B.Sc.

Programme- B.Sc.

Course- Biotechnology (USBT)

(Third Year – Sem. V & VI)

(Credit Based Semester and Grading System with effect from
the academic year 2018-2019)

TYBSC Biotechnology Course Structure

Semester V

Course code USBT	Title	Theory /Practical	Marks	Credits	Nos of Lectures & Practical
501	Cell biology	Theory	100	2.5	60
502	Medical Microbiology & Instrumentation	Theory	100	2.5	60
503	Genomes and Molecular Biology	Theory	100	2.5	60
504	Marine Biotechnology	Theory	100	2.5	60
P501+502	Cell biology+ Medical Microbiology & Instrumentation	Practical	100	3.0	72
P503+504	Genomes and Molecular Biology+ Marine Biotechnology	Practical	100	3.0	72
Applied Component	Biosafety	Theory	100	2.0	48
	Biosafety	Practical	100	2.0	48
	TOTAL		800	20	480

Semester VI

Course code USBT	Title	Theory/ Practical	Marks	Credits	Nos of Lectures & Practical
601	Biochemistry	Theory	100	2.5	60
602	Industrial Microbiology	Theory	100	2.5	60
603	Pharmacology and Neurochemistry	Theory	100	2.5	60
604	Environmental Biotechnology	Theory	100	2.5	60
P 601-P 602	Biochemistry& Industrial Microbiology	Practical	100	3	72
P 603-P 604	Pharmacology - Neurochemistry and Environmental Biotechnology (50M)+ Project work (50M)	Practical	100	3	72
Applied component	Agribiotechnology	Theory	100	2.0	48
Applied component	Agribiotechnology	Practical	100	2.0	48
	TOTAL		800	20	480

Teaching pattern:

One (01) Credit would be of thirty- forty (30-40) learning hours; of this more than fifty percent of the time will be spent on class room instructions including practical as prescribed by the University. Rest of the time spent invested for assignments, projects, journal writing, case studies, library work, industrial visits, attending seminars / workshops, preparations for examinations etc. would be considered as notional hours. The present syllabus considers (60L as class room teaching and 15 lectures as Notional hours/ paper). Each lecture duration would be for 48 min

The names of the reference books provided in the syllabus are for guidance purpose only. Students and faculty are encouraged to explore additional reference books, online lectures, videos, science journals for latest/ additional information.

Semester V

Course code USBT	Title	Unit	Topics	Credit	No of Lectures
501	Cell Biology	I: Cell cycle	Cell cycle Introduction: Prokaryotic and Eukaryotic- 3 Lectures ; The Early Embryonic Cell Cycle and the Role of MPF- 4 Lectures ; Yeasts and the Molecular Genetics of Cell-Cycle Control – 4 Lectures ; Apoptosis, Cell-Division Controls in Multicellular Animals- 4 Lectures	2.5	15
		II: Cell Signalling	Cell signalling and signal transduction:Introduction General Principles of Cell Signaling - 3 Lectures ; Signaling via G-Protein-linked Cell-Surface Receptors - 3 Lectures ; Signaling via Enzyme-linked Cell-Surface Receptors - 3 Lectures ; Target-Cell Adaptation, The Logic of Intracellular - 3 Lectures ; Signaling: Lessons from Computer-based "Neural Networks"- 3 Lectures		15
		III: Developmental Biology	Overview of how the modern era of developmental biology emerged through multidisciplinary approaches - 5 Lectures ; Stages of development- zygote, blastula, gastrula, neurula cell fate & commitment – potency- concept of embryonic stem cells, differential gene expression, terminal differentiation ,lineages of three germ layers, fate map - 6 Lectures ; Mechanisms of differentiation- cytoplasmic determinants, embryonic induction, concept of morphogen, mosaic and regulative development Pattern formation-- axis specification, positional identification (regional specification), Morphogenetic movements, Model organisms in Developmental biology - 4 Lectures		15
		IV: Cancer Biology	Cancer: Introduction, Cancer as a Microevolutionary Process - 4 Lectures ; The Molecular Genetics of Cancer - 6 Lectures ; Cancer and Virus Cancer diagnosis and chemotherapy - 5 Lectures		15
		Total			60

Course code USBT	Title	Unit	Topics	Credit	No of Lectures
502	Medical Microbiology and Instrumentation	I: Virology	<p>Introduction to viruses-Position in biological spectrum; Virus properties - 2 Lectures;</p> <p>General structure of viruses Baltimore Classification and Taxonomy(ICTV) - 2 Lectures;</p> <p>Cultivation of viruses - 2 Lectures;</p> <p>Reproduction of ds DNA phages Hepatitis /ss RNA (influenza), animal viruses and plant (TMV)virus - 4 Lectures;</p> <p>Virus purification and assays - 2 Lectures;</p> <p>Cytocidal infections and cell damage - 2 Lectures; Viroids and Prions - 1 Lecture</p>	2.5	15
		II: Chemotherapeutic drugs	<p>Discovery and Design of antimicrobial agents -1 Lecture;</p> <p>Classification of Antibacterial agents, Selective toxicity, MIC, MLC - 2 Lectures</p> <p>Inhibition of cell wall synthesis (Mode of action for): Beta lactam antibiotics: Penicillin, Cephalosporins; Glycopeptides: Vancomycin; Polypeptides: Bacitracin -2 Lectures</p> <p>Injury to Plasma membrane: Polymyxin – 1 Lecture;</p> <p>Inhibition of protein synthesis Aminoglycosides, Tetracyclines Chloramphenicol, Macrolides-Erythromycin- 2 Lectures;</p> <p>Inhibition of Nucleic acid synthesis: Quinolones, Rifampicin, Metronidazole - 2 lectures;</p> <p>Antimetabolites: Sulphonamides, Trimethoprim - 1 lecture;</p> <p>Drug Resistance: Mechanism, Origin and transmission of drug resistance - 1 lecture;</p> <p>Use and misuse of antimicrobial agents - 1 lecture;</p> <p>Antifungal drugs, Antiviral drugs - 2 lectures</p>		15

		III: Spectroscopy	Principle, instrumentation, working and applications of: Fluorescence Spectroscopy - 3 Lectures Luminometry - 3 Lectures Light scattering spectroscopy - 3 Lectures Infrared Spectroscopy - 3 Lectures Atomic absorption Spectroscopy - 3 Lectures		15
		IV: Bio-analytical techniques	Principle, working and applications of: Affinity chromatography - 2 Lectures Ion-exchange chromatography - 2 Lectures Molecular (size) exclusion chromatography - 2 Lectures ; HPLC - Method development and validation- 3 Lectures ; Isotopes in Biology: Nature of radioactivity - 1 Lecture ; Detection Techniques using GM counter, Scintillation counter, autoradiography - 4 Lectures ; Applications of Tracer techniques in Biology - 1 Lecture		15
		Total			60

References:

1. Principles and techniques in biochemistry and molecular biology (2010), Keith Wilson and John Walker, 7th edition, Cambridge University Press
2. Biophysics (2002) Vasantha Pattabhi and N. Gautham, Kluwer Academic Publishers
3. Physical Biochemistry: principles and applications, 2nd edition (2009), David Sheehan, John Wiley & Sons Ltd
4. HPLC method validation for pharmaceuticals: a review (2013), Harshad V. Paithankar, International Journal of Universal Pharmacy and Bio Sciences 2(4): July-August.
5. Mim's Medical Microbiology 5th edition
6. Microbiology by Prescott Harley and Klein 5th edition Mc Graw Hill
7. Medical Microbiology Jawetz, E., Brooks, G.E, Melnick, J.L., Butel, J.S Adelberg E. A 18th edition
8. Medical Microbiology by Patrick Murray 5th edition
9. Foundations In Microbiology by Talaro and Talaro Third edition W.C Brown
10. Understanding Viruses by Teri Shors

Course Code USBT	Title	Unit	Topics	Credit	No. of Lectures
504	Marine Biotechnology	I: Marine Biotechnology-Introduction & Bioprospecting	Introduction to Marine Biotechnology- 1 lecture ; The marine ecosystem and its functioning: intertidal, estuarine, salt marsh, mangrove, coral reef, coastal & deep sea ecosystems. Hydrothermal vents- 4 lectures ; Bioprospecting, Marine Microbial Habitats and Their Biotechnologically relevant Microorganisms- 2 lectures ; Methods for Microbial Bioprospecting in Marine Environments - 2 lectures ; Biotechnological Potential of Marine Microbes - 1 lecture ; Bioactive compounds from other Marine Organisms: fungi, Microalgae, Seaweeds, Actinomycetes, sponges - 5 lectures	2.5	15
		II: Marine Drugs and Enzymes	Drugs from Marine organisms: Pharmaceutical compounds from marine flora and fauna - marine toxins, antiviral and antimicrobial agents - 4 lectures ; Approved Marine Drugs as Pharmaceuticals - 2 lecture ; Marine Natural products and its Challenges - 2 lectures ; Marine Microbial Enzymes- Marine Extremozymes and Their Significance, Current Use of Marine Microbial Enzymes - 7 lectures.		15
		III: Marine Functional foods and Nutraceuticals	Marine Functional Foods: Marine Sources as Healthy Foods or Reservoirs of Functional Ingredients - 3 lectures ; Marine-Derived Ingredients with Biological Properties- 3 lectures ; Functional Foods Incorporating Marine-Derived Ingredients - 2 lectures ; Marine Nutraceuticals : Marine Bioactives as Potential Nutraceuticals, Functional Carbohydrates, Polyunsaturated Fatty Acids- 3 lectures ; Carotenoids, Soluble Calcium, Fish Collagen and Gelatin, Marine Probiotics - 4 lectures.		15
		IV: Marine Bioresources and	Marine Bioresources, Marine Secondary Metabolites, Marine Proteins, Marine Lipids- 4 lectures ; Cosmetics from Marine Sources: Scenario of Marine Sources in the Cosmetic Industry, Cosmetics: Definition and Regulations,		15

		Cosmetics	Cosmeceuticals , Target Organs and Cosmetics Delivery Systems , Components of Cosmetics, Major Functions of Some Marine Components in Cosmetics and Cosmeceuticals , Treatments Based on Marine Resources , Products Based on Marine Resources - 11 lectures.		
		Total			60

References:

1. Kim, S.K. Springer Handbook of Marine Biotechnology; Springer: Berlin, Germany; Heidelberg, Germany, 2015.
2. Nollet, Leo M. L- Marine microorganisms- extraction and analysis of bioactive compounds-CRC Press_Taylor& Francis (2017)
3. R. S. K. Barnes, R. N. Hughes(auth.)-An Introduction to Marine Ecology, Third Edition-Wiley-Blackwell (1999)
4. Blanca Hernández-Ledesma, Miguel Herrero-Bioactive Compounds from Marine Foods-Plant and Animal Sources-Wiley-Blackwell (2013)
5. Fabio Rindi, Anna Soler-Vila, Michael D. Guiry (auth.), Maria Hayes (eds.)-Marine Bioactive Compounds_ Sources, Characterization and Applications-Springer US (2012)
6. W. Evans-Trease and Evans Pharmacognosy 15 th ed.-Saunders (2010)

Course	Title	Unit	Topics	Credits	Lectures
Applied component	Biosafety	I: Introduction to biosafety	Introduction - 1 lecture Biological Risk Assessment, Hazardous Characteristics of an Agent- 2 lectures ; Genetically modified agent hazards - 1 lecture ; Cell cultures - 1 lecture ; Hazardous Characteristics of Laboratory Procedures - 1 lecture ; Potential Hazards Associated with Work Practices – 2 lectures ; Safety Equipment and Facility Safeguards - 2 lectures ; Pathogenic risk and management - 2 lectures	2.0	15
		II: GLP	Concept of GLP- 1 lectures ; Practicing GLP- 1 lecture ; Guidelines to GLP - 2 lectures ; Documentation of Laboratory work - 1 lectures ; Preparation of SOPs - 2 lectures ; Calibration records - 1 lectures ; Validation of methods - 1 lectures ; Documentation of results - 1 lecture ; Audits & Audit reports - 1 lecture .		12
		III: Detection and testing of contaminants	Microbial Contamination in food and pharma product - 3 lectures ; Some common microbial contaminants - 3 lectures ; Microbiological Assays for pharmaceutical products - 4 lectures ; Regulatory Microbiological testing in pharmaceuticals - 3 lectures .		12
		IV: Biosafety in Biotechnology	Concepts on biosafety in Biotechnology - 2 lectures ; Regulating rDNA technology - 2 lectures ; Regulating food and food ingredients - 3 lectures ; Genetically engineered crops, livestock Bioethics - 3 lectures ; Contemporary issues in Bioethics - 2 lectures .		12
		Total			48

Course Code USBT	Title	Unit	Topics	Credit	No. of Lectures
602	Industrial Microbiology	I: Dairy technology	Milk: Normal flora, changes in raw milk - 2 lectures ; Enumeration - 1 lecture ; Factors affecting bacteriological quality - 1 lecture ; Dairy technology Preservation methods - 2 lectures ; Pasteurization- 1 lecture ; Starter Cultures - 2 lectures ; Fermented products-Production process and spoilage of Cheese: Swiss and Cheddar - 2 lectures ; Butter - 2 lectures ; Yogurt - 1 lectures and Buttermilk - 1 lecture .	2.5	15
		II: Down-stream Processing (DSP)	Introduction of DSP - 2 lectures ; Foam separation - 1 lecture ; Types of Precipitation - 1 lecture ; Filtration 2 lectures , Centrifugation - 1 lecture ; Chromatography in DSP - 2 lectures ; Cell disruption- physical and chemical methods - 2 lectures ; Solvent recovery, Membrane processes - 1 lecture ; Drying - 1 lecture ; Crystallization and Whole broth processing - 2 lectures .		15
		III: Fermentation process	Introduction to Inoculum development - 2 lectures ; Bacterial and fungal inoculum development with one example each - 3 lectures , scale up, scale down - 2 lectures ; Production of: Streptomycin - 1 lecture ; Protease - 1 lecture ; Mushroom - 1 lecture ; Glutamic acid - 1 lecture ; Lysine - 1 lecture , ethanol production 1 lecture Semi-synthetic Penicillin 1 lecture , Biotransformation - 1 lecture .		15
		IV: QA-QC	Concept of GMP- 1 Lectures ; Requirements of GMP implementation - 2 Lectures ; Documentation of GMP practices - 2 Lectures ; Regulatory certification of GMP - 2 Lectures ; Quality Control (QC): Concept of QC - 2 Lectures ; Requirements for implementing QC -		15

Course	Title	Unit	Topics	Credit	No. of Lectures
Applied component	Agri Biotechnology	I: Precision Agriculture and Agriculture systems	Introduction to Agriculture and Agriculture systems- 1 Lecture ; Green house Technology-- Types of green house, importance, functions and features of green house, Design criteria and calculation - 2 Lectures ; Construction material, covering material and its characteristics, growing media, green house irrigation system. nutrient management - 3 Lectures ; Greenhouse heating, cooling and shedding and ventilation system, Computer controlled environment - 3 Lectures ;; Phytotrons, fertigation and roof system - 1 Lecture ; Precision Cultivation- tools, sensors for information acquisition - 2 Lectures .	2	12
		II: Plant stress biology	Abiotic stress –Physiological and molecular responses of plants to water stress, salinity stress, temperature stress – heat and cold, Photooxidative stress, stress perception and stress signaling pathways, Ionic and osmotic homeostasis, reactive oxygen species scavenging- 4 Lectures ; Biotic stress - plant interaction with bacterial, viral and fungal pathogens, plant responses to pathogen– biochemical and molecular basis of host-plant resistance , toxins of fungi and bacteria , systemic and induced resistance –pathogen derived resistance, signalling - 8 Lectures .		12
		III: Molecular Markers in Plant Breeding	Genetic markers in plant breeding-- Classical markers, DNA markers (RFLP, RAPD, AFLP, SSR, SNP)- 4 Lectures ; Application of Molecular Markers to Plant Breeding [quantitative trait locus (QTL) mapping] - 4 Lectures ; Plant DNA Barcoding- Barcoding Markers (matK, rbcl, ITS, tmH-psbA), steps, recent advances, Benefits, Limitations - 4 Lectures .		12

		IV: Biofertilizers and Biopesticides	Biofertilizer: Nitrogen-fixing Rhizobacteria - Symbiotic Nitrogen Fixers -2 Lectures; Nonsymbiotic Nitrogen Fixers Plant Growth Promoting Microorganisms-Phosphate-Solubilizing Microbes (PSM), Phytohormones and Cytokinins, Induced Systemic Resistance- 2 Lectures; Plant Growth Promotion by Fungi-- Mycorrhizae Arbuscular Mycorrhizae Ectomycorrhizae -2 Lectures; Microbial Inoculants -- Inocula, Carriers, and Applications, Monoculture and Co-culture Inoculant Formulations Biocontrol, Polymicrobial Inoculant Formulations- 3 Lectures; Biopesticides – types, Bacillus thuringiensis, insect viruses and entomopathogenic fungi (characteristics, physiology, mechanism of action and application) -3 Lectures.		12
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References:

1. M. Ajmal Ali, G. Gyulai, F. Al-Hemaid -Plant DNA Barcoding and Phylogenetics, LAP Lambert Academic Publishing (2015)
2. P. Parvatha Reddy (auth.)-Sustainable Crop Protection under Protected Cultivation- Springer Singapore (2016)
3. S.B. Anderson (ed.), Plant Breeding from Laboratories to Fields, InTech,2013
4. Henry Leung, Subhas Chandra Mukhopadhyay (eds.) - Intelligent Environmental Sensing (2015, Springer International Publishing)
5. Travis R. Glare, Maria E. Moran-Diez - Microbial-Based Biopesticides_ Methods and Protocols (2016, Humana Press)
6. Altieri, Miguel A.Farrell, John G-Agroecology- The Science Of Sustainable Agriculture, Second Edition-CRC Press (2018)
7. Arie Altman, Paul Michael Hasegawa-Plant Biotechnology and Agriculture_ Prospects for the 21st Century-Academic Press (2011)



Janardan Bhagat Shikshan Prasarak Sanstha's

CHANGU KANA THAKUR
ARTS, COMMERCE & SCIENCE COLLEGE, NEW PANVEL
(AUTONOMOUS)

Re-accredited 'A+' Grade by NAAC

'College with Potential for Excellence' Status Awarded by UGC

'Best College Award' by University of Mumbai

Affiliated to University of Mumbai with an autonomous Status

Revised Syllabus of

Program: M.Sc. Biotechnology

M.Sc. Part-I

(Semester I & II)

Choice Based Credit & Grading System (60:40)

(To be implemented from Academic Year 2019-2020)

Preamble:

Master of Science (M.Sc.) Programme in Biotechnology is a P.G. Programme of Department of Biotechnology, Changu Kana Thakur Arts, Commerce & Science College, New Panvel, affiliated to University of Mumbai with an Autonomous status. Biotechnology is technology based on biology. Biotechnology harnesses cellular and bio-molecular processes to develop technologies and products that help to improve our lives and the health. Modern biotechnology provides breakthrough products and technologies to combat debilitating and rare diseases, reduce our environmental footprint, feed the hungry, cleaner energy, and have safer, cleaner, and more efficient industrial manufacturing processes.

The Choice Based Credit and Grading System (CBCGS) to be implemented through this curriculum would allow students to develop a strong footing in the fundamentals and specialize in the disciplines of his/her liking and abilities. The proposed credit-based curriculum and grading system will even add much more to the existing interdisciplinary nature of biotechnology.

Under the 'autonomy' we have made an attempt to design Master's in Biotechnology course syllabus to cater to the needs of credit based- semester and grading system. The changing scenario of higher education in India and abroad is taken into consideration to make this syllabus more oriented towards current need of modern research and industrial sectors. The syllabus encompasses the fundamental academics at one end and latest technologies in life science at the other. Theory courses will help students develop their knowledge sets on various topics of biotechnology, to which, they are introduced at the undergraduate level. Extensive practical courses are designed to supplement the theory courses with hands on experimentation in wet-lab and on fields.

At the post graduate level they will be exposed to the advanced principles of biochemistry, molecular and cell biology, bioinformatics, Biostatic, Nanotechnology etc. along with technological advances and applications of basic principles to successfully carry out research and industrial developments. A research project/ industrial training modules are incorporated to provide a buffer zone for budding biotechnologists eager to enter the life science sector.

M.Sc. Biotechnology Course Structure

Semester I

Course code PSBT	Title	Theory /Practical	Marks	Credits	Nos of Lectures/ week
PBT1BC1	Biochemistry	Theory	100	4	4
PBT1IM2	Immunology	Theory	100	4	4
PBT1CB3	Cell Biology	Theory	100	4	4
PBT1GE4	Genomics and Emerging Technologies	Theory	100	4	4
PBT1PR-1	Practical- I (Paper-I &IV)	Practical	100	4	8
PBT1PR-2	Practical –II (Paper-II &III)	Practical	100	4	8
		TOTAL	600	24	32

Semester II

Course code PSBT	Title	Theory /Practical	Marks	Credits	Nos of Lectures/ week
PBT2BB1	Bioinformatics and Biostatistics	Theory	100	4	4
PBT2PA2	Plant and Animal Biotechnology	Theory	100	4	4
PBT2BE3	Bioprocess Engineering and Technology	Theory	100	4	4
PBT2IP4	Intellectual property rights and Bioethics	Theory	100	4	4
PBT2PR-1	Practical- I (Paper-I &III)	Practical	100	4	8
PBT2PR-2	Practical –II (Paper-II &IV)	Practical	100	4	8
		TOTAL	600	24	32


M.Sc. Biotechnology



Semester –I


Paper-IV- Genomics and Emerging Technologies (PBT1GE4)

Unit	Topics	Credits	Number of lectures
Course Objectives The objectives of this course are to provide introductory knowledge concerning genomics, proteomics and their applications. The objectives of this course are to teach basics of the new principles to students so as to appreciate current-day research tool-kit better.			
Student Learning Outcomes : Students should be able to acquire knowledge and understanding of fundamentals of genomics and proteomics, transcriptomics and metabolomics and their applications in various applied areas of biology. Students should be to learn history, theoretical basis, and basic understanding of latest technologies in area of biotechnology with applications of these technologies.			
Unit-I Regulation of Genome Activities	Transient changes in genome activity, permanent and semi-permanent changes. Regulation of genome activity during development: sporulation in <i>Bacillus</i> , Vulva development in <i>C.elegance</i> and development in <i>Drosophila melanogaster</i> .	4	15
Unit-II Genome Editing Technologies	Principles for maximizing gene expression: Expression vectors; pMal; GST; pET-based vectors; Protein purification; His-tag; GST-tag; MBP-tag <i>etc.</i> ; Intein-based vectors; Baculovirus and <i>Pichiavectors</i> system. Principle and application of gene silencing. Introduction to methods of genetic manipulation in different model systems <i>e.g.</i> fruit flies (<i>Drosophila</i>), worms (<i>C. elegans</i>), frogs (<i>Xenopus</i>), fish (zebra fish) and chick. Transgenics- gene replacement; gene targeting; creation of transgenic and knock-out mice; disease model.		15

M.Sc. Biotechnology
Semester –II
Bioinformatics and Biostatistics (PBT2BB1)

Unit	Topic	Credits	Number of lectures
Course Objectives: The objective of this course is to give conceptual exposure of essential contents of statistics to students and to provide theory and practical experience of the use of common computational tools and databases which facilitate investigation of molecular biology and evolution-related concepts.			
Student Learning Outcomes : Student should be able to : To Gain broad understanding in statistics and approach to problem solving, on a diverse variety of disciplines. To Gain working knowledge of these computational tools and methods.			
Unit -I Basics of Bioinformatics and DNA sequence analysis	Bioinformatics basics: Computers in biology and medicine. Introduction to Unix and Linux systems and basic commands; Database concepts; Protein and nucleic acid databases; Structural databases; Biological XML DTD's; pattern matching algorithm basics; Databases and search tools: biological background for sequence analysis; Identification of protein sequence from DNA sequence; searching of databases similar sequence; NCBI; publicly available tools; resources at EBI; resources on web; database mining tools. DNA sequence analysis: gene bank sequence database; submitting DNA sequences to databases and database searching; sequence alignment; pairwise alignment techniques; motif discovery and gene prediction; local structural variants of DNA, their relevance in molecular level processes, and their identification; assembly of data from genome sequencing.	4 	15



<p>Unit -II Multiple sequence alignments and protein modelling</p>	<p>Multiple sequence analysis; multiple sequence alignment; flexible sequence similarity searching with the FASTA3 program package; use of CLUSTALW and CLUSTALX for multiple sequence alignment; submitting DNA protein sequence to databases: where and how to submit, SEQUIN, genome centres; submitting aligned sets of sequences, updating submitted sequences, methods of phylogenetic analysis. Protein modelling: introduction; force field methods; energy, buried and exposed residues; side chains and neighbors; fixed regions; hydrogen bonds; mapping properties onto surfaces; fitting monomers; RMS fit of conformers; assigning secondary structures; sequence alignment- methods, evaluation, scoring; protein completion: backbone construction and side chain addition; small peptide methodology; protein displays; substructure manipulations, annealing.</p>		<p>15</p>
<p>Unit -III Biostatistics</p>	<p>Introduction and Scope of statistics in biological studies and basic concepts.</p> <p>Collection of data, by different sampling methods: Simple random sampling stratifies random sampling and systemic sampling. Measures of central tendency; Mean, Median and Mode.</p> <p>Measures of Dispersion: Variance/ standard deviation, coefficient of variation.</p> <p>Confidence limits for mean and proportion.</p> <p>Probability and Basic concepts: Normal and binomial distribution. Correlation and regression analysis for a bivariate data: Scatter diagram.</p>		<p>15</p>



Unit -IV Biostatistics	<p>Test of Hypothesis: Null hypothesis, alternate hypothesis, test statistics, Type I and Type II errors, Level of significance and critical region.</p> <p>Z test: for a single sample, two samples, and two sample proportion.</p> <p>t-test a single sample, two samples and testing the significance of the correlation. Coefficient: t paired test.</p> <p>χ^2 test: As a goodness of fit and in 2x2 contingency test</p>		15
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References:

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2. Mount, D. W. (2001). Bioinformatics: Sequence and Genome Analysis. Cold Spring Harbor, NY: Cold Spring Harbor Laboratory Press.
3. Baxevanis, A. D. & Ouellette, B. F. (2001). Bioinformatics: a Practical Guide to the Analysis of Genes and Proteins. New York: Wiley-Interscience.
4. Pevsner J. (2015); Bioinformatics and Functional Genomics. Hoboken, NJ: Wiley-Blackwell.
5. Bourne, P. E., & Gu, J. (2009). Structural Bioinformatics, Hoboken, NJ: Wiley-Liss.
6. Lesk, A. M. (2004). Introduction to Protein Science: Architecture, Function, and Genomics. Oxford: Oxford University Press.
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8. Wayne W. Daniel Biostatistics: A foundation For Analysis In Health Sciences (7th Edition 1999) John Wiley & Sons Inc.
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11. E. A. Shortliffe: Computer Based Decision Making in Medicine American Elsevier.
12. David W. Mount Bioinformatics: Sequence and Genome Analysis (Second Edition 2004). Coldspring Harbor Laboratory Press

M.Sc. Biotechnology
Semester –II
Plant and Animal Biotechnology (PBT2PA2)



Unit	Topic	Credit	Number of lectures
Course Objectives: The objectives of this course are to provide hands-on training in basic experiments of plant and animal biotechnology.			
Student Learning Outcomes: On completion of course, students should be able to gain basic skills in plant and animal biotechnology			
Unit-I Plant Tissue Culture	<p>Plant tissue culture: historical perspective; organogenesis; Somatic embryogenesis; establishment of cultures –Micropropagation; somaclonal variation; androgenesis and its applications in genetics and plant breeding;</p> <p>Germplasm conservation and cryopreservation; synthetic seed production.</p> <p>Protoplast culture and somatic hybridization - protoplast isolation; culture and usage; somatic hybridization - methods and applications; cybrids and somatic cell genetics.</p> <p>Plant cell cultures for secondary metabolite production. Hairy root culture.</p>	<p>4</p> 	15
Unit-II Animal Cell Culture	<p>Animal cell culture: brief history of animal cell culture; culture of mammalian cells, tissues and organs; primary culture, secondary culture, continuous cell lines, suspension cultures; application of animal cell culture for virus isolation and <i>in vitro</i> testing of drugs, testing of toxicity of environmental pollutants in cell culture.</p> <p>Application of cell culture technology in production of human and animal viral vaccines and pharmaceutical proteins.</p>		15


Unit-III Animal Reproductive Biotechnology	<p>Animal reproductive biotechnology: structure of sperms and ovum; cryopreservation of sperms and ova of livestock; artificial insemination; super ovulation, embryo recovery and <i>in vitro</i> fertilization; culture of embryos; cryopreservation of embryos; embryo transfer technology; transgenic manipulation of animal embryos.</p> <p>Applications of transgenic animal technology; animal cloning - basic concept, cloning for conservation for conservation endangered species.</p>		15
Unit-IV Molecular Mapping And Marker Assisted Selection Plant Genetic Manipulations	<p>Molecular Mapping: Molecular polymorphism, RFLP, RAPD, STS, AFLP, SNPmarkers; Construction of genetic and physical map; Gene mapping and cloning; QTL mapping and cloning.</p> <p>Marker Assisted Selection (MAS): Quantitative and qualitative traits; MAS for genes of agronomic importance, e.g. insect resistance, grain quality and grain yield.</p> <p>Strategies for Introducing Biotic and Abiotic Stress Resistance/Tolerance: Viral resistance; Fungal resistance; Insects and pathogens resistance; Drought, salinity, thermal stress, flooding and submergence tolerance.</p> <p>Chloroplast transformation; Molecular pharming: concept of plants as biofactories, production of industrial enzymes and pharmaceutically important compounds.</p>		15

References

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3. Glick, B. R., & Pasternak, J. J. (2010). Molecular Biotechnology: Principles and Applications of Recombinant DNA. Washington, D.C.: ASM Press.

M.Sc. Biotechnology
Semester –II
Bioprocess Engineering and Technology (PBT2BE3)

Unit	Topics	Credit	Number of lectures
Course Objectives: The objectives of this course are to educate students about the fundamental concepts of bioprocess technology and its related applications, thus preparing them to meet the challenges of the new and emerging areas of biotechnology industry.			
Student Learning Outcomes: Students should be able to: Appreciate relevance of microorganisms from industrial context. Give an account of design and operations of various fermenters. Give an account of important microbial/enzymatic industrial processes in food and fuel industry.			
Unit-I Basic Principles of Biochemical Engineering	Sources of Microorganisms used in Biotechnology: Literature search and culture collection supply, Isolation de novo of organisms producing metabolites of economic importance. Strain Improvement: Selection from naturally occurring variants, Manipulation of the genome of industrial organisms in strain improvement Bioreactor design and analysis: upstream processing: media formulation and optimization; sterilization; aeration, agitation and heat transfer in bioprocess; scale up and scale down; measurement and control of bioprocess parameters, fermentation economics.	4  	15

	<p>production and applications in food preservation Nisin</p> <ul style="list-style-type: none"> • Microbial production of colors and flavors. • Polyhydric alcohols low-calorie sweetener and is particularly useful for sweetening food products for diabetics • Microbial exopolysaccharides production of Xanthan gum • Process Food wastes- for bioconversion to useful products (Compost, biofuels, biomass cheap source of raw material in fermentation etc). 		
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References:

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2. Stanbury, P. F., & Whitaker, A. (2010). Principles of Fermentation Technology. Oxford: Pergamon Press.
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5. Lee, Y. K. (2013). Microbial Biotechnology: Principles and Applications. Hackensack, NJ: World Scientific.
6. Alexander N. Glazer and Hiroshi Nikaido -Microbial Biotechnology: Fundamentals of Applied Microbiology, 2nd Edition.
7. Michael Wailes and Morgan, Rockney and Highton -Industrial microbiology : An Introduction.
8. Robert Whitehurst and Maarten Van Oort - Enzymes in food technology 2nd ed
9. Nduka Okafor Modern industrial microbiology and biotechnology Science Publishers, Enfield, NH, USA (2007).
10. Immobilized enzymes- An introduction and application in biotechnology- Michael Trevan, John Wiley sons (1980).
11. Fundamentals of enzymology-NC Price and L Stevens.
12. Methods in Enzymology Ed by K. Mosbach Vol 44 (1976), Vol 135, 135a (1987).

M.Sc. Biotechnology
Semester –II
Intellectual Property Rights and Bioethics (PBT2IP4)

Unit	Topic	Credits	Number of lectures
Course Objectives: The objectives of this course are: <ul style="list-style-type: none"> To provide basic knowledge on intellectual property rights and their implications in biological research and product development To become familiar with India's IPR Policy To learn biosafety and risk assessment of products derived from biotechnology and regulation of such products;- To become familiar with ethical issues in biological research. This course will focus on consequences of biomedical research technologies such as cloning of whole organisms, genetic modifications, DNA testing. 			
Student Learning Outcomes: On completion of this course, students should be able to: <ul style="list-style-type: none"> Understand the rationale for and against IPR and especially patents; Understand why India has adopted an IPR Policy and be familiar with broad outline of patent regulations; Gain knowledge of biosafety and risk assessment of products derived from recombinant DNA research and environmental release of genetically modified organisms, national and international regulations. 			
Unit- 1 Introduction to IPR	Introduction to intellectual property; types of IP: patents, trademarks, trade secrets, copyright & related rights, industrial design, geographical indications, Biodiversity importance and legislation, International convention and treaties; plant variety protection and farmer's rights act. , traditional knowledge.	4	15
Unit -2 Patents	<p>Basics of patents: eligibility criteria, classification of patents, categories, special patents, and patenting biological products.</p> <p>Patentable and Non-patentable inventions in India and abroad. Process of Patenting, Patent Search, and Inventor's homework, drafting patent applications, patenting systems.</p> <p>Rights of the patent holder, assignment and licensing of patents and patent Infringement, case studies. Patent Agent.</p>		15



Unit -3 Patentability of Biotechnology Inventions	<p>Patentability of Biotechnology Inventions in India, Statutory Provisions Regarding Biotechnological Inventions Under the Current Patent Act 1970 (as Amended 2005). Biotechnological Inventions as Patentable Subject Matter, Territorial Nature of</p> <p>Patents,; From Territorial to Global Patent Regime, Interpreting TRIPS in the Light of Biotechnology Inventions, Feasibility of a Uniform Global Patent System, Merits and Demerits of Uniform Patent Law, Relevance of the Existing International Patent, Tentative Harmonisation Efforts, Implications of Setting up a Uniform World Patent System. This is purely hypothetical and only of academic interest.</p>		15
Unit- 4 Bioethics	<p>Introduction, bioethics in health care- euthanasia, artificial reproductive technologies, prenatal diagnosis, genetic screening, gene therapy, organ transplantation. Ethics of clinical research, Bioethics in research – cloning and stem cell research, Human, and animal experimentation, Agricultural biotechnology - Genetically engineered food, environmental risk, labelling and public opinion. Bioterrorism.</p>		15

References:

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4. Padma Nambisan (Auth.) - An Introduction to Ethical, Safety and Intellectual Property Rights Issues in Biotechnology- Academic Press (2017)
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Janardan Bhagat Shikshan Prasarak Sanstha's



**CHANGU KANA THAKUR
ARTS, COMMERCE & SCIENCE COLLEGE, NEW PANVEL
(AUTONOMOUS)**

Re-accredited 'A+' Grade by NAAC
'College with Potential for Excellence' Status Awarded by UGC
'Best College Award' by University of Mumbai

Affiliated to University of Mumbai with an autonomous Status

**Revised Syllabus of
Program: M.Sc. Biotechnology
M.Sc. Part-II
(Semester III & IV)
Choice Based Credit & Grading System (60:40)**

(To be implemented from Academic Year 2020-2021)

Preamble:

Master of Science (M.Sc.) Programme in Biotechnology is a P.G. Programme of Department of Biotechnology, Changu Kana Thakur Arts, Commerce & Science College, New Panvel, affiliated to University of Mumbai with an Autonomous status. Biotechnology is technology based on biology. Biotechnology harnesses cellular and bio-molecular processes to develop technologies and products that help to improve our lives and the health. Modern biotechnology provides breakthrough products and technologies to combat debilitating and rare diseases, reduce our environmental footprint, feed the hungry, cleaner energy, and have safer, cleaner, and more efficient industrial manufacturing processes.

The Choice Based Credit and Grading System (CBCGS) to be implemented through this curriculum would allow students to develop a strong footing in the fundamentals and specialize in the disciplines of his/her liking and abilities. The proposed credit-based curriculum and grading system will even add much more to the existing interdisciplinary nature of biotechnology.

Under the 'autonomy' we have made an attempt to design Master's in Biotechnology course syllabus to cater to the needs of credit based- semester and grading system. The changing scenario of higher education in India and abroad is taken into consideration to make this syllabus more oriented towards current need of modern research and industrial sectors.

The present M.Sc. Biotechnology Second Year (Semester III and IV) syllabus is based on the remodeled M.Sc. Biotechnology Curriculum, May 2017, Department of Biotechnology, Ministry of Science and Technology, Government of India and revised syllabus of University of Mumbai. Syllabus is robust and well-designed to enable students to pursue high quality research or increase employability of the students. Online course component has been introduced in the curriculum in keeping with the digital initiatives of MHRD to provide good quality self-learning content through MOOCs under SWAYAM and allied platforms. It is hoped that the revised syllabus shall serve its objective of promoting outcome-based learning to meet the changing needs of the biotechnology sector.

M.Sc. Biotechnology Course Structure

Semester III

Course code PSBT	Title	Theory /Practical	Marks	Credits	Nos of Lectures / week
PBT3AVM	Applied Virology and Microbiology	Theory	100	4	4
PBT3EBT	Environmental Biotechnology	Theory	100	4	4
PBT3BRA	Biologics and Regulatory Affairs	Theory	100	4	4
PBT3MET	Molecular Enzymology and Enzyme Technology	Theory	100	4	4
PBT3PR1	Practical- I (Paper-I &IV)	Practical	100	4	8
PBT3PR2	Practical –II (Paper-II &III)	Practical	100	4	8
		TOTAL	600	24	32

Semester IV

Course code PSBT	Title	Theory /Practical	Marks	Credits	Nos of Lectures / week
PBT4NBT	Nanobiotechnology	Theory	100	4	4
PBT4OSB	OMICS & Systems Biology	Theory	100	4	4
PBT4DDC	Drug Discovery & Clinical Study	Theory	100	4	4
PBT4SWF	Scientific Writing & Food Biotechnology	Theory	100	4	4
PBT4PR1	Practical- I (Paper-I &II)	Practical	100	4	8
PBT4PR2	Practical –II (Paper-III &IV)	Practical	100	4	8
		TOTAL	600	24	32

Teaching pattern: One (01) Credit would be of thirty-forty (30-40) learning hours; of this, more than fifty per cent of the time will be spent on classroom instructions including practical as prescribed by the University. Rest of the time would be invested for assignments, projects, journal writing, case studies, library work, industrial visits, attending seminars/workshops, preparations for examinations etc. would be considered as notional hours. The present syllabus considers (60L as classroom teaching and 15 lectures as Notional hours/ paper). Each lecture duration would be for 60 min. The names of the reference books provided in the syllabus are for guidance purpose only. Students and faculty are encouraged to explore additional reference books, online lectures, videos, science journals for latest/ additional information.

Eligibility: As per University of Mumbai Rules

Scheme of Examinations: (a) Internal assessment of 40 marks per course per semester should be conducted. (b) External assessment of 60 marks per course per semester at the end of every semester (c) Practical examination of 200 marks should be conducted at the end of every semester.

A) Internal Assessment: 40 %

40 Marks

Sr. No.	Particular		Marks
01	One periodical class test / online examination to be conducted in the given semester		20 Marks
02	One case study (clinical case/trial study report for paper III) /review / project with presentation based on curriculum to be assessed by the teacher concerned		15 Marks
	Presentation	10 Marks	
	Written Document	05 Marks	
03	Active participation in routine class instructional deliveries and overall conduct as a responsible learner, mannerism and articulation and exhibit of leadership qualities in organizing related academic activities		05 Marks

	Semester -IV	
	a. FOR PAPER 4: The internal assessment will comprise of the following: Online course: The student is expected to complete at least one online course relevant for the subject from any of the appropriate reputed online platforms. A proof of successful completion of the online course must be provided for the award of marks. /TEST	20 Marks
	b. Research Proposal: The student is expected to submit a research proposal relevant to the subject	20 Marks

Question Paper Pattern
(Periodical Class Test for the Courses at Under Graduate Programs)

Maximum Marks: 20

Duration: 40 Minutes

Questions to be set: 02

All Questions are Compulsory

Question No.	Particular	Marks
Q-1	Match the Column / Fill in the Blanks / Multiple Choice Questions/ Answer in One or Two Lines (Concept based Questions) (1 Marks / 2 Marks each)	10 Marks
Q-2	Answer in Brief (Attempt any Two of the Three) (5 Marks each)	10 Marks

B) Semester End Examination: 60 % 60 Marks Duration: 2 $\frac{1}{2}$ hours
Question Paper Pattern

Theory question paper pattern
1. There shall be five questions each of 12 marks. 2. All questions shall be compulsory with internal options. 3. Question may be subdivided into sub-questions a, b, c... and the allocation of marks depends on the weightage of the unit.

Passing Standard:

The learners shall have to obtain a minimum of 40% marks in aggregate for each course where the course consists of Internal Assessment and Semester End Examination. The learners shall obtain minimum of 40% marks (i.e. 16 out of 40) in the Internal Assessment and 40% marks in Semester End Examination (i.e. 24 Out of 60) separately, to pass the course and minimum of grade D in each project wherever applicable to pass a particular

Practical Examination Evaluation scheme (50 marks per paper)

SL. No.	Questions	MARKS
1.	Practical Question 1	25
2.	Practical Question 2	15
3.	Journal	05
4.	Viva Voce	05
OR		
1.	Practical Question	40
2.	Journal	05
3.	Viva Voce	05
	Semester IV- Project Dissertation	100
<ul style="list-style-type: none">For semester IV it is mandatory for students to undergo Hands-on Project training in an established research laboratory or college laboratory for 4-6 months; This should involve one or more relevant instrumentation technique.Thesis on the same to be evaluated by the guide alternatively by an internal examiner for 50M based on the student's performance, written matter and experimentation.A certificate must be appended with the thesis. The external examiner will assess for 50M as a Presentation during practical exams. Marks allotted by Internal examiner would be scaled down if required as per university guidelines		

The practical examinations at a center would be evaluated by one external examiner assigned by the University and one internal examiner assigned by the college/department.

Semester-III

M.Sc. Biotechnology
Semester –III
Paper-I Applied Virology & Microbiology (PBT3AVM)

Course Objectives:	<ul style="list-style-type: none"> Students will be exposed to pandemic diseases, significance of epidemiology in studying various diseases and societal & economic issues related to such diseases. Students will also learn details about emerging viral, bacterial, parasitic pathogens. Students will learn advanced, automated methods for determining antimicrobial susceptibility, drug resistance and various aspects of biofilms 		
Course Outcomes:	<ul style="list-style-type: none"> Students will understand epidemiological principles in prevention, control and management of pandemic disease. They will acquire understanding of antimicrobial resistance for management of drug resistance in population. Students will understand the different aspects of biofilm and their management. They will also get insights into latest development of diagnostics & therapeutics for such diseases. 		
Units	Topics	Credit	Lectures
Unit-I Pandemic Diseases, Pathogenesis, Diagnosis and Treatment	<ul style="list-style-type: none"> Introduction to Pandemic diseases and causative agent like H1N1, MERS, SARS, Swine flu, COVID-19, Nipah virus, Ebola virus. Structure of these virus-coat and envelope protein, genome composition. Pathogenesis (Mechanism of infection) and Acute Clinical manifestations (Signs and symptoms) of H1N1, MERS, SARS, Swine flu, COVID-19, Nipah virus, Ebola virus. Diagnosis, and Treatment for H1N1, MERS, SARS, Swine flu, COVID-19, Nipah virus, Ebola virus. Economic and Social loss due to t Viruses. 	4	15

Unit- II Epidemiology of Infectious Diseases	<ul style="list-style-type: none"> • Concept of Host, Reservoir, Source of infection, Carrier, Epidemic, Endemic, Pandemic, Outbreak • History, Definition scope, importance of epidemiology • Epidemiology, Health & Public Health • Epidemiological principles in prevention & control of disease • Measures of disease frequency – Concept of incidence, prevalence, Incidence rate, cumulative incidence, case fatality • Epidemiological studies Organizations in disease control & Research – WHO, CDC, UNICEF, NACO, ICMR, NARI, NIV & NGOs 		15
Unit- III Medical Microbiology	<ul style="list-style-type: none"> • Emerging Pathogens / Infections: Diseases caused by Bacteria / parasites/ viruses- Name of causative agent, Name of disease caused, History, Antigenic structure, virulence factors, source of infection, Transmission, Pathogenesis, Clinical manifestations, Laboratory diagnosis, Treatment, Prophylaxis, vaccines, Current research and developments • Bacteria as emerging pathogens / Diseases caused by bacteria: MOTT, Legionella, Conditions caused by <i>Helicobacter pylori</i> • Viruses as emerging pathogens / Diseases caused by viruses: HIV (AIDS), Chikungunya, Dengue, • Parasites as emerging pathogens / Diseases caused by parasites: Malaria, <i>Entamoeba histolytica</i> (Amoebic dysentery) 		15
Unit- IV Biofilms & Antimicrobial Activity	<ul style="list-style-type: none"> • Structure of Biofilm – Extracellular polymeric substances, Biofilm architecture. • Stages in formation of Biofilm. • Microbial interactions in Biofilms (Quorum sensing) Need for formation of Biofilms by microorganisms. • Microorganisms commonly associated with biofilms on indwelling medical devices 		15

	<p>Response of biofilms to host defense mechanisms & antimicrobial agents</p> <ul style="list-style-type: none"> • Recent advances in biofilm management. • Conventional methods of drug susceptibility testing (Kirby-Bauer disc diffusion, Stoke's method, E test) • Advanced methods- Macro & Micro broth dilution methods, Time kill curves, serum killing curves and checker-board assays. • Detection of drug resistance in Staphylococci, Streptococci, Enterococci. Automated methods of sensitivity testing. Concept of CLSI standards. 		
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References:


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2.	Basic Epidemiology R. Bonita, Beaglehole, T. Kjellstrom, 2nd Edition, 2006, WHO.
3.	Principles of Epidemiology in Public Health Practice, Third edition, US Department of Health & Human Services, CDC, 2012.
4.	Martin Rusnák, Viera Rusnáková, Georges Kamto,,: Relations Between Epidemiology and Public Health, 2018 https://www.researchgate.net/publication/323964710
5.	Evaluation and use of Epidemiological evidence for environmental health risk assessment guideline document World Health Organization 2000 eur/00/5020369
6.	Ananthanarayan and Paniker's Textbook of Microbiology, by Reba Kanungo, 10th ed Universities Press; Tenth edition, 2017
7.	Koneman's Colour Atlas & Textbook of Diagnostic microbiology, 7th edition, 2017, Lippincott, Williams & Wilkins.
8.	Mackie & McCartney Medical Microbiology, J. G. Collee, J. P. Duguid, A. G. Fraser, B. P. Marmion, Thirteenth edition, Churchill Livingstone
9.	Bailey and Scotts Diagnostic Microbiology Forbes, Sahem et al 12th ed, Mosby

Unit- II Production of Biologics and Biosimilar s	<ul style="list-style-type: none"> • Reference Biologic and its significance, Choice of expression system/s and stability of cell lines Development of upstream and downstream processes and scale up to manufacturing. • Major factors contributing to the maintenance of product quality: raw materials and manufacturing conditions, virus filtration, mycoplasma removal, ultrafiltration. • Example: Production of Monoclonal antibody, downstream processing of Mab Introduction to the concept of Biobetters vs Biosimilars. 		15
Unit- III Characteriza tion of Biologics and Biosimilars	<ul style="list-style-type: none"> • Appearance, particulates, pH, osmolality, particle size Molecular Weight, Protein Sequence and/or amino acid composition Glycosylation, Sialylation, Phosphorylation, Acetylation, and Myristoylation, if any Sulfhydryl groups(s) and di-sulphide bridges. • Size and Purity on HPLC/ MALDI Isoform pattern, Gel electrophoresis (IEF, SDS PAGE and Native PAGE), Western blot Fluorescence spectrum FTIR spectrum and NMR spectrum Bioassays, characterization using Monoclonal Antibody as an example. 		15
Unit- IV Quality Assurance & Regulatory Affairs of Biologics and Biosimilars	<ul style="list-style-type: none"> • Introduction to Regulatory Affairs and approvals of Biosimilars, Products approved under the FD&C. • PHS/BCPI Act 2009: Innovator Biologics Approval, Biosimilar Pathway, Totality of Evidence, Information required to demonstrate biosimilarity, Inter changeability, Product Switching, Product Naming Global regulatory framework. 		15

M.Sc. Biotechnology

Semester –III

Paper-IV-Molecular Enzymology and Enzyme Technology (PBT3MET)

Course Objectives	<ul style="list-style-type: none">• To get familiarity with the basic concepts of enzymes like enzyme kinetics, catalytic power of enzymes, active site and transition state, regulatory and allosteric enzymes, on protein enzymes.• Techniques of enzyme purification and its importance. Need for enzyme engineering and its benefits and applications.• Role of enzymes as a diagnostic tool and for industrial applications. Use of enzymes as Biosensors.		
Course Outcomes	<ul style="list-style-type: none">• Enzyme deficiencies and use of enzymes as therapeutics. At the end of the course the student will be aware of the enzyme kinetics, the catalytic power of an enzyme, changes in the active site, and the importance of the transition state. The importance of obtaining enzymes in their pure form and the ways it can be achieved. The need for and methods for enzyme engineering to enhance its activity or half-life.• The significance of enzymes as diagnostic tools, in therapy, industrial application and as biosensors; and the outcome of enzyme deficiencies.		
Unit	Topics	Credits	Lectures
Unit-I Basic concepts of Enzymology	<ul style="list-style-type: none">• Brief history and introduction; chemical nature and properties of enzymes;• how enzymes work-mechanism of action; catalytic power and specificity of enzymes; types of catalysis; active site; transition state and evidence for enzyme transition state complementarity; enzyme kinetics – factors affecting enzyme activity; enzyme inhibition; enzyme specificity;• Regulatory enzymes, regulation of enzyme activity; allosteric enzymes and their kinetic properties; units of enzymes; non protein enzymes.	4	15
Unit-II Techniques of Enzyme Purification and Studies /Enzyme Engineering	<div> Purification and Characterization: Based on molecular size (Dialysis/ ultrafiltration, density gradient centrifugation, size exclusion chromatography);</div> <ul style="list-style-type: none">• based on solubility of proteins (Isoelectric precipitation, salting out); Based on electric charge		15

	<ul style="list-style-type: none"> (Ion exchange chromatography, Electrophoresis-capillary electrophoresis, 2D electrophoresis); Based on adsorption properties (Adsorption and Affinity chromatography). Other techniques: Immobilized metal ion affinity chromatography, Hydrophobic interaction chromatography, Reversed-phase chromatography and Chromato-focusing. <p>Enzyme engineering - Introduction, Objectives, Principles, Examples and Steps involved in enzymes engineering. Random mutagenesis and molecular breeding of DNA. Recent advances in rational approaches for Enzyme engineering. Applications of enzyme engineering.</p>		
Unit-III Industrial & Medical Application Of Enzymes	<ul style="list-style-type: none"> Textile Industry, Detergent Industry, Pulp and Paper Industry, Animal Feed Industry: Enzyme Technology for Detoxification of Mycotoxins in Animal Feed, Phytases for Feed Applications and Leather Industry. Enzyme Applications for Human and Animal Nutrition. Biosensors - Introduction, instrumentation, Types and examples. Enzymes based sensors as diagnostic tools- Biosensors for Blood Glucose, Biosensors for Urea in Blood and Urine, Biosensors for Uric Acid, Biosensors for Arginine, Biosensors for Asparagine, Biosensors for Creatinine, Biosensors for Cholesterol, Allosteric enzyme-based biosensors. 		15
Unit-IV Enzyme Deficiencies/ Diagnostic Enzymes/ Therapeutics	<ul style="list-style-type: none"> Disorders of amino acid metabolism- Phenylketonuria, Alkaptonuria, Homocystinuria. Disorders of carbohydrate metabolism - Galactosemia, Hereditary fructose intolerance, hereditary lactose intolerance. Disorder of lipid metabolism - Gaucher disease, Fabry disease. Enzymes in diagnosis of diseases- Liver disorders, Cancer, Cardiac disorders. Role of Other enzymes- Lysozyme, Butyryl choline esterase and Lipases. 		15

	<ul style="list-style-type: none"> • Therapeutic uses of enzymes - enzymes in replacement therapy enzymes in cancer treatment, enzymes for fibrinolysis, enzymes used for various treatments and enzyme gene therapy. • Iso-enzymes; enzyme pattern in diseases. 		
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References:

1.	Lehninger Principles of Biochemistry (4th Ed. Nelson, D., and Cox, M.; W.H. Freeman and Company, New York, 2005
2.	Satyanarayan and Chakrapani, Biochemistry. New Delhi, Elsevier Health Sciences APAC, 2013.
3.	Berg JM, Tymoczko JL, Stryer L (2002): Biochemistry, 5th ed., Freeman WH and Co., New York.
4.	https://shodhganga.inflibnet.ac.in/bitstream/10603/100595/7/07_chapter%201.pdf General Introduction to enzymes
5.	https://iopscience.iop.org/book/978-0-7503-1302-5/chapter/bk978-0-7503-1302-5ch1 Introduction to enzymes and their applications.
6.	Biochemistry by Lehninger, 2nd Ed, Kalyani publication 2008.
7.	Understanding enzymes (3rd edition). Edited by Trevor Palmer, Ellis Horwood, Chichester, 1991.
8.	Protein purification principles, High Resolution Methods, and Applications, 3rd Edition, Jan-Christer Janson, John Wiley & Sons, Inc., Hoboken, New Jersey.
9.	https://www.biotecharticles.com/Applications-Article/Methods-of-Purification-of-Enzymes-583.html
10.	https://www.creative-enzymes.com/service/enzyme-purification_307.html Enzyme Purification
11.	http://web.sungshin.ac.kr/~spark/class/enzchem/EnzChem_ch02.pdf Chapter 2 - purification of enzymes
12.	https://www.labome.com/method/Protein-Purification.html
13.	http://www1.lsbu.ac.uk/water/enztech/index.html Chapter 6 Enzyme preparation and use Revised Syllabus for M.Sc. (Biotechnology) Semester III and IV Page 21 of 35
14.	https://docplayer.net/20937505-Protein-purification-nison-sattayasai-khon-kaen-universitythailand-1-introduction-2-extraction-of-protein.html
15.	http://www.processdevelopmentforum.com/ppts/posters/Protein_purification_methods_overview,_29155460.pdf
16.	https://www.researchgate.net/publication/281102215 How_to_purify_proteins.
17.	Fundamentals of Enzyme Engineering, Young Je Yoo, Yan Feng, Yong-Hwan Kim, Camila Flor J. Yagonia, : Springer Netherlands 2017

Semester-IV

Unit	Topic	Credit	Lectures
Unit-I OMICS- The OMICS Technology, A Broad Outlook	<ul style="list-style-type: none"> Tools of Omics-Introduction to Epigenomics Human genome project- goals, conclusions and application. Structural and functional proteomics-protein- protein interaction and identification of interactions by various methods. Application of Proteomics and Genomics in human diseases –screening, testing and treatment of diseases. Metagenomics: concept, strategies, and applications in environmental biotechnology, agriculture and health 	4	15
Unit-II Transcriptomics, Lipidomics and Metabolomics	<ul style="list-style-type: none"> Introduction to Transcriptomics, Lipidomics And Metabolomics, Glycomics, Pharmacogenomics Techniques used in Lipidomics- Mass Spectroscopy, TLC, HPLC, GC and Capillary electrophoresis, MALDI. Technique used in Metabolomics- Mass Spectroscopy, Electrophoresis, chromatography- GC, LC & NMR. Technique used in Transcriptomics- next generation sequencing, northern blotting, DDRT-PCR, microarrays, gel free assays like biolayer interference, SPR. Applications of transcriptomics metabolomics and lipidomics in human diseases –screening, testing and treatment of diseases. (in clinical applications, personalized medicine, infectious diseases) 		15
Unit-III Introduction to Systems Biology	<ul style="list-style-type: none"> Systems biology towards systems level understanding of biological systems Systems structure, systems dynamics, systems design and control, systems project Models and Modelling systems in systems biology What is a model? Key properties of models, Basic of computational models, networks, 		15

	<p>data integration, standards, and model organism</p> <ul style="list-style-type: none"> • Perturbation of biological systems and 'Omics' as Quantitative high throughput experimental tools for systems biology Standards and formats for systems biology. • Computational Databases and software tools in systems biology. • Biological networks: metabolic networks, gene regulatory networks, PPI networks, genetic interaction (GI) networks, and signaling networks. 		
Unit-IV Data mining and Application of Systems Biology	<ul style="list-style-type: none"> • Introduction to Knowledge of discovery in databases (KDD) What is knowledge, need for KDD, KDD process outline, concept and goals. • Data Mining methods: Statistics – classification, correlation, association analysis, regression, and clustering Machine learning –Symbolic and statistical approaches. • Text mining, and Pattern evaluation. • Data mining in scientific application • Application of systems biology: 1. Systems biology to systems medicine. 2. Application of systems biology in drug discovery and development 3. Systems biology and synthetic biology. 		15

References

1.	Bioinformatics and functional genomics (2003). Jonathan Pevsner John wiley & sons Publications.
2.	Integration of omics approaches and systems biology for clinical applications. Antonia Vlahou, Harald Mischak, Jerome Zoidakis, Fulvio Magni. Wiley publications.
3.	Omic technologies: genomics, transcriptomics, proteomics and metabolomics. Richard P. Horgan And Louise C. Kenny Scientific advisory committee (sac), the obstetrician and gynaecologist.
4.	Bioinformatics and functional Jonathan Pevsner. Wiley blackwell genomics, <i>third edition</i> publications.

M.Sc. Biotechnology
Semester –IV
Drug Discovery & Clinical Study (PBT4DDC)

Course Objectives:	<ul style="list-style-type: none"> The objective of this course is to have a firm foundation in Drug Discovery and Clinical Studies. To provide students' knowledge about Clinical Trial Design and Indian Regulations, Pharmacovigilance and Clinical Data Science. 		
Course Outcomes:	<p>By the end of the course the student will:</p> <ul style="list-style-type: none"> Able to learn about drug discovery-design pathway using some in-silico tools. Able to understand the clinical trial design set up as well as they will gain information on rules-regulation and responsibilities in clinical studies. 		
Unit	Topics	Credit	Lectures
Unit-I Clinical Research Informatics in Drug Discovery	Introduction to the drug discovery & development <ul style="list-style-type: none"> Source of drugs Structural effects on drug action Drugs derived from natural products General principles of pharmacology Drug development and testing process Approaches to new drug discovery <ul style="list-style-type: none"> Computer-aided drug design Identification of novel drug candidates and drug targets Construction the signaling network of a drug using integer linear programming Identification for druggable targets of a disease 	4	15
Unit II Clinical Trial Design And Indian Regulations	Clinical Trial Design <ul style="list-style-type: none"> Basic framework of clinical trial Randomized clinical trials and different phases Adaptive randomization methods Seamless design Internal pilot design Design selection factors 		15

	Regulations <ul style="list-style-type: none"> • The national regulatory body • Key documents in clinical research • Regulatory requirements for the conduct of clinical trials in India The Roles and Responsibilities of Stakeholders in the Sharing of Clinical Trial Data <ul style="list-style-type: none"> • Participants in clinical trials, Investigators, • Research institutions and universities • Journals and Professional societies 		
Unit III Pharmaco-vigilance	Scope and purposes of pharmacovigilance <ul style="list-style-type: none"> • Adverse Drug Reactions (ADR) • ADR classification • Nature and mechanism of ADR • Concept of safety • Phases and types of DATA The process of Pharmacovigilance <ul style="list-style-type: none"> • Signal detection, evaluation and investigation, • Communication Methods of evaluating effectiveness of action International regulatory collaboration <ul style="list-style-type: none"> • WHO, CIOMS, ICH, ISoP, ISPE 		15
Unit-IV Clinical Data Science	Data management in clinical research: An overview <ul style="list-style-type: none"> • Data Sources and Data Types • Standards in Healthcare Data • Research Data Stewardship for Healthcare Professionals • Preparing Data for Prediction Model Development • Prediction Modeling Methodology • Clinical Decision Support System 		15

References:

1.	Introduction to Basics of Pharmacology and Toxicology, Volume 1: General and Molecular Pharmacology: Principles of Drug Action, Chapter 3 Gerard Marshall Raj Ramasamy Raveendran, Editors ISBN 978-981-32-9778-4 ISBN 978-981-32- 9779-1 (eBook) https://oi.org/10.1007/978-981-32-9779-1
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M.Sc. Biotechnology
Semester –IV
Scientific Writing & Food Biotechnology (PBT4SWF)

Course Objectives:	<ul style="list-style-type: none"> • To develop skills for the processing and analysis of scientific data. • To enable students to present their research results in the format of oral or poster presentations at conferences, to write scientific publications (theses, articles) and to prepare applications for scientific grants (research proposals). • To inculcate good scientific writing practices. 		
Course Outcomes:	<ul style="list-style-type: none"> • Think critically, organize and analyze scientific data. • Develop advanced scientific writing skills to write research articles, reviews, thesis, and proposals and to make oral, poster or power point presentations. Understand the best practices of scientific writing by adhering to research ethics and by avoiding plagiarism. 		
Unit	Topics	Credit	Lectures
Unit-I Basic Scientific Writing and Plagiarism	Introduction to scientific writing. <ul style="list-style-type: none"> • Basic scientific writing skills: style and language, spelling, grammar, syntax, jargon and sentence structure. • Elements of a scientific paper: abstract, introduction, materials & methods, results, discussion, references and drafting titles. • Scientific writing process: thinking, planning, rough draft, revision of content. • Processing data & application of statistics Displaying data: text, table, graph and defining terms and abbreviations. • Statistical analysis and tools for experimental data. • Referencing software: Mendeley, Endnote. • Plagiarism: Definition, Common types of plagiarism, Intentional and Unintentional plagiarism, Detection of plagiarism by anti-plagiarism tools (Turnitin, Duplichecker, Viper, Copyleaks), Penalties for plagiarism, Avoiding plagiarism. 	04	15

Unit II Advanced Scientific Writing	Guidelines for Medical writing. Scientific writing skills: <ul style="list-style-type: none"> • Writing a research paper for biomedical journal, • Writing science research papers and articles, Writing a research proposal, • Writing a research report, writing popular reports, writing thesis and dissertation, Writing clinical study reports. • Presentation skills: Oral presentation, Poster Preparation & presentation, PowerPoint presentations. • Research ethics, Scientific misconduct. 		15
Unit III Food Biotechnology- Nutraceuticals	<ul style="list-style-type: none"> • Nutraceuticals and functional foods Definition, characteristic features, and classification, phytonutraceuticals, • Prebiotics and Probiotics, Sources (with examples e.g. microbes, plants, algae, animals), Blue biotechnology, Food security, Food preservation, Chemopreservation Food processing (animal and sea food), Food packaging 		15
Unit-IV Food biotechnology in management of health and disease	<ul style="list-style-type: none"> • Applications of nutraceuticals in human health and nutrition- health effects of commonly used nutraceuticals and functional foods (case studies), Safety and Regulatory guidelines • Nutraceuticals in management of health and disease • Development of designer foods for specific chronic diseases • Nutraceutical adjuvants 		15



**Janardan Bhagat Shikshan Prasarak Sanstha's
CHANGU KANA THAKUR
ARTS, COMMERCE & SCIENCE COLLEGE, NEW
PANVEL (AUTONOMOUS)**

**Re-accredited 'A+' Grade by NAAC
'College with Potential for Excellence' Status Awarded by UGC
'Best College Award' by University of Mumbai**

**Program: B.Sc
Revised Syllabus of F.Y.B.Sc. Computer Science
Choice Based Credit & Grading System (60:40)
w.e.f. Academic Year 2019-20**

F.Y.B.Sc. Computer Science Syllabus
Credit Based System and Grading System

Academic year 2019-2020

SEMESTER - I

CODE	COURSE TYPE	SUBJECT	SCHEME OF INSTRUCTION		SCHEME OF EXAMINATION			NO. OF
			(PERIOD PER WEEK)		(MAX MARKS)			CREDITS
			TH	LAB	CA	EA	TOTAL	
UCS1COD	CORE	Computer Organization and Design	3	3	40	60	100	2
UCS1PP1	CORE	Programming with Python-I	3	3	40	60	100	2
UCS1PWC	CORE	Programming with C	3	3	40	60	100	2
UCS1FOS	CORE	Free and Open Source Software	3	3	40	60	100	2
UCS1DMA	CORE	Discrete Mathematics	3	3	40	60	100	2
UCS1DSP	CORE	Descriptive Statistics and Introduction to Probability	3	3	40	60	100	2
UCS1SSD	ABILITY ENHANCEMENT COURSE-1	Soft Skills Development	3	-	40	60	100	2
UCS1PPR1	CORE SUBJECT PRACTICAL	UCS1COD + UCS1PP1	-	6	100			2
UCS1PPR2	CORE SUBJECT PRACTICAL	UCS1PWC + UCS1FOS	-	6	100			2
UCS1PPR3	CORE SUBJECT PRACTICAL	UCS1DMA + UCS1DSP	-	6	100			2
TOTAL					1000			20

SEMESTER – II

CODE	COURSE TYPE	SUBJECT	SCHEME OF INSTRUCTION		SCHEME OF EXAMINATION			NO. OF
			(PERIOD PER WEEK)		(MAX MARKS)			CREDITS
			TH	LAB	CA	EA	TOTAL	
UCS2DSY	CORE	Database Systems	3	3	40	60	100	2
UCS2PP2	CORE	Programming with Python-II	3	3	40	60	100	2
UCS2LIN	CORE	Linux	3	3	40	60	100	2
UCS2DST	CORE	Data Structures	3	3	40	60	100	2
UCS2CAL	CORE	Calculus	3	3	40	60	100	2
UCS2SMH	CORE	Statistical Methods and Testing of Hypothesis	3	3	40	60	100	2
UCS2GRT	ABILITY ENHANCEMENT COURSE-2	Green Technologies	3	-	40	60	100	2
UCS2PPR1	CORE SUBJECT PRACTICAL	UCS2DSY + UCS2PP2	-	6	100			2
UCS2PPR2	CORE SUBJECT PRACTICAL	UCS2LIN + UCS2DST	-	6	100			2
UCS2PPR3	CORE SUBJECT PRACTICAL	UCS2CAL + UCS2SMH	-	6	100			2
TOTAL							1000	20

Course: UCS1SSD	Soft Skills Development (Credits : 2 Lectures/Week: 3)	
<p>1. Objectives: To help learners develop their soft skills and develop their personality together with their technical skills. Developing professional, social and academic skills to harness hidden strengths, capabilities and knowledge equip them to excel in real work environment and corporate life. Understand various issues in personal and profession communication and learn to overcome them</p> <p>2. Expected Learning Outcomes:</p> <p>1) To know about various aspects of soft skills and learn ways to develop personality</p> <p>2) Understand the importance and type of communication in personal and professional environment.</p> <p>3) To provide insight into much needed technical and non-technical qualities in career planning.</p> <p>4) Learn about Leadership, team building, decision making and stress management</p> <p>5) Learn to connect and work with team to achieve a given task.</p>		
Unit I	Introduction to Soft Skills and Hard Skills Personality Development: Knowing Yourself, Positive Thinking, Johari's Window, Communication Skills, Non-verbal Communication, Physical Fitness Emotional Intelligence: Meaning and Definition, Need for Emotional Intelligence, Intelligence Quotient versus Emotional Intelligence Quotient, Components of Emotional Intelligence, Competencies of Emotional Intelligence, Skills to Develop Emotional Intelligence Etiquette and Mannerism: Introduction, Professional Etiquette, Technology Etiquette Communication Today: Significance of Communication, GSC's 3M Model of Communication, Vitality of the Communication Process, Virtues of Listening, Fundamentals of Good Listening, Nature of Non-Verbal Communication, Need for Intercultural Communication, Communicating Digital World	15L
Unit II	Academic Skills Employment Communication: Introduction, Resume, Curriculum Vitae, Scannable Resume, Developing an Impressive Resume, Formats of Resume, Job Application or Cover Letter Professional Presentation: Nature of Oral Presentation, Planning a Presentation, Preparing the Presentation, Delivering the Presentation Job Interviews: Introduction, Importance of Resume, Definition of Interview, Background Information, Types of Interviews, Preparatory Steps for Job Interviews, Interview Skill Tips, Changes in the Interview Process, FAQ During Interviews Group Discussion: Introduction, Ambience/Seating Arrangement for Group Discussion, Importance of Group Discussions, Difference between Group Discussion, Panel Discussion and Debate, Traits, Types of Group Discussions, topic based and Case based Group Discussion, Individual Traits	15L

Unit III	<p>Professional Skills Creativity at Workplace: Introduction, Current Workplaces, Creativity, Motivation, Nurturing Hobbies at Work, The Six Thinking Hat Method Ethical Values: Ethics and Society, Theories of Ethics, Correlation between Values and Behavior, Nurturing Ethics, Importance of Work Ethics, Problems in the Absence of Work Ethics Capacity Building: Learn, Unlearn and Relearn: Capacity Building, Elements of Capacity Building, Zones of Learning, Ideas for Learning, Strategies for Capacity Building. Leadership and Team Building: Leader and Leadership, Leadership Traits, Culture and Leadership, Leadership Styles and Trends, Team Building, Types of Teams.</p> <p>Decision Making and Negotiation: Introduction to Decision Making, Steps for Decision Making, Decision Making Techniques, Negotiation Fundamentals, Negotiation Styles, Major Negotiation Concepts.</p> <p>Stress and Time Management: Stress, Sources of Stress, Ways to Cope with Stress</p>	15L
	<p>Text Books</p> <p>Soft Skills: An integrated Approach To Maximize Personality, Gajendra S. Chauhan, Sangeeta Sharma</p> <p>Additional References</p> <ol style="list-style-type: none"> 1) Personality Development and Soft Skills, Barun K. Mitra, Oxford Press 2) Business Communication, Shalini Kalia, Shailja Agrawal, Wiley India 3) Soft Skills - Enhancing Employability, M. S. Rao, I. K. International 4) Cornerstone: Developing Soft Skills, Sherfield, Pearson India 	



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Program: B.Sc

Revised Syllabus of S.Y.B.Sc. Computer Science

Choice Based Credit & Grading System (60:40)

w.e.f. Academic Year 2020-21

S.Y.B.Sc. (Semester III and IV)
Computer Science Syllabus
Credit Based Semester and Grading System
To be implemented from the Academic year 2020-2021
SEMESTER III

CODE	COURSE TYPE	SUBJECT	SCHEME OF INSTRUCTION (PERIOD PER WEEK)		SCHEME OF EXAMINATION (MAX MARKS)			NO. OF CRE DITS
			TH	LAB	CA	EA	TOTAL	
UCS3TOC	Core Subject	Theory of Computation	3		40	60	100	2
UCS3CJV	Core Subject	Core JAVA	3		40	60	100	2
UCS3OPS	Core Subject	Operating System	3		40	60	100	2
UCS3DMS	Core Subject	Database Management Systems	3		40	60	100	2
UCS3CGT	Core Subject	Combinatorics and Graph Theory	3		40	60	100	2
UCS3IOT	Core Subject	Physical Computing and IoT Programming	3					2
UCS3WEB	Skill Enhancement	Skill Enhancement: Web Programming	3					2
UCS3PR1	Core Subject Practical	Practical of UCS3CJV+ UCS3OPS		6	100			2
UCS3PR2	Core Subject Practical	Practical of UCS3DMS + UCS3CGT		6	100			2
UCS3PR3	Core Subject Practical	Practical of UCS3IOT + UCS3WEB	-	6	100			2
TOTAL					1000			20

SEMESTER IV

CODE	COURSE TYPE	SUBJECT	SCHEME OF INSTRUCTION		SCHEME OF EXAMINATION			NO. OF
			(PERIOD PER WEEK)		(MAX MARKS)			CRE DITS
			TH	LAB	CA	EA	TOTAL	
UCS4FOA	Core Subject	Fundamentals of Algorithms	3					2
UCS4AJV	Core Subject	Advanced JAVA	3	-	40	60	100	2
UCS4CNW	Core Subject	Computer Networks	3	-	40	60	100	2
UCS4SWE	Core Subject	Software Engineering	3	-	40	60	100	2
UCS4LAP	Core Subject	Linear Algebra using Python	3	-	40	60	100	2
UCS4NET	Core Subject	.Net Technologies	3					2
UCS4AND	Skill Enhancement	Skill Enhancement: Android Developer Fundamentals		-	40	60	100	2
UCS4PR1	Core Subject Practical	Practical of UCS4FOA+ UCS4AJV	-	6	100			2
UCS4PR2	Core Subject Practical	Practical of UCS4CNW + UCS4LAP	-	6	100			2
UCS4PR3	Core Subject Practical	Practical of UCS4NET + UCS4AND	-	6	100			2
TOTAL					1000			20

Course: UCS3WBP	TOPICS (Credits : 02 Lectures/Week: 03) Web Programming	
Objectives: To provide insight into emerging technologies to design and develop state of - the art web applications using client-side scripting, server-side scripting, and database connectivity.		
Expected Learning Outcomes: <ol style="list-style-type: none"> 3. To design valid, well-formed, scalable, and meaningful pages using emerging technologies. 4. Understand the various platforms, devices, display resolutions, viewports, and browsers that render websites 5. To develop and implement client-side and server-side scripting language programs. 6. To develop and implement Database Driven Websites. 7. Design and apply XML to create a markup language for data and document centric applications. 		
Unit I	HTML5: Fundamental Elements of HTML, Formatting Text in HTML, Organizing Text in HTML, Links and URLs in HTML, Tables in HTML, Images on a Web Page, Image Formats, Image Maps, Colors, FORMs in HTML, Interactive Elements, Working with Multimedia - Audio and Video File Formats, HTML elements for inserting Audio / Video on a web page CSS: Understanding the Syntax of CSS, CSS Selectors, Inserting CSS in an HTML Document, CSS properties to work with background of a Page, CSS properties to work with Fonts and Text Styles, CSS properties for positioning an Element	15L
Unit II	JavaScript: Using JavaScript in an HTML Document, Programming Fundamentals of JavaScript – Variables, Operators, Control Flow Statements, Popup Boxes, Functions – Defining and Invoking a Function, Defining Function arguments, Defining a Return Statement, Calling Functions with Timer, JavaScript Objects - String, RegExp, Math, Date, Browser Objects - Window, Navigator, History, Location, Document, Cookies, Document Object Model, Form Validation using JavaScript XML: Comparing XML with HTML, Advantages and Disadvantages of XML,	15L

	Structure of an XML Document, XML Entity References, DTD, XSLT: XSLT Elements and Attributes - xsl:template, xsl:apply-templates, xsl:import, xsl:call-template, xsl:include, xsl:element, xsl:attribute, e xsl:attribute-set, xsl:value-of	
Unit III	<p>AJAX: AJAX Web Application Model, How AJAX Works, XMLHttpRequest Object – Properties and Methods, Handling asynchronous requests using AJAX</p> <p>PHP: Variables and Operators, Program Flow, Arrays, Working with Files and Directories, Working with Databases, Working with Cookies, Sessions and Headers</p> <p>Introduction to jQuery: Fundamentals, Selectors, methods to access HTML attributes, methods for traversing, manipulators, events, effects</p>	15L
<p>Text Book(s):</p> <ol style="list-style-type: none"> 1) HTML 5 Black Book, Covers CSS 3, JavaScript, XML, XHTML, AJAX, PHP and jQuery, 2ed, Dreamtech Press 2) Web Programming and Interactive Technologies, scriptDemics, StarEdu Solutions India. 3) PHP: A Beginners Guide, Vikram Vaswani, TMH <p>Additional Reference(s):</p> <ol style="list-style-type: none"> 1) HTML, XHTML, and CSS Bible Fifth Edition, Steven M. Schafer, WILEY 2) Learn to Master HTML 5, scriptDemics, StarEdu Solutions Pvt Ltd. 3) Learning PHP, MySQL, JavaScript, CSS & HTML5, Robin Nixon, O'Reilly 4) PHP, MySQL, JavaScript & HTML5 All-in-one for Dummies, Steve Suehring, Janet Valade Wiley 		

Suggested List of Practical

UCS3WBP : Web Programming

UCS3WBP : Web Programming	
<ul style="list-style-type: none"> b. CSS properties to change Fonts and Text Styles c. CSS properties for positioning an element 	
<p>4. Write JavaScript code for</p> <ul style="list-style-type: none"> a. Performing various mathematical operations such as calculating factorial / finding Fibonacci Series / Displaying Prime Numbers in a given range / Evaluating Expressions / Calculating reverse of a number b. Validating the various Form Elements 	
<p>5. Write JavaScript code for</p> <ul style="list-style-type: none"> a. Demonstrating different JavaScript Objects such as String, RegExp, Math, Date b. Demonstrating different JavaScript Objects such as Window, Navigator, History, Location, Document, c. Storing and Retrieving Cookies 	
<p>6. Create a XML file with Internal / External DTD and display it using</p> <ul style="list-style-type: none"> a. CSS b. XSL 	
<p>7. Design a webpage to handle asynchronous requests using AJAX on</p> <ul style="list-style-type: none"> a. Mouseover b. button click 	
<p>8. Write PHP scripts for</p> <ul style="list-style-type: none"> a. Retrieving data from HTML forms b. Performing certain mathematical operations such as calculating factorial / finding Fibonacci Series / Displaying Prime Numbers in a given range / Evaluating Expressions / Calculating reverse of a number c. Working with Arrays d. Working with Files (Reading / Writing) 	
<p>9. Write PHP scripts for</p> <ul style="list-style-type: none"> a. Working with Databases (Storing Records / Retrieving Records and Display them) 	

<p>b. Storing and Retrieving Cookies</p>	
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<p>c. Storing and Retrieving Sessions</p>	
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10. Design a webpage with some jQuery animation effects.

Course: UCS4AND	TOPICS (Credits : 02 Lectures/Week: 03) Android Developer Fundamentals	
Objectives: To provide the comprehensive insight into developing applications running on smart mobile devices and demonstrate programming skills for managing task on mobile. To provide systematic approach for studying definition, methods and its applications for Mobile-App development.		
Expected Learning Outcomes: <ol style="list-style-type: none"> 1) Understand the requirements of Mobile programming environment. 2) Learn about basic methods, tools and techniques for developing Apps 3) Explore and practice App development on Android Platform 4) Develop working prototypes of working systems for various uses in daily lives. 		
Unit I	What is Android? Obtaining the required tools, creating first android app, understanding the components of screen, adapting display orientation, action bar, Activities and Intents, Activity Lifecycle and Saving State, Basic Views: TextView, Button, ImageButton, EditText, CheckBox, ToggleButton, RadioButton, and RadioGroup Views, ProgressBar View, AutoCompleteTextView, TimePicker View, DatePicker View, ListView View, Spinner View	15L
Unit II	User Input Controls, Menus, Screen Navigation, RecyclerView, Drawables, Themes and Styles, Material design, Providing resources for adaptive layouts, AsyncTask and AsyncTaskLoader, Connecting to the Internet, Broadcast receivers, Services, Notifications, Alarm managers, Transferring data efficiently	15L
Unit III	Data - saving, retrieving, and loading: Overview to storing data, Shared preferences, SQLite primer, store data using SQLite database, ContentProviders, loaders to load and display data, Permissions, performance and security, Firebase and AdMob, Publish your app	15L

Textbook(s):

- 1) “Beginning Android 4 Application Development”, Wei-Meng Lee, March 2012, WROX.

Additional Reference(s):

- 1) <https://developers.google.com/training/courses/android-fundamentals>
- 2) <https://www.gitbook.com/book/google-developer-training/android-developer-fundamentals-course-practicals/details>

Suggested List of Practical – SEMESTER IV**UCS4AND:Android Developer Fundamentals**

1. Install Android Studio and Run Hello World Program.
2. Create an android app with Interactive User Interface using Layouts.
3. Create an android app that demonstrates working with TextView Elements.
4. Create an android app that demonstrates Activity Lifecycle and Instance State.
5. Create an android app that demonstrates the use of Keyboards, Input Controls, Alerts, and Pickers.
6. Create an android app that demonstrates the use of an Options Menu.
7. Create an android app that demonstrate Screen Navigation Using the App Bar and Tabs.
8. Create an android app to Connect to the Internet and use BroadcastReceiver.
9. Create an android app to show Notifications and Alarm manager.
10. Create an android app to save user data in a database and use of different queries.



**Janardan Bhagat Shikshan Prasarak Sanstha's
CHANGU KANA THAKUR
ARTS, COMMERCE & SCIENCE COLLEGE,
NEW PANVEL (AUTONOMOUS)**

**Re-accredited 'A+' Grade by NAAC
'College with Potential for Excellence' Status Awarded by UGC
'Best College Award' by University of Mumbai**

Program: B.Sc

**Revised Syllabus of F.Y.B.Sc. Information Technology
Choice Based Credit & Grading System (60:40)
w.e.f. Academic Year 2019-2020**

Choice Based Credit Grading and Semester System (CBCGS)
F.Y.B. Sc. Information Technology Syllabus
To be implemented from the Academic year 2019-2020
SEMESTER I

Course Code	Course Type	Course Title	Credits
UIT1CPT	Core Subject	Introduction to C++ programming	2
UIT1DET	Core Subject	Digital Electronics	2
UIT1OST	Core Subject	Operating Systems	2
UIT1DMT	Core Subject	Discrete Mathematics	2
UIT1CST	Ability Enhancement Skill Course	Communication Skills	2
UIT1CPP	Core Subject Practical	Introduction to C++ Programming Practical	2
UIT1DEP	Core Subject Practical	Digital Electronics Practical	2
UIT1OSP	Core Subject Practical	Operating Systems Practical	2
UIT1DMP	Core Subject Practical	Discrete Mathematics Practical	2
UIT1PCP	Ability Enhancement Skill Course Practical	Communication Skills Practical	2
Total Credits			20

Choice Based Credit Grading and Semester System (CBCGS)
F.Y.B. Sc. Information Technology Syllabus
To be implemented from the Academic year 2019-2020
SEMESTER II

Course Code	Course Type	Course Title	Credits
UIT2OPT	Core Subject	Object Oriented Programming	2
UIT2MAT	Core Subject	Microprocessor Architecture	2
UIT2DST	Core Subject	Database Management System	2
UIT2NMT	Core Subject	Numerical Methods	2
UIT2WPT	Ability Enhancement Skill Course	Web Programming	2
UIT2OPP	Core Subject Practical	Object Oriented Programming Practical	2
UIT2MAP	Core Subject Practical	Microprocessor Architecture Practical	2
UIT2DSP	Core Subject Practical	Database Management System Practical	2
UIT2NMP	Core Subject Practical	Numerical Methods Practical	2
UIT2WPP	Ability Enhancement Skill Course Practical	Web Programming Practical	2
Total Credits			20

Course Code UIT1CST	Communication Skills	
Objectives: To understand the basics of Professional as well as Business Communication Skills.		
Expected Learning Outcomes: 1) To Understand the basics of communication and to develop the communication skill. 2) To Understand the business communication. 3) To Make the learners aware about the communication skills at corporate level.		
I	Understanding Business Communication: Nature and Scope of Communication, Non-verbal Communication, Cross-cultural communication, Technology-enabled Business Communication The Seven Cs of Effective Communication: Completeness, Conciseness, Consideration, Concreteness, Clarity, Courtesy, Correctness	12
II	Writing Business Messages and Documents: Business writing, Business Correspondence, Instructions Business Reports and Proposals, Career building, Job Application and Resume writing.	12
III	Group Communication: Meetings and Conferences, Group Discussions and Team Presentations, Team Briefing , Understanding Specific Communication Needs, Communication across Functional Areas	12
IV	Understanding Specific Communication Needs: Corporate Communication, Persuasive Strategies in Business Communication, Ethics in Business Communication, Business Communication Aids	12
V	Presentation Skills: Planning the presentations, executing the presentations, Impressing the audience by performing, Planning stage: Brainstorming, mind maps / concept maps, executing stage: chunking theory, creating outlines, Use of templates. Adding graphics to your presentation: Visual communication, Impress stage: use of font, colour, layout, Importance of practice and performance.	12

Course Code	Practical List
UIT1PCP	1. Mock Interviews <ol style="list-style-type: none"> a. You are in the HR department of an organization and you are supposed to hire a candidate. Write a telephonic interview between you and the client. b. Write an interview (a face-to-face interview) between Mr Smith and Mr John regarding a job position in a company. Mr John is the manager whereas Mr Smith is the candidate. c. You are asked to conduct a video interview for hiring a candidate in your company. Write the questions than you can ask and possible answers that can be given by the candidate. 2. Presentations <ol style="list-style-type: none"> a. 3D Glasses b. Apple Talk c. Mobile IP d. Big Data

3. Group Discussions

- a. Climate Change/ Pollution
- b. Banking Scams
- c. Poverty in India: Facts, Causes, Effects, Solution
- d. Social Media: Impact on human behaviour and society

4. Role Play

- a. Assume that you are a Sales person. Write a conversation between the sales person and the customer for selling a printer.
- b. Introduce yourself as a kitchen gadget
- c. Assume that you are a king of a kingdom. Write a conversation between you and your ministers regarding the development of your kingdom.

5. Situational Conversion

- a. Tell me about a time you proved you're the perfect person for this job.
- b. What would you do if you made a mistake that no one else noticed? Would you address the error and risk slowing things down or ignore it to keep the project or task moving forward?
- c. What would you do if you were asked to perform a task you've never done before?
- d. What would you do if an angry and dissatisfied customer confronted you? How would you resolve their concern?

6. Advertising

- a. There is a campaign in you college regarding the women's safety in college. Write an advertisement for the same.
- b. A new product named 'Techno' is introduced by an IT company which helps you locate your personal things like mobile phone, wallet, keys, etc. Write an advertisement to sell this product. Also state its features.
- c. There is new TV reality show and you are asked to promote it. How will you write an advertisement for the same.

7. Story-Telling

- a. A middle-aged woman discovers a ghost.
- b. A group of children discover a dead body
- c. A long journey is interrupted by a disaster.

8. Pronunciation Skills

9. Listening Skills

10. Writing Skills

Reference Books:

- 1) Business Communication, Edited by Meenakshi Raman and Prakash Singh, Second Edition, Oxford University Press,
- 2) Professional Communication, ArunaKoneru, Tata McGraw Hill
- 3) Business Communication, Dr.Rishipal and Dr.JyotiSheoran, SPD
- 4) Strategies for improving your business communication, Prof. M. S. Rao, Shroff publishers and distributors
- 5) Graphics for Learning: Proven Guidelines for Planning, Designing, and Evaluating Visuals in Training Materials, Ruth C. Clark, Chopeta Lyons, Pfeiffer

Course Code UIT2WPT	Web Programming
<p>Objectives: On completion of this course, a learner will be able to develop a web application using web technologies. Learners will gain the skills and project-based experience needed for entry into web application and development careers. Learners will be able to develop a dynamic webpage by the use of java script , basic php along with interaction with mysql database.</p> <p>Expected Learning Outcomes: 1) Learners will be able to develop static web pages using HTML. 2) Learners will be able to add interactivity to web pages using javascript event handling and functions. 3) Learners will be able to retrieve form data sent from client, process it and store it on database using php code.</p>	
I	<p>Internet and the World Wide Web: What is Internet? Introduction to internet and its applications, E-mail, telnet, FTP, e-commerce, video conferencing, e-business. Internet service providers, domain name server, internet address, World Wide Web (WWW): World Wide Web and its evolution, uniform resource locator (URL), browsers – internet explorer, Netscape navigator, opera, Firefox, chrome, Mozilla. search engine, web saver – apache, IIS, proxy server, HTTP protocol</p> <p>HTML5: Introduction, Why HTML5? Formatting text by using tags, using lists and backgrounds, Creating hyperlinks and anchors. Style sheets, CSS formatting text using style sheets, formatting paragraphs using style sheets</p>
II	<p>HTML5 Page layout and navigation: Creating navigational aids: planning site organization, creating text based navigation bar, creating graphics based navigation bar, creating graphical navigation bar, creating image map, redirecting to another URL, creating division based layouts: HTML5 semantic tags, creating divisions, creating HTML5 semantic layout, positioning and formatting divisions.</p> <p>HTML5 Tables, Forms and Media: Creating tables: creating simple table, specifying the size of the table, specifying the width of the column, merging table cells, using tables for page layout, formatting tables: applying table borders, applying background and foreground fills, changing cell padding, spacing and alignment, creating user forms: creating basic form, using check boxes and option buttons, creating lists, additional input types in HTML5, Incorporating sound and video: audio and video in HTML5, HTML multimedia basics, embedding video clips, incorporating audio on web page.</p>
III	<p>Java Script: Introduction, Client-Side JavaScript, Server-Side JavaScript, JavaScript Objects, JavaScript Security,</p> <p>Operators: Assignment Operators, Comparison Operators, Arithmetic Operators, % (Modulus), ++(Increment), --(Decrement), -(Unary Negation), Logical Operators, Short-Circuit Evaluation, String Operators, Special Operators, ?: (Conditional operator), , (Comma operator), delete, new, this, void</p> <p>Statements: Break, comment, continue, delete, do...while, export, for, for...in, function, if...else, import, labelled, return, switch, var, while, with</p> <p>Core JavaScript (Properties and Methods of Each):</p>

	<p>Array, Boolean, Date, Function, Math, Number, Object, String, regExp</p> <p>Document and its associated objects:</p> <p>Document, Link, Area, Anchor, Image, Applet, Layer</p> <p>Events and Event Handlers:</p> <p>General Information about Events, Defining Event Handlers, event, onAbort, onBlur, onChange, onClick, onDbClick, onDragDrop, onError, onFocus, onKeyDown, onKeyPress, onKeyUp, onLoad, onMouseDown, onMouseMove, onMouseOut, onMouseOver, onMouseUp, onMove, onReset, onResize, onSelect, onSubmit, onUnload</p>	
IV	<p>PHP:</p> <p>Why PHP and MySQL? Server-side scripting, PHP syntax and variables, comments, types, control structures, branching, looping, termination, functions, passing information with PHP, GET, POST, formatting form variables, superglobal arrays, strings and string functions, regular expressions, arrays, number handling, basic PHP errors/problems</p>	12
V	<p>Advanced PHP and MySQL:</p> <p>PHP/MySQL Functions, Integrating web forms and databases, Displaying queries in tables, Building Forms from queries, String and Regular Expressions, Sessions, Cookies and HTTP, E-Mail</p>	12

Course Code	Practical List
UIT2WPP	<p>1. Use of Basic Tags</p> <ol style="list-style-type: none"> Design a web page using different text formatting tags. Design a web page with links to different pages and allow navigation between web pages. Design a web page demonstrating all Style sheet types <p>2. Image maps, Tables, Forms and Media</p> <ol style="list-style-type: none"> Design a web page with Imagemaps. Design a web page demonstrating different semantics Design a web page with different tables. Design a webpages using table so that the content appears well placed. Design a web page with a form that uses all types of controls. Design a web page embedding with multimedia features. <p>3. Java Script</p> <ol style="list-style-type: none"> Using JavaScript design, a web page that prints factorial/Fibonacci series/any given series. Design a form and validate all the controls placed on the form using Java Script. Write a JavaScript program to display all the prime numbers between 1 and 100. Write a JavaScript program to accept a number from the user and display the sum of its digits. Write a program in JavaScript to accept a sentence from the user and display the number of words in it. (Do not use split () function). Write a java script program to design simple calculator. <p>4. Control and looping statements and Java Script references</p> <ol style="list-style-type: none"> Design a web page demonstrating different conditional statements. Design a web page demonstrating different looping statements.

- c. Design a web page demonstrating different Core JavaScript references (Array, Boolean, Date, Function, Math, Number, Object, String, regExp).

5. Basic PHP I

- a. Write a PHP Program to accept a number from the user and print it factorial.
b. Write a PHP program to accept a number from the user and print whether it is prime or not.

6. Basic PHP II

- a. Write a PHP code to find the greater of 2 numbers. Accept the no. from the user.
b. Write a PHP program to display the following Binary Pyramid:

```
1
0  1
1  0  1
0  1  0  1
```

7.String Functions and arrays

- a. Write a PHP program to demonstrate different string functions.
b. Write a PHP program to create one dimensional array.

8.PHP and Database

- a. Write a PHP code to create:
• Create a database College
• Create a table Department (Dname, Dno, Number_Of_faculty)
b. Write a PHP program to create a database named “College”. Create a table named “Student” with following fields (sno, sname, percentage). Insert 3 records of your choice. Display the names of the students whose percentage is between 35 to 75 in a tabular format.
c. Design a PHP page for authenticating a user.

9.Email

- a. Write a program to send email with attachment.

10.Sessions and Cookies

- a. Write a program to demonstrate use of sessions and cookies.

Reference Books:

- 1) “HTML5 Step by Step”, FaitheWempen , Microsoft Press
- 2) “JavaScript 2.0: The Complete Reference “,Thomas Powell and Fritz Schneider , Second Edition, Tata McGraw Hill Publication
- 3) “PHP 5.1 for Beginners” , Ivan Bayross , Sharanam Shah, SPD Publication
- 4) “PHP 6 and MySQL Bible “,SteveSuehring, Tim Converse, Joyce Park, Wiley Publication
- 5) “PHP Project for Beginners “,SharanamShah, Vaishali Shah , SPD Publication
- 6) “Web Design The Complete Reference ” , Thomas Powell , Tata McGraw Hill Publication
- 7) “Head First HTML 5 programming “,Eric Freeman , O’Reilly Publication



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**Re-accredited 'A+' Grade by NAAC
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Program: B.Sc

**Revised Syllabus of S.Y.B.Sc. Information Technology
Choice Based Credit & Grading System (60:40)
w.e.f. Academic Year 2019-2020**

Choice Based Credit Grading and Semester System (CBCGS)
S.Y.B. Sc. Information Technology Syllabus
To be implemented from the Academic year 2019-2020
SEMESTER III

Course Code	Course Type	Course Title	Credits
UIT3PYP	Skill Enhancement Course	Python Programming	2
UIT3DST	Core Subject	Data Structures	2
UIT3C-N	Core Subject	Computer Networks	2
UIT3DMS	Core Subject	Database Management System	2
UIT3MAT	Core Subject	Applied Mathematics	2
UIT3PPP	Skill Enhancement Course Practical	Python Programming Practical	2
UIT3DSP	Core Subject Practical	Data Structures Practical	2
UIT3CNP	Core Subject Practical	Computer Networks Practical	2
UIT3DMP	Core Subject Practical	Database Management Systems Practical	2
UIT3MPP	Core Subject Practical	Mobile Programming Practical	2
Total Credits			20

Choice Based Credit Grading and Semester System (CBCGS)
S.Y.B. Sc. Information Technology Syllabus
To be implemented from the Academic year 2019-2020
SEMESTER IV

Course Code	Course Type	Course Title	Credits
UIT4CJ V	Skill Enhancement Course	Core Java	2
UIT4EMB	Core Subject	Introduction to Embedded systems	2
UIT4COS	Core Subject	Computer Oriented Statistical Techniques	2
UIT4SWE	Core Subject	Software Engineering	2
UIT4CGA	Core Subject	Computer Graphics and Animation	2
UIT4CJ P	Skill Enhancement Course Practical	Core Java Practical	2
UIT4ESP	Core Subject Practical	Introduction to Embedded Systems Practical	2
UIT4COP	Core Subject Practical	Computer Oriented Statistical Techniques Practical	2
UIT4SEP	Core Subject Practical	Software Engineering Practical	2
UIT4CGP	Core Subject Practical	Computer Graphics and Animation Practical	2
Total Credits			20

Semester III

Course Code UIT3PYP	Python Programming
Objectives The objective of this course is to introduce the concept of the basic programming language with C++.	
Expected Learning Outcomes: <ol style="list-style-type: none"> 1) Learners should be able to understand how C++ improves C with object-oriented features. 2) Learners should be able to learn how to write inline functions for efficiency and performance 3) Learners should be able to write programs that are very efficient in memory usage. 	
I	Introduction: The Python Programming Language, History, features, Installing Python, Running Python program, Debugging : Syntax Errors, Runtime Errors, Semantic Errors, Experimental Debugging, Formal and Natural Languages, The Difference Between Brackets, Braces, and Parentheses, Variables and Expressions Values and Types, Variables, Variable Names and Keywords, Type conversion, Operators and Operands, Expressions, Interactive Mode and Script Mode, Order of Operations. Conditional Statements: if, if-else, nested if –else Looping: for, while, nested loops Control statements: Terminating loops, skipping specific conditions
II	Functions: Function Calls, Type Conversion Functions, Math Functions, Composition, Adding New Functions, Definitions and Uses, Flow of Execution, Parameters and Arguments, Variables and Parameters Are Local, Stack Diagrams, Fruitful Functions and Void Functions, Why Functions? Importing with from, Return Values, Incremental Development, Composition, Boolean Functions, More Recursion, Leap of Faith, Checking Types Strings: A String Is a Sequence, Traversal with a for Loop, String Slices, Strings Are Immutable, Searching, Looping and Counting, String Methods, The in Operator, String Comparison, String Operations.
III	Lists: Values and Accessing Elements, Lists are mutable, traversing a List, Deleting elements from List, Built-in List Operators, Concatenation, Repetition, In Operator, Built-in List functions and methods Tuples and Dictionaries: Tuples, Accessing values in Tuples, Tuple Assignment, Tuples as return values, Variable-length argument tuples, Basic tuples operations, Concatenation, Repetition, in Operator, Iteration, Built-in Tuple Functions Creating a Dictionary, Accessing Values in a dictionary, Updating Dictionary, Deleting Elements from Dictionary, Properties of Dictionary keys, Operations in Dictionary, Built-In Dictionary Functions, Built-in Dictionary Methods Files: Text Files, The File Object Attributes, Directories Exceptions: Built-in Exceptions, Handling Exceptions, Exception with Arguments, User-defined Exceptions
IV	Regular Expressions – Concept of regular expression, various types of regular expressions, using match function. Classes and Objects: Overview of OOP (Object Oriented Programming), Class Definition, Creating Objects, Instances as Arguments, Instances as return values, Built-in Class Attributes, Inheritance, Method Overriding, Data Encapsulation, Data Hiding Multithreaded Programming: Thread Module, creating a thread, synchronizing threads,

	multithreaded priority queue Modules: Importing module, Creating and exploring modules, Math module, Random module, Time module	
V	Creating the GUI Form and Adding Widgets: Widgets: Button, Canvas, Checkbutton, Entry, Frame, Label, Listbox, Menubutton, Menu, Message, Radiobutton, Scale, Scrollbar, text, Toplevel, Spinbox, PanedWindow, LabelFrame, tkMessageBox. Handling Standard attributes and Properties of Widgets. Layout Management: Designing GUI applications with proper Layout Management features. Look and Feel Customization: Enhancing Look and Feel of GUI using different appearances of widgets. Storing Data in Our MySQL Database via Our GUI: Connecting to a MySQL database from Python, Configuring the MySQL connection, Designing the Python GUI database, Using the INSERT command, Using the UPDATE command, Using the DELETE command, Storing and retrieving data from MySQL database.	12

Course Code	Practical List
UIT3PPP	<ol style="list-style-type: none"> Write the program for the following: <ol style="list-style-type: none"> Create a program that asks the user to enter their name and their age. Print out a message addressed to them that tells them the year that they will turn 100 years old. Enter the number from the user and depending on whether the number is even or odd, print out an appropriate message to the user. Write a program to generate the Fibonacci series. Write a function that reverses the user defined value. Write a function to check the input value is Armstrong and also write the function for Palindrome. Write a recursive function to print the factorial for a given number. Write the program for the following: <ol style="list-style-type: none"> Write a function that takes a character (i.e. a string of length 1) and returns True if it is a vowel, False otherwise. Define a function that computes the <i>length</i> of a given list or string. Define a procedure histogram() that takes a list of integers and prints a histogram to the screen. For example, histogram([4, 9, 7]) should print the following: <pre>**** ***** *****</pre> Write the program for the following: <ol style="list-style-type: none"> A pangram is a sentence that contains all the letters of the English alphabet at least once, for example: The quick brown fox jumps over the lazy dog. Your task here is to write a function to check a sentence to see if it is a pangram or not. Take a list, say for example this one: <pre>a=[1,1,2,3,5,8,13,21,34,55,89]</pre> and write a program that prints out all the elements of the list that are less than 5.

4. Write the program for the following:

- a. Write a program that takes two lists and returns True if they have at least one common member.
- b. Write a Python program to print a specified list after removing the 0th, 2nd, 4th and 5th elements.
- c. Write a Python program to clone or copy a list

5. Write the program for the following:

- a. Write a Python script to sort (ascending and descending) a dictionary by value.
- b. Write a Python script to concatenate following dictionaries to create a new one.
Sample Dictionary : dic1={ 1:10, 2:20} dic2={ 3:30, 4:40} dic3={ 5:50,6:60}
Expected Result : { 1: 10, 2: 20, 3: 30, 4: 40, 5: 50, 6: 60}
- c. Write a Python program to sum all the items in a dictionary.

6. Write the program for the following:

- a. Write a Python program to read an entire text file.
- b. Write a Python program to append text to a file and display the text.
- c. Write a Python program to read last n lines of a file.

7. Write the program for the following:

- a. Design a class that store the information of student and display the same
- b. Implement the concept of inheritance using python

8. Write the program for the following:

- a. Open a new file in IDLE ("New Window" in the "File" menu) and save it as geometry.py in the directory where you keep the files you create for this course. Then copy the functions you wrote for calculating volumes and areas in the "Control Flow and Functions" exercise into this file and save it.
Now open a new file and save it in the same directory. You should now be able to import your own module like this: import geometry
- b. Write a program to implement exception handling.

9. Write the program for the following:

- a. Try to configure the widget with various options like: bg="red", family="times", size=18
- b. Try to change the widget type and configuration options to experiment with other widget types like Message, Button, Entry, Checkbutton, Radiobutton, Scale etc.

10. Design the database applications for the following:

- | | |
|--|--|
| | <p>a. Design a simple database application that stores the records and retrieve the same.</p> <p>b. Design a database application to search the specified record from the database.</p> <p>c. Design a database application to that allows the user to add, delete and modify the records.</p> |
|--|--|

Reference Books:

- 1) “Think Python” , Allen Downey, First edition, O’Reilly publication
- 2) “An Introduction to Computer Science using Python 3” , Jason Montojo, First Edition, SPD publication.
- 3) “Python GUI Programming Cookbook”, Burkhard A. Meier, Packt Edition
- 4) “Introduction to Problem Solving with Python”, E Balagurusamy , First Edition ,Tata McGraw Hill.
- 5) “Murach’s Python Programming” , Joel Murach & Michael Urban, First Edition, SPD Publication
- 6) “Object Oriented Programming in Python”,Michael H. Glodwasser,First Edition, Pearson Prentice Hall Publication
- 7) “Exploring Python”, Budd, First Edition, TMH Publication

Semester IV

Course Code UIT4CJV	Core Java
<p>Objectives</p> <p>The objective of this course is to introduce the concept of the java programming language and understand its fundamentals.</p> <p>Expected Learning Outcomes:</p> <ol style="list-style-type: none"> 1) Students will be introduced with the basic concepts of java programming. 2) Students will be able to implement java programs using control structures, iteration. 3) Students will use the advance class features including inheritance, polymorphism and overloading, overriding, interfacing, abstract classes and develop efficient and reusable codes. 4) Learners will be made familiar with multithreading, IO File handling and exception handling techniques. 5) Students will be able to design, develop and execute AWT application. 	
I	<p>Introduction: History, architecture and its components, Java Class File, Java Runtime Environment, The Java Virtual Machine, JVM Components, The Java API, java platform, java development kit, Lambda Expressions, Methods References, Type Annotations, Method Parameter Reflection, setting the path environment variable, Java Compiler And Interpreter, java programs, java applications, main(), public, static, void, string[] args, statements, white space, case sensitivity, identifiers, keywords, comments, braces and code blocks, variables, variable name</p> <p>Data types: primitive data types, Object Reference Types, Strings, Auto boxing, operators and properties of operators, Arithmetic operators, assignment operators, increment and decrement operator, relational operator, logical operator, bitwise operator, conditional operator.</p>

12

II	<p>Control Flow Statements: The If...Else If...Else Statement, The Switch...Case Statement</p> <p>Iterations: The While Loop, The Do ... While Loop, The For Loop, The Foreach Loop, Labelled Statements, The Break And Continue Statements, The Return Statement</p> <p>Classes: Types of Classes, Scope Rules, Access Modifier, Instantiating Objects From A Class, Initializing The Class Object And Its Attributes, Class Methods, Accessing A Method, Method Returning A Value, Method's Arguments, Method Overloading, Variable Arguments [Varargs], Constructors, this Instance, super Instance, Characteristics Of Members Of A Class, constants, this instance, static fields of a class, static methods of a class, garbage collection</p>	12
III	<p>Inheritance: Derived Class Objects, Inheritance and Access Control, Default Base Class Constructors, this and super keywords.</p> <p>Abstract Classes And Interfaces, Abstract Classes, Abstract Methods, Interfaces, What Is An Interface? How Is An Interface Different From An Abstract Class?, Multiple Inheritance, Default Implementation, Adding New Functionality, Method Implementation, Classes V/s Interfaces, Defining An Interface, Implementing Interfaces.</p> <p>Packages: Creating Packages, Default Package, Importing Packages, Using A Package.</p>	12
IV	<p>Enumerations, Arrays: Two Dimensional Arrays, Multi-Dimensional Arrays, Vectors, Adding Elements To A Vector, Accessing Vector Elements, Searching For Elements In A Vector, Working With The Size of The Vector.</p> <p>Multithreading: the thread control methods, thread life cycle, the main thread, creating a thread, extending the thread class.</p> <p>Exceptions: Catching Java Exceptions, Catching Run-Time Exceptions, Handling Multiple Exceptions, The finally Clause, The throws Clause</p> <p>Byte streams: reading console input, writing console output, reading file, writing file, writing binary data, reading binary data, getting started with character streams, writing file, reading file</p>	12
V	<p>Event Handling: Delegation Event Model, Events, Event classes, Event listener interfaces, Using delegation event model, adapter classes and inner classes.</p> <p>Abstract Window Toolkit: Window Fundamentals, Component, Container, Panel, Window, Frame, Canvas. Components – Labels, Buttons, Check Boxes, Radio Buttons, Choice Menus, Text Fields, Text, Scrolling List, Scrollbars, Panels, Frames</p> <p>Layouts: Flow Layout, Grid Layout, Border Layout, Card Layout.</p>	12

Course Code	Practical List
UIT4CJP	<p>1.Java Basics</p> <ol style="list-style-type: none"> Write a Java program that takes a number as input and prints its multiplication table upto 10. Write a Java program to display the patterns. Write a Java program to print the area and perimeter of a circle. <p>2.Use of Operators</p> <ol style="list-style-type: none"> Write a Java program to add two binary numbers. Write a Java program to convert a decimal number to binary number and vice versa. Write a Java program to reverse a string. <p>3.Java Data Types</p> <ol style="list-style-type: none"> Write a Java program to count the letters, spaces, numbers and other characters of an input string. Implement a Java function that calculates the sum of digits for a given char array consisting of the digits '0' to '9'. The function should return the digit sum as a long value.

c. Find the smallest and largest element from the array

4.Methods and Constructors

- a. Designed a class SortData that contains the method asec() and desc().
- b. Designed a class that demonstrates the use of constructor and destructor.
- c. Write a java program to demonstrate the implementation of abstract class.

5.Inheritance

- a. Write a java program to implement single level inheritance.
- b. Write a java program to implement method overriding
- c. Write a java program to implement multiple inheritance.

6.Packages and Arrays

- a. Create a package, Add the necessary classes and import the package in java class.
- b. Write a java program to add two matrices and print the resultant matrix.
- c. Write a java program for multiplying two matrices and print the product for the same.

7.Vectors and Multithreading

- a. Write a java program to implement the vectors.
- b. Write a java program to implement thread life cycle.
- c. Write a java program to implement multithreading.

8.File Handling

- a. Write a java program to open a file and display the contents in the console window.
- b. Write a java program to copy the contents from one file to other file.
- c. Write a java program to read the student data from user and store it in the file.

9.GUI and Exception Handling

- a. Design a AWT program to print the factorial for an input value.
- b. Design an AWT program to perform various string operations like reverse string, string concatenation etc.
- c. Write a java program to implement exception handling.

10.GUI Programming.

- a. Design an AWT application that contains the interface to add student information and display the same.
- b. Design a calculator based on AWT application.
- c. Design an AWT application to generate result marks sheet.

Reference Books:

- 1) “Core Java 8 for Beginners” , Vaishali Shah, Sharnam Shah, First edition, SPD publication
- 2) “Java: The Complete Reference” , Herbert Schildt, Ninth Edition, McGraw Hill.



**Janardan Bhagat Shikshan Prasarak Sanstha's
CHANGU KANA THAKUR
ARTS, COMMERCE & SCIENCE COLLEGE, NEW
PANVEL (AUTONOMOUS)**

**Re-accredited 'A+' Grade by NAAC
'College with Potential for Excellence' Status Awarded by UGC
'Best College Award' by University of Mumbai**

Program: B.Sc

**Revised Syllabus of T.Y.B.Sc. Information Technology
Choice Based Credit & Grading System (60:40)
w.e.f. Academic Year 2021-2022**

Choice Based Credit Grading and Semester System (CBCGS)
T.Y.B. Sc. Information Technology Syllabus
To be implemented from the Academic year 2021-2022
SEMESTER V

Course Code	Course Type	Course Title	Credits
UIT5SPM	Skill Enhancement Course	Software Project Management	2
UIT5IOT	Skill Enhancement Course	Internet of Things	2
UIT5AWP	Skill Enhancement Course	Advanced Web Programming	2
UIT5LSA	Discipline Specific	Linux System Administration	2
UIT5ENJ	Discipline Specific	Enterprise Java	2
UIT5PDP	Skill Enhancement Course Practical	Project Dissertation	2
UIT5ITP	Skill Enhancement Course Practical	Internet of Things Practical	2
UIT5WPP	Skill Enhancement Course Practical	Advanced Web Programming Practical	2
UIT5LAP	Discipline Specific Practical	Linux Administration Practical	2
UIT5EJP	Discipline Specific Practical	Enterprise Java Practical	2
Total Credits		20	

Choice Based Credit Grading and Semester System (CBCGS)
T.Y.B. Sc. Information Technology Syllabus
To be implemented from the Academic year 2021-2022
SEMESTER VI

Course Code	Course Type	Course Title	Credits
UIT6SQ A	Skill Enhancement Course	Software Quality Assurance	2
UIT6SIC	Skill Enhancement Course	Security in Computing	2
UIT6BUI	Skill Enhancement Course	Business Intelligence	2
UIT6GIS	Discipline Specific	Principles of Geographic Information Systems	2
UIT6ISM	Discipline Specific	IT Service Management	2
UIT6PIP	Skill Enhancement Course Practical	Project Implementation	2
UIT6SCP	Skill Enhancement Course Practical	Security in Computing Practical	2
UIT6BIP	Skill Enhancement Course Practical	Business Intelligence Practical	2
UIT6GIP	Discipline Specific Practical	Principles of Geographic Information Systems Practical	2
UIT6ISP	Skill Enhancement Course Practical	Advanced Mobile Programming	2
Total Credits		20	

Semester V

Course Code UIT5SPM	Software Project Management		
Objectives The objective of this course is to understand some problem and concern of software project manager, learners will able to cost estimation of project.			
Expected Learning Outcomes: 1) Learners will be able to clear the idea about project planning. 2) Learners will be able to determine Success criteria for a project. 3) Learners will be able to reduce some risk certain of appropriate prototype 4) Learners will be able to determine, estimate the overall duration of project. 5) Learners will be able to Identify the resource requirements.			
I	Introduction to Software Project Management: Introduction, Why is Software Project Management Important? What is a Project? Software Projects versus Other Types of Project, Contract Management and Technical Project Management, Activities Covered by Software Project Management, Plans, Methods and Methodologies, Some Ways of Categorizing Software Projects, Project Charter, Stakeholders, Setting Objectives , The Business Case , Project Success and Failure, What is Management? Management Control, Project Management Life Cycle , Traditional versus Modern Project Management Practices. Project Evaluation and Programme Management: Introduction, Business Case , Project Portfolio Management, Evaluation of Individual Projects, Cost-benefit Evaluation Techniques , Risk Evaluation, Programme Management, Managing the Allocation of Resources within Programmes, Strategic Programme Management, Creating a Programme , Aids to Programme Management, Some Reservations about Programme Management, Benefits Management. An Overview of Project Planning : Introduction to Step Wise Project Planning , Step 0: Select Project, Step 1: Identify Project Scope and Objectives, Step 2: Identify Project Infrastructure, Step 3: Analyse Project Characteristics , Step 4: Identify Project Products and Activities, Step 5: Estimate Effort for Each Activity, Step 6: Identify Activity Risks , Step 7: Allocate Resources, Step 8: Review/Publicize Plan, Steps 9 and 10: Execute Plan/Lower Levels of Planning		12
II	Selection of an Appropriate Project Approach: Introduction, Build or Buy? Choosing Methodologies and Technologies , Software Processes and Process Models, Choice of Process Models, Structure versus Speed of Delivery, The Waterfall Model, The Spiral Model, Software Prototyping, Other Ways of Categorizing Prototypes, Incremental Delivery, Atern/Dynamic Systems Development Method, Rapid Application Development, Agile Methods , Extreme Programming (XP) , Scrum, Lean Software Development, Managing Iterative Processes, Selecting the Most Appropriate Process Model. Software Effort Estimation: Introduction, Where are the Estimates Done? Problems with Over- and Under-Estimates, The Basis for Software Estimating, Software Effort Estimation Techniques, Bottom-up Estimating, The Top-down Approach and Parametric Models, Expert Judgement, Estimating by Analogy, Albrecht Function Point Analysis, Function Points Mark II, COSMIC Full Function Points , COCOMO II : A Parametric Productivity Model, Cost Estimation.		12

	Staffing Pattern, Effect of Schedule Compression, Capers Jones Estimating Rules of Thumb.	
III	<p>Activity Planning: Introduction, Objectives of Activity Planning, When to Plan, Project Schedules, Projects and Activities, Sequencing and Scheduling Activities, Network Planning Models, Formulating a Network Model, Adding the Time Dimension, The Forward Pass, Backward Pass, Identifying the Critical Path, Activity Float, Shortening the Project Duration, Identifying Critical Activities, Activity-on-Arrow Networks.</p> <p>Risk Management: Introduction, Risk, Categories of Risk, Risk Management Approaches, A Framework for Dealing with Risk, Risk Identification, Risk Assessment, Risk Planning, Risk Management, Evaluating Risks to the Schedule, Boehm's Top 10 Risks and Counter Measures, Applying the PERT Technique, Monte Carlo Simulation, Critical Chain Concepts.</p> <p>Resource Allocation: Introduction, Nature of Resources, Identifying Resource Requirements, Scheduling Resources, Creating Critical Paths, Counting the Cost, Being Specific, Publishing the Resource Schedule, Cost Schedules, Scheduling Sequence.</p>	12
IV	<p>Monitoring and Control: Introduction, Creating the Framework, Collecting the Data, Review, Visualizing Progress, Cost Monitoring, Earned Value Analysis, Prioritizing Monitoring, Getting the Project Back to Target, Change Control, Software Configuration Management (SCM).</p> <p>Managing Contracts: Introduction, Types of Contract, Stages in Contract Placement, Typical Terms of a Contract, Contract Management, Acceptance.</p> <p>Managing People in Software Environments: Introduction, Understanding Behaviour, Organizational Behaviour: A Background, Selecting the Right Person for the Job, Instruction in the Best Methods, Motivation, The Oldham-Hackman Job Characteristics Model, Stress, Stress Management, Health and Safety, Some Ethical and Professional Concerns.</p>	12
V	<p>Working in Teams: Introduction, Becoming a Team, Decision Making, Organization and Team Structures, Coordination Dependencies, Dispersed and Virtual Teams, Communication Genres, Communication Plans, Leadership.</p> <p>Software Quality : Introduction, The Place of Software Quality in Project Planning, Importance of Software Quality, Defining Software Quality, Software Quality Models, ISO 9126, Product and Process Metrics, Product versus Process Quality Management, Quality Management Systems, Process Capability Models, Techniques to Help Enhance Software Quality, Testing, Software Reliability, Quality Plans.</p>	12

ReferenceBooks:

- 1) Software Project Management, Bob Hughes, Mike Cotterell, Rajib Mall sixth edition.
- 2) Project Management and Tools & Technologies – An overview, Shailesh Mehta 1st edition

Course Code UIT5IOT	Internet of Things Internet of Things
Objectives: To assess the vision and introduction of IoT. To Understand IoT Market perspective. To provide an understanding of the technologies and the standards relating to the Internet of Things.	
Expected Learning Outcomes <ol style="list-style-type: none"> 1) Learners will be able to Interpret the vision of IoT from a global context 2) Learners will be able to become familiar with IoT hardware components 3) Learners will be able to acquire skills to design 3D modules 4) Learners will be able to determine the Market perspective of IoT 5) Learners will be able to acquire skills on developing their enterprise level technical strategies 	
I	<p>The Internet of Things: An Overview : The Flavour of the Internet of Things, The “Internet” of “Things”, The Technology of the Internet of Things, Enchanted Objects, Who is Making the Internet of Things?</p> <p>Design Principles for Connected Devices: Calm and Ambient Technology, Magic as Metaphor, Privacy, Keeping Secrets, Whose Data Is It Anyway? Web Thinking for Connected Devices, Small Pieces, Loosely Joined, First-Class Citizens On The Internet, Graceful Degradation, Affordances.</p> <p>Internet Principles: Internet Communications: An Overview, IP, TCP, The IP Protocol Suite (TCP/IP), UDP, IP Addresses, DNS, Static IP Address Assignment, Dynamic IP Address Assignment, IPv6, MAC Addresses, TCP and UDP Ports, An Example: HTTP Ports, Other Common Ports, Application Layer Protocols, HTTP, HTTPS: Encrypted HTTP, Other Application Layer Protocols.</p>
II	<p>Thinking About Prototyping: Sketching, Familiarity, Costs versus Ease of Prototyping, Prototypes and Production, Changing Embedded Platform, Physical Prototypes and Mass Personalisation, Climbing into the Cloud, Open Source versus Closed Source, Why Closed? Why Open? Mixing Open and Closed Source, Closed Source for Mass Market Projects, Tapping into the Community.</p> <p>Prototyping Embedded Devices: Electronics, Sensors, Actuators, Scaling Up the Electronics, Embedded Computing Basics, Microcontrollers, System-on-Chips, Choosing Your Platform, Arduino, Developing on the Arduino, Some Notes on the Hardware, Openness, Raspberry Pi, Cases and Extension Boards, Developing on the Raspberry Pi, Some Notes on the Hardware, Openness.</p>
III	<p>Prototyping the Physical Design: Preparation, Sketch, Iterate, and Explore, 12 Nondigital Methods, Laser Cutting, Choosing a Laser Cutter, Software, Hinges and Joints, 3D Printing, Types of 3D Printing, Software, CNC Milling, Repurposing/Recycling.</p> <p>Prototyping Online Components: Getting Started with an API, Mashing Up APIs, Scraping, Legalities, Writing a New API, Clockodillo, Security, Implementing the API, Using Curl to Test, Going Further, Real-Time Reactions, Polling, Comet, Other Protocols, MQ Telemetry Transport, 12</p>
IV	<p>Techniques for Writing Embedded Code: Memory Management, Types of Memory, Making the Most of Your RAM, Performance and Battery Life, Libraries, Debugging,</p> <p>Business Models: A Short History of Business Models, Space and Time, From Craft to Mass Production, The Long Tail of the Internet, Learning from History, The Business 12</p>

	Model Canvas, Who Is the Business Model For? Models, Make Thing, Sell Thing, Subscriptions, Customisation, Be a Key Resource, Provide Infrastructure: Sensor Networks, Take a Percentage, Funding an Internet of Things Startup, Hobby Projects and Open Source, Venture Capital, Government Funding, Crowdfunding, Lean Startups.	
V	Moving to Manufacture: What Are You Producing? Designing Kits, Designing Printed circuit boards, Software Choices, The Design Process, Manufacturing Printed Circuit Boards, Etching Boards, Milling Boards. Assembly, Testing, Mass-Producing the Case and Other Fixtures, Certification, Costs, Scaling Up Software, Deployment, Correctness and Maintainability, Security, Performance, User Community. Ethics: Characterizing the Internet of Things, Privacy, Control, Disrupting Control, Crowdsourcing, Environment, Physical Thing, Electronics, Internet Service, Solutions, The Internet of Things as Part of the Solution, Cautious Optimism, The Open Internet of Things Definition.	12

Course Code	Internet of Things Practical List	
UIT5ITP	1 Starting Raspbian OS, Familiarising with Raspberry Pi Components and interface, Connecting to Ethernet , Monitor and USB 2 Displaying different LED patterns with Raspberry Pi. 3 Displaying Time over 4-Digit 7-Segment Display using Raspberry Pi 4 Raspberry Pi Based Oscilloscope 5 Controlling Raspberry Pi with WhatsApp. 6 Setting up Wireless Access Point using Raspberry Pi 7 Fingerprint Sensor interfacing with Raspberry Pi 8 Raspberry Pi GPS Module Interfacing 9 IoT based Web Controlled Home Automation using Raspberry Pi 10 Visitor Monitoring with Raspberry Pi and Pi Camera 11 Interfacing Raspberry Pi with RFID. 12 Building Google Assistant with Raspberry Pi. 13 Installing Windows 10 IoT Core on Raspberry Pi	

Reference Books:

- 1) Designing the Internet of Things , “Adrian McEwen” First Edition,WILEY
- 2) Internet of Things – Architecture and Design, “Raj Kamal”, First Edition,McGraw Hill

Course Code UIT5AWP	Advanced Web Programming	
Objectives: To learn to develop web applications that use object-oriented techniques and advanced database interactions. Concepts such as advanced CSS concepts web environment, authentication and security will also be explored.		
Expected Learning Outcomes: <div>1) Learners will be able to do programming with C# Language.</div> <div>2) Learners will be able to acquire skills to design web page incorporate with different server controls on webpages.</div> <div>3) Learners will be able to acquire skills to handle Error Handling, Logging, and Tracing , State Management</div> <div>4) Learners will be able to acquire skills to develop dynamic web pages using ADO.NET Fundamentals</div> <div>5) Learners will be able to provide interaction between web pages using ASP.NET AJAX.</div>		
I	Introducing .NET: The .NET Framework, C#, VB, and the .NET Languages, The Common Language Runtime, The .NET Class Library. .NET programming tools: Visual Studio Gallery ,LINQPad , SQL Complete. The C# Language: C# Language Basics, Variables and Data Types, Variable Operations, Object-Based Manipulation, Conditional Logic, Loops, Methods. Types, Objects, and Namespaces: The Basics About Classes, Building a Basic Class, Value Types and Reference Types, Understanding Namespaces and Assemblies, Advanced Class Programming.	12
II	Web Form Fundamentals: Writing Code, Using the Code-Behind Class, Adding Event Handlers, Understanding the Anatomy of an ASP.NET Application, Introducing Server Controls, Using the Page Class, Using Application Events, Configuring an ASP.NET Application. Form Controls: Stepping Up to Web Controls, Web Control Classes, List Controls, Table Controls, Web Control Events and AutoPostBack, Validation, Understanding Validation, Using the Validation Controls, Rich Controls, The Calendar, The AdRotator, Pages with Multiple Views, User Controls and Graphics, User Controls, Dynamic Graphics, The Chart Control, Website Navigation: Site Maps, URL Mapping and Routing, The SiteMapPath Control, The TreeView Control, The Menu Control.	12
III	Error Handling, Logging, and Tracing : Avoiding Common Errors, Understanding Exception Handling, Handling Exceptions, Throwing Your Own Exceptions, Using Page Tracing State Management : Understanding the Problem of State, Using View State, Transferring Information Between Pages, Using Cookies, Managing Session State, Configuring Session State, Using Application State, Comparing State Management Options Styles, Themes, and Master Pages : Styles, Themes, Master Page Basics, Advanced Master Pages	12
IV	ADO.NET Fundamentals: Understanding Databases, Configuring Your Database, Understanding SQL Basics, Understanding the Data Provider Model, Using Direct Data Access, Using Disconnected Data Access.	12

	<p>Data Binding: Introducing Data Binding, Using Single-Value Data Binding, Using Repeated-Value Data Binding, Working with Data Source Controls,</p> <p>The Data Controls: The GridView, Formatting the GridView, Selecting a GridView Row, Editing with the GridView, Sorting and Paging the GridView, Using GridView Templates, The DetailsView and FormView</p>	
V	<p>XML: XML Explained, The XML Classes, XML Validation, XML Display and Transforms.</p> <p>Security Fundamentals: Understanding Security Requirements, Authentication and Authorization, Forms Authentication, Windows Authentication.</p> <p>ASP.NET AJAX: Understanding Ajax, Using Partial Refreshes, Using Progress Notification, Implementing Timed Refreshes, Working with the ASP.NET AJAX Control Toolkit.</p>	12

Course Code	Advanced Web Programming Practical List
UIT5WPP	<p>1.Working with basic C# and ASP .NET</p> <ol style="list-style-type: none"> Create an application that obtains four int values from the user and displays the product. Create an application to demonstrate string operations. Create an application that receives the (Student Id, Student Name, Course Name, Date of Birth) information from a set of students. The application should also display the information of all the students once the data is entered. <p>Create an application to demonstrate following operations</p> <ol style="list-style-type: none"> Generate Fibonacci series. Test for prime numbers. Test for vowels. Use of foreach loop with arrays Reverse a number and find sum of digits of a number. <p>2. Working with Object Oriented C# and ASP .NET</p> <ol style="list-style-type: none"> Create simple application to perform following operations <ol style="list-style-type: none"> Finding factorial Value Money Conversion Quadratic Equation Temperature Conversion <ol style="list-style-type: none"> Create simple application to demonstrate use of following concepts <ol style="list-style-type: none"> Function Overloading Inheritance (all types) Constructor overloading Interfaces <ol style="list-style-type: none"> Create simple application to demonstrate use of following concepts <ol style="list-style-type: none"> Using Delegates and events Exception handling <p>3. Working with Web Forms and Controls</p> <ol style="list-style-type: none"> Create a simple web page with various sever controls to demonstrate setting and use of their properties. (Example :AutoPostBack) Demonstrate the use of Calendar control to perform following operations. <ol style="list-style-type: none"> Display messages in a calendar control Display vacation in a calendar control Selected day in a calendar control using style Difference between two calendar dates

c. Demonstrate the use of Treeview control perform following operations.

- a) Treeview control and datalist b) Treeview operations

4. Working with Form Controls

a. Create a Registration form to demonstrate use of various Validation controls.

b. Create Web Form to demonstrate use of Adrotator Control.

c. Create Web Form to demonstrate use User Controls.

5. Working with Navigation, Beautification and Master page.

a. Create Web Form to demonstrate use of Website Navigation controls and Site Map.

b. Create a web application to demonstrate use of Master Page with applying Styles and Themes for page beautification.

c. Create a web application to demonstrate various states of ASP.NET Pages.

6. Working with Database

a. Create a web application bind data in a multiline textbox by querying in another textbox.

b. Create a web application to display records by using database.

c. Demonstrate the use of Datalist link control.

7. Working with Database

a. Create a web application to display Databinding using dropdownlist control.

b. Create a web application for to display the phone no of an author using database.

c. Create a web application for inserting and deleting record from a database. (Using Execute-Non Query).

8. Working with data controls

a. Create a web application to demonstrate various uses and properties of SqlDataSource.

b. Create a web application to demonstrate data binding using DetailsView and FormView Control.

c. Create a web application to display Using Disconnected Data Access and Databinding using GridView.

9. Working with GridView control

a. Create a web application to demonstrate use of GridView control template and GridView hyperlink.

b. Create a web application to demonstrate use of GridView button column and GridView events.

c. Create a web application to demonstrate GridView paging and Creating own table format using GridView.

10. Working with AJAX and XML

a. Create a web application to demonstrate reading and writing operation with XML.

b. Create a web application to demonstrate Form Security and Windows Security with proper Authentication and Authorization properties.

c. Create a web application to demonstrate use of various Ajax controls.

11. Programs to create and use DLL

Reference Books:

- 1) Beginning ASP.NET 4.5 in C# ,mathevmacDonald,Apress
- 2) Murach's ASP.NET 4.6 Web Programming in C#2015, SPD,SixthEdition,Mary Delamater and Anne Bohem

Course Code	Project Dissertation and Viva
UIT5PDP	The learners are expected to develop a project of undergraduate level. Normal websites, web applications, mobile apps are expected. The details are given in Appendix-I

Semester- VI

Course Code USIT6SQA	Software Quality Assurance
Objectives: The course is designed to introduce concepts about quality as the driving force behind success of software product, also focuses on life cycle of testing and different testing methodologies used for various test processes. Expected Learning Outcomes: <ol style="list-style-type: none">1) Learners will be able to analyse the quality of software product2) Learners will be able to understand different testing methodology3) Learners will be able to analyse the difference between black box and white box testing4) Learners will be able to understand verification and validation techniques5) Learners will be able to understand special types of testing and levels of testing	
I	Introduction to Quality: Historical Perspective of Quality, What is Quality? (Is it a fact or perception?), Definitions of Quality, Core Components of Quality, Quality View , Financial Aspect of Quality, Customers, Suppliers and Processes, Total Quality Management (TQM) , Quality Principles of Total Quality Management, Quality Management Through Statistical Process Control, Quality Management Through Cultural Changes, Continual (Continuous) Improvement Cycle, Quality in Different Areas, Benchmarking and Metrics , Problem Solving Techniques , Problem Solving Software Tools . Software Quality: Introduction, Constraints of Software Product Quality Assessment, Customer is a King, Quality and Productivity Relationship , Requirements of a Product, Organisation Culture, Characteristics of Software , Software Development Process , Types of Products, Schemes of Criticality Definitions, Problematic Areas of Software Development Life Cycle , Software Quality Management, Why Software Has Defects? Processes Related to Software Quality, Quality Management System Structure, Pillars of Quality Management

12

	System , Important Aspects of Quality Management.	
II	<p>Fundamentals of testing: Introduction, Necessity of testing, What is testing? Fundamental test process, The psychology of testing, Historical Perspective of Testing, Definitions of Testing, Approaches to Testing, Testing During Development Life Cycle, Requirement Traceability Matrix, Essentials of Software Testing, Workbench, Important Features of Testing Process, Misconceptions About Testing, Principles of Software Testing, Salient Features of Good Testing, Test Policy, Test Strategy or Test Approach, Test Planning, Testing Process and Number of Defects Found in Testing, Test Team Efficiency, Mutation Testing, Challenges in Testing, Test Team Approach, Process Problems Faced by Testing, Cost Aspect of Testing, Establishing Testing Policy, Methods, Structured Approach to Testing, Categories of Defect, Defect, Error, or Mistake in Software, Developing Test Strategy, Developing Testing Methodologies (Test Plan), Testing Process, Attitude Towards Testing (Common People Issues), Test Methodologies/Approaches, People Challenges in Software Testing, Raising Management Awareness for Testing, Skills Required by Tester, Testing throughout the software life cycle, Software development models, Test levels, Test types, the targets of testing, Maintenance testing</p>	12
III	<p>Unit Testing: Boundary Value Testing: Normal Boundary Value Testing, Robust Boundary Value Testing, Worst-Case Boundary Value Testing, Special Value Testing, Examples, Random Testing, Guidelines for Boundary Value Testing, Equivalence Class Testing: Equivalence Classes, Traditional Equivalence Class Testing, Improved Equivalence Class Testing, Edge Testing, Guidelines and Observations. Decision Table-Based Testing: Decision Tables, Decision Table Techniques, Cause-and-Effect Graphing, Guidelines and Observations, Path Testing: Program Graphs, DD-Paths, Test Coverage Metrics, Basis Path Testing, Guidelines and Observations, Data Flow Testing: Define/Use Testing, Slice-Based Testing, Program Slicing Tools.</p>	12
IV	<p>Software Verification and Validation: Introduction, Verification, Verification Workbench, Methods of Verification, Types of reviews on the basis of Stage Phase, Entities involved in verification, Reviews in testing lifecycle, Coverage in Verification, Concerns of Verification, Validation, Validation Workbench, Levels of Validation, Coverage in Validation, Acceptance Testing, Management of Verification and Validation, Software development verification and validation activities.</p> <p>V-test Model: Introduction, V-model for software, Testing during Proposal stage, Testing during requirement stage, Testing during test planning phase, Testing during design phase, Testing during coding, VV Model, Critical Roles and Responsibilities.</p>	12
V	<p>Levels of Testing: Introduction, Proposal Testing, Requirement Testing, Design Testing, Code Review, Unit Testing, Module Testing, Integration Testing, Big-Bang Testing, Sandwich Testing, Critical Path First, Sub System Testing, System Testing, Testing Stages.</p> <p>Special Tests: Introduction, GUI testing, Compatibility Testing, Security Testing, Performance Testing, Volume Testing, Stress Testing, Recovery Testing, Installation Testing, Requirement Testing, Regression Testing, Error Handling Testing, Manual Support Testing, Intersystem Testing, Control Testing, Smoke Testing, Adhoc Testing, Parallel Testing, Execution Testing, Operations Testing, Compliance Testing, Usability Testing, Decision Table Testing, Documentation Testing, Training testing, Rapid Testing, Control flow graph, Generating tests on the basis of Combinatorial Designs, State Graph, Risk Associated with New Technologies, Process maturity level of Technology, Testing Adequacy of Control in</p>	12

	New technology usage, Object Oriented Application Testing, Testing of Internal Controls, COTS Testing, Client Server Testing, Web Application Testing, Mobile Application Testing, eBusinessCommerce Testing, Agile Development Testing, Data Warehousing Testing.	
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Reference Books:

- 1)Software Testing: Principles, Techniques and Tools M. G. Limaye TMH 2017
- 2) Software Testing and Continuous Quality Improvement William E. Lewis Third Edition 2016
- 3)Software Testing: A Craftsman's Approach Paul C. Jorgenson 4th Edition 2017

Course Code	Security in Computing	
USIT6SIC		
Objectives: The course is designed to introduce the fundamentals about the security in computing for the network, hardware, applications, devices & data with the help of different types of security.		
Expected Learning Outcomes: <div><div></div><div>1) Learners will be able to introduce to basics of information security with risk analysis and design</div><div>2) Learners will be able to identify some of the factors driving the need for Database and storage security</div><div>3) Learners will be able to identify some of the factors driving the need for Network security</div><div>4) Learners will be able to gather information about multiple attacks, vulnerabilities and how to detect & prevent them.</div><div>5) Learners will be aware of information about cloud storage, virtualization and how to secure them</div></div>		
I	Information Security Overview : The Importance of Information Protection, The Evolution of Information Security, Justifying Security Investment, Security Methodology, How to Build a Security Program, The Impossible Job, The Weakest Link, Strategy and Tactics, Business Processes vs. Technical Controls. Risk Analysis: Threat Definition, Types of Attacks, Risk Analysis. Secure Design Principles: The CIA Triad and Other Models, Defense Models, Zones of Trust, Best Practices for Network Defense.	12
II	Authentication and Authorization: Authentication, Authorization Encryption: A Brief History of Encryption, Symmetric-Key Cryptography, Public Key Cryptography, Public Key Infrastructure. Storage Security: Storage Security Evolution, Modern Storage Security, Risk Remediation, Best Practices. Database Security: General Database Security Concepts, Understanding Database Security Layers, Understanding Database-Level Security, Using Application Security, Database Backup and Recovery, Keeping Your Servers Up to Date, Database Auditing and Monitoring.	12
III	Secure Network Design: Introduction to Secure Network Design, Performance, Availability, Security. Network Device Security: Switch and Router Basics, Network Hardening.	12

	<p>Firewalls: Overview, The Evolution of Firewalls, Core Firewall Functions, Additional Firewall Capabilities, Firewall Design.</p> <p>Wireless Network Security: Radio Frequency Security Basics, Data-Link Layer Wireless Security Features, Flaws, and Threats, Wireless Vulnerabilities and Mitigations, Wireless Network Hardening Practices and Recommendations, Wireless Intrusion Detection and Prevention, Wireless Network Positioning and Secure Gateways.</p>	
IV	<p>Intrusion Detection and Prevention Systems: IDS Concepts, IDS Types and Detection Models, IDS Features, IDS Deployment Considerations, Security Information and Event Management (SIEM).</p> <p>Voice over IP (VoIP) and PBX Security: Background, VoIP Components, VoIP Vulnerabilities and Countermeasures, PBX, TEM: Telecom Expense Management.</p> <p>Operating System Security Models: Operating System Models, Classic Security Models, Reference Monitor, Trustworthy Computing, International Standards for Operating System Security.</p>	12
V	<p>Virtual Machines and Cloud Computing: Virtual Machines, Cloud Computing.</p> <p>Secure Application Design: Secure Development Lifecycle, Application Security Practices, Web Application Security, Client Application Security, Remote Administration Security.</p> <p>Physical Security: Classification of Assets, Physical Vulnerability Assessment, Choosing Site Location for Security, Securing Assets: Locks and Entry Controls, Physical Intrusion Detection.</p>	12

Course Code	Security in Computing Practical List
UIT6SCP	<p>1 Configure Routers</p> <p>a OSPF MD5 authentication.</p> <p>b NTP.</p> <p>c To log messages to the syslog server.</p> <p>d To support SSH connections.</p> <p>2 Configure AAA Authentication</p> <p>a Configure a local user account on Router and configure authenticate on the console and vty lines using local AAA</p> <p>b Verify local AAA authentication from the Router console and the PC-A client</p> <p>3 Configuring Extended ACLs</p> <p>a Configure, Apply and Verify an Extended Numbered ACL</p> <p>4 Configure IP ACLs to Mitigate Attacks and IPV6 ACLs</p> <p>a Verify connectivity among devices before firewall configuration.</p> <p>b Use ACLs to ensure remote access to the routers is available only from management station PC-C.</p> <p>c Configure ACLs on to mitigate attacks.</p> <p>d Configuring IPv6 ACLs</p> <p>5 Configuring a Zone-Based Policy Firewall</p> <p>6 Configure IOS Intrusion Prevention System (IPS) Using the CLI</p> <p>a Enable IOS IPS.</p> <p>b Modify an IPS signature.</p> <p>7 Layer 2 Security</p> <p>a Assign the Central switch as the root bridge.</p> <p>b Secure spanning-tree parameters to prevent STP manipulation attacks.</p> <p>c Enable port security to prevent CAM table overflow attacks.</p> <p>8 Layer 2 VLAN Security</p> <p>9 Configure and Verify a Site-to-Site IPsec VPN Using CLI</p> <p>10 Configuring ASA Basic Settings and Firewall Using CLI</p> <p>a Configure basic ASA settings and interface security levels using CLI</p> <p>b Configure routing, address translation, and inspection policy using CLI</p> <p>c Configure DHCP, AAA, and SSH</p> <p>d Configure a DMZ, Static NAT, and ACLs</p>

Reference Books:

1. The Complete Reference: Information Security ,Mark Rhodes-Ousley, 2nd, McGraw-Hill
2. Essential Cybersecurity Science, Josiah Dykstra , Fifth, O'Reilly
3. Principles of Computer Security: CompTIA Security+ and Beyond ,Wm.ArthurConklin,

Course Code UIT6BUI	Business Intelligence
<p>Objectives: To provide graduate students of M.Sc. Information Systems with comprehensive and in-depth knowledge of Business Intelligence (BI) principles and techniques by introducing the relationship between managerial and technological perspectives. This course is also designed to expose students to the frontiers of BI-intensive BIG data computing and information systems, while providing a sufficiently strong foundation to encourage further research.</p> <p>Expected Learning Outcomes:</p> <ol style="list-style-type: none"> 1) Learners will be able to Identify the major frameworks of computerized decision support: decision support systems (DSS), data analytics and business intelligence. 2) Learners will be able to analyze data, choose relevant models and algorithms for respective applications. 3) Learners will be able to become familiar with classification methods, clustering methods. 4) Learners will be able to design application using Business Intelligence techniques. 5) Learners will be able to ability to design and develop the AI applications in real world scenario 	
I	<p>Business intelligence: Effective and timely decisions, Data, information and knowledge, The role of mathematical models, Business intelligence architectures, Ethics and business intelligence</p> <p>Decision support systems: Definition of system, Representation of the decision-making process, Evolution of information systems, Definition of decision support system, Development of a decision support system</p> <p style="text-align: right;">12</p>
II	<p>Mathematical models for decision making: Structure of mathematical models, Development of a model, Classes of models</p> <p>Data mining: Definition of data mining, Representation of input data , Data mining process, Analysis methodologies</p> <p>Data preparation: Data validation, Data transformation, Data reduction</p> <p style="text-align: right;">12</p>
III	<p>Classification: Classification problems, Evaluation of classification models, Bayesian methods, Logistic regression, Neural networks, Support vector machines</p> <p>Clustering: Clustering methods, Partition methods, Hierarchical methods, Evaluation of clustering models</p> <p style="text-align: right;">12</p>
IV	<p>Business intelligence applications:</p> <p>Marketing models: Relational marketing, Sales force management,</p> <p>Logistic and production models: Supply chain optimization, Optimization models for logistics planning, Revenue management systems.</p> <p>Data envelopment analysis: Efficiency measures, Efficient frontier, The CCR model, Identification of good operating practices</p> <p style="text-align: right;">12</p>
V	<p>Knowledge Management: Introduction to Knowledge Management, Organizational Learning and Transformation, Knowledge Management Activities, Approaches to Knowledge Management, Information Technology (IT) In Knowledge Management, Knowledge Management Systems Implementation, Roles of People in Knowledge Management</p> <p>Artificial Intelligence and Expert Systems: Concepts and Definitions of Artificial Intelligence, Artificial Intelligence Versus Natural Intelligence, Basic Concepts of Expert Systems, Applications of Expert Systems, Structure of Expert Systems, Knowledge Engineering, Development of Expert Systems</p> <p style="text-align: right;">12</p>

Course Code	Business Intelligence Practical List
UIT6BIP	<ol style="list-style-type: none"> 1) Import the legacy data from different sources such as (Excel , SqlServer, Oracle etc.) and load in the target system. (You can download sample database such as Adventureworks, Northwind, foodmart etc.) 2) Perform the Extraction Transformation and Loading (ETL) process to construct the database in the Sqlserver. 3)a. Create the Data staging area for the selected database. b. Create the cube with suitable dimension and fact tables based on ROLAP, MOLAP and HOLAP model. 4) a.Create the ETL map and setup the schedule for execution. b. Execute the MDX queries to extract the data from the datawarehouse. 5)a. Import the datawarehouse data in Microsoft Excel and create the Pivot table and Pivot Chart. b. Import the cube in Microsoft Excel and create the Pivot table and Pivot Chart to perform data analysis. 6) Apply the what – if Analysis for data visualization. Design and generate necessary reports based on the data warehouse data. 7)Perform the data classification using classification algorithm. 8)Perform the data clustering using clustering algorithm. 9)Perform the Linear regression on the given data warehouse data. 10)Perform the logistic regression on the given data warehouse data.

Reference Books:

- 1)Business Intelligence: Data Mining and Optimization for Decision Making, Carlo Vercellis, First Edition , Wiley
- 2) Decision support and Business Intelligence Systems, Efraim Turban, Ramesh Sharda, DursunDelen , Ninth, Pearson

Course Code	Advanced Mobile Programming Practical List
UIT6ISP	<ol style="list-style-type: none"> 1. Introduction to Android, Introduction to Android Studio IDE, Application Fundamentals: Creating a Project, Android Components, Activities, Services, Content Providers, Broadcast Receivers, Interface overview, Creating Android Virtual device, USB debugging mode, Android Application Overview. Simple “Hello World” program. 2. Programming Resources Android Resources: (Color, Theme, String, Drawable, Dimension, Image 3. Programming Activities and fragments Activity Life Cycle, Activity methods, Multiple Activities, Life Cycle of fragments and multiple fragments. 4. Programs related to different Layouts Coordinate, Linear, Relative, Table, Absolute, Frame, List View, Grid View. 5. Programming UI elements

	<p>AppBar, Fragments, UI Components</p> <p>6. Programming menus, dialog, dialog fragments</p> <p>7. Programs on Intents, Events, Listeners and Adapters</p> <p>The Android Intent Class, Using Events and Event Listeners</p> <p>8. Programs on Services, notification and broadcast receivers</p> <p>9. Database Programming with SQLite</p> <p>10. Programming threads, handles and asynchronized programs</p> <p>11. Programming Media API and Telephone API</p> <p>12. Programming Security and permissions</p> <p>13. Programming Network Communications and Services (JSON)</p>
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Course Code	Project Implementation
UIT6PIP	The details are given in Appendix-I

APPENDIX –1

Project Dissertation Semester V and Project Implementation Semester VI

Chapter 1 to 4 should be submitted in Semester V in spiral binding. These chapters have also to be included in Semester VI report. Semester VI report has to be hard bound with golden embossing. Students will be evaluated based on the dissertation in semester V and dissertation and viva voce in Semester VI.

I. OBJECTIVES

- Describe the Systems Development Life Cycle (SDLC).
- Evaluate systems requirements.
- Complete a problem definition.
- Evaluate a problem definition.
- Determine how to collect information to determine requirements.
- Perform and evaluate feasibility studies like cost-benefit analysis, technical feasibility, time feasibility and Operational feasibility for the project.
- Work on data collection methods for fact finding.
- Construct and evaluate data flow diagrams.
- Construct and evaluate data dictionaries.
- Evaluate methods of process description to include structured English, decision tables and decision trees.
- Evaluate alternative tools for the analysis process.
- Create and evaluate such alternative graphical tools as systems flow charts and state transition diagrams.
- Decide the S/W requirement specifications and H/W requirement specifications.
- Plan the systems design phase of the SDLC.
- Distinguish between logical and physical design requirements.
- Design and evaluate system outputs.
- Design and evaluate systems inputs.

- Design and evaluate validity checks for input data.
- Design and evaluate user interfaces for input.
- Design and evaluate file structures to include the use of indexes.
- Estimate storage requirements.
- Explain the various file update processes based on the standard file organizations.
- Decide various data structures.
- Construct and evaluate entity-relationship (ER) diagrams for RDBMS related projects.
- Perform normalization for the unnormalized tables for RDBMS related projects
- Decide the various processing systems to include distributed, client/server, online and others.
- Perform project cost estimates using various techniques.
- Schedule projects using both GANTT and PERT charts.
- Perform coding for the project.
- Documentation requirements and prepare and evaluate systems documentation.
- Perform various systems testing techniques/strategies to include the phases of testing.
- Systems implementation and its key problems.
- Generate various reports.
- Be able to prepare and evaluate a final report.
- Brief the maintenance procedures and the role of configuration management in operations.
- To decide the future scope and further enhancement of the system.
- Plan for several appendices to be placed in support with the project report documentation.
- Decide the various processing systems to include distributed, client/server, online and others.
- Perform project cost estimates using various techniques.
- Schedule projects using both GANTT and PERT charts.
- Perform coding for the project.
- Documentation requirements and prepare and evaluate systems documentation.

- Perform various systems testing techniques/strategies to include the phases of testing.
 - Systems implementation and its key problems.
 - Generate various reports.
 - Be able to prepare and evaluate a final report.
 - Brief the maintenance procedures and the role of configuration management in operations.
 - To decide the future scope and further enhancement of the system.
 - Plan for several appendices to be placed in support with the project report documentation.
-
- Work effectively as an individual or as a team member to produce correct, efficient, well-organized and documented programs in a reasonable time.
 - Recognize problems that are amenable to computer solutions, and knowledge of the tool necessary for solving such problems.
 - Develop of the ability to assess the implications of work performed.
 - Get good exposure and command in one or more application areas and on the software
 - Develop quality software using the software engineering principles
 - Develop of the ability to communicate effectively.

II. Type of the Project

The majority of the students are expected to work on a real-life project preferably in some industry/ Research and Development Laboratories/Educational Institution/Software Company. Students are encouraged to work in the areas listed below. However, it is ***not mandatory*** for a student to work on a real-life project. The student can formulate a project problem with the help of her/his Guide and submit the project proposal of the same. **Approval of the project proposal is mandatory.** If approved, the student can commence working on it, and complete it. Use the latest versions of the software packages for the development of the project.

III. SOFTWARE AND BROAD AREAS OF APPLICATION

FRONT END / GUI Tools	.Net Technologies,Java
DBMS/BACK END	Oracle, SQL Plus, MY SQL, SQL Server,
LANGUAGES	C, C++, Java, VC++, C#, R,Python
SCRIPTING LANGUAGES	PHP,JSP, SHELL Scripts (Unix), Tcl/Tk,

.NET Platform	F#,C#. Net, Visual C#. Net, ASP.Net
MIDDLE WARE (COMPONENT) TECHNOLOGIES	COM/DCOM, Active-X, EJB
UNIX INTERNALS	Device Drivers, RPC, Threads, Socket
NETWORK/WIRELESS TECHNOLOGIES	-

IV. Introduction

The project report should be documented with scientific approach to the solution of the problem that the students have sought to address. The project report should be prepared in order to solve the problem in a methodical and professional manner, making due references to appropriate techniques, technologies and professional standards. The student should start the documentation process from the first phase of software development so that one can easily identify the issues to be focused upon in the ultimate project report. The student should also include the details from the project diary, in which they will record the progress of their project throughout the course. The project report should contain enough details to enable examiners to evaluate the work. The important points should be highlighted in the body of the report, with details often referred to appendices.

1.1 PROJECT REPORT:

Title Page

Original Copy of the Approved Proforma of the Project Proposal

Certificate of Authenticated work

Role and Responsibility Form

Abstract

Acknowledgement

Table of Contents

Table of Figures

CHAPTER 1: INTRODUCTION

1.1 Background

1.2 Objectives

1.3 Purpose, Scope, and Applicability

1.3.1 Purpose

1.3.2 Scope

1.3.3 Applicability

1.4 Achievements

1.5 Organisation of Report

CHAPTER 2: SURVEY OF TECHNOLOGIES

CHAPTER 3: REQUIREMENTS AND ANALYSIS

3.1 Problem Definition

3.2 Requirements Specification

3.3 Planning and Scheduling

3.4 Software and Hardware Requirements

3.5 Preliminary Product Description

3.6 Conceptual Models

CHAPTER 4: SYSTEM DESIGN

4.1 Basic Modules

4.2 Data Design

4.2.1 Schema Design

4.2.2 Data Integrity and Constraints

4.3 Procedural Design

4.3.1 Logic Diagrams

4.3.2 Data Structures

4.3.3 Algorithms Design

4.4 User interface design

4.5 Security Issues

4.6 Test Cases Design

The documentation should use tools like star UML, Visuo for windows, Rational Rose for design as part of Software Project Management Practical Course. The documentation should be spiral bound for semester V and the entire documentation should be hard bound during semester VI.

CHAPTER 5: IMPLEMENTATION AND TESTING

T.Y.B.Sc, Information Technology Syllabus

5.1 Implementation Approaches

5.2 Coding Details and Code Efficiency 68

5.2.1 Code Efficiency

5.3 Testing Approach

5.3.1 Unit Testing

5.3.2 Integrated Testing

5.3.3 Beta Testing

5.4 Modifications and Improvements

5.5 Test Cases

CHAPTER 6: RESULTS AND DISCUSSION

6.1 Test Reports

6.2 User Documentation

CHAPTER 7: CONCLUSIONS

7.1 Conclusion

7.1.1 Significance of the System

7.2 Limitations of the System

7.3 Future Scope of the Project

REFERENCES

GLOSSARY

APPENDIX A

APPENDIX B

V. EXPLANATION OF CONTENTS

Title Page

Sample format of Title page is given in Appendix 1 of this block. Students should follow the given format.

Original Copy of the Approved Proforma of the Project Proposal

Sample Proforma of Project Proposal is given in Appendix 2 of this block. Students should follow the given format.

Certificate of Authenticated work

Sample format of Certificate of Authenticated work is given in Appendix 3 of this block. Students should follow the given format.

Role and Responsibility Form

Sample format for Role and Responsibility Form is given in Appendix 4 of this block.

Students should follow the given format.

Abstract

This should be one/two short paragraphs (100-150 words total), summarising the project work. It is important that this is not just a re-statement of the original project outline. A suggested flow is background, project aims and main achievements. From the abstract, a reader should be able to ascertain if the project is of interest to them and, it should present results of which they may wish to know more details.

Acknowledgements

This should express student's gratitude to those who have helped in the preparation of project. Table of Contents: The table of contents gives the readers a view of the detailed structure of the report. The students would need to provide section and subsection headings with associated pages. The formatting details of these sections and subsections are given below. Table of Figures: List of all Figures, Tables, Graphs, Charts etc. along with their page numbers in a table of figures.

Chapter 1: Introduction

The introduction has several parts as given below:

Background: A description of the background and context of the project and its relation to work already done in the area. Summarise existing work in the area concerned with the project work.

Objectives: Concise statement of the aims and objectives of the project. Define exactly what is going to be done in the project; the objectives should be about 30 /40 words. Purpose, Scope and Applicability: The description of Purpose, Scope, and Applicability are given below:

- Purpose: Description of the topic of the project that answers questions on why this project is being done. How the project could improve the system its significance and theoretical framework.

- **Scope:** A brief overview of the methodology, assumptions and limitations. The students should answer the question: What are the main issues being covered in the project? What are the main functions of the project?
- **Applicability:** The student should explain the direct and indirect applications of their work. Briefly discuss how this project will serve the computer world and people. **Achievements:** Explain what knowledge the student achieved after the completion of the work. What contributions has the project made to the chosen area? **Goals achieved** -describes the degree to which the findings support the original objectives laid out by the project. The goals may be partially or fully achieved, or exceeded.
- Organisation of Report:** Summarising the remaining chapters of the project report, in effect, giving the reader an overview of what is to come in the project report.

Chapter 2: Survey of Technologies

In this chapter Survey of Technologies should demonstrate the students awareness and understanding of Available Technologies related to the topic of the project. The student should give the detail of all the related technologies that are necessary to complete the project. The should describe the technologies available in the chosen area and present a comparative study of all those Available Technologies. Explain why the student selected the one technology for the completion of the objectives of the project.

Chapter 3: Requirements and Analysis

Problem Definition: Define the problem on which the students are working in the project. Provide details of the overall problem and then divide the problem in to sub-problems. Define each sub-problem clearly

Requirements Specification: In this phase the student should define the requirements of the system, independent of how these requirements will be accomplished. The Requirements Specification describes the things in the system and the actions that can be done on these things. Identify the operation and problems of the existing system.

Planning and Scheduling: Planning and scheduling is a complicated part of software development. Planning, for our purposes, can be thought of as determining all the small tasks that must be carried out in order to accomplish the goal. Planning also takes into account, rules, known as constraints, which, control when certain tasks can or cannot happen. Scheduling can be thought of as determining whether adequate resources are available to carry out the plan. The student should show the Gantt chart and Program Evaluation Review Technique (PERT).

Software and Hardware Requirements: Define the details of all the software and hardware needed for the development and implementation of the project.

- **Hardware Requirement:** In this section, the equipment, graphics card, numeric co-processor, mouse, disk capacity, RAM capacity etc. necessary to run the software must be noted.

- Software Requirements: In this section, the operating system, the compiler, testing tools, linker, and the libraries etc. necessary to compile, link and install the software must be listed.

Preliminary Product Description: Identify the requirements and objectives of the new system. Define the functions and operation of the application/system the students are developing as project.

Conceptual Models: The student should understand the problem domain and produce a model of the system, which describes operations that can be performed on the system, and the allowable sequences of those operations. Conceptual Models could consist of complete Data Flow Diagrams, ER diagrams, Object-oriented diagrams, System Flowcharts etc.

Chapter 4: System Design

Describes desired features and operations in detail, including screen layouts, business rules, process diagrams, pseudo code and other documentation.

Basic Modules: The students should follow the divide and conquer theory, so divide the overall problem into more manageable parts and develop each part or module separately. When all modules are ready, the student should integrate all the modules into one system. In this phase, the student should briefly describe all the modules and the functionality of these modules. Data Design: Data design will consist of how data is organised, managed and manipulated.

- Schema Design: Define the structure and explanation of schemas used in the project.
- Data Integrity and Constraints: Define and explain all the validity checks and constraints provided to maintain data integrity.

Procedural Design: Procedural design is a systematic way for developing algorithms or procedurals.

- Logic Diagrams: Define the systematically flow of procedure that improves its comprehension and helps the programmer during implementation. e.g., Control Flow Chart, Process Diagrams etc.
- Data Structures: Create and define the data structure used in procedures.
- Algorithms Design: With proper explanations of input data, output data, logic of processes, design and explain the working of algorithms.

User Interface Design: Define user, task, environment analysis and how to map those requirements in order to develop a “User Interface”. Describe the external and internal components and the architecture of user interface. Show some rough pictorial views of the user interface and its components.

Security Issues: Discuss Real-time considerations and Security issues related to the project and explain how the student intends avoiding those security problems. What are the security policy plans and architecture?

Test Cases Design: Define test cases, which will provide easy detection of errors and mistakes with in a minimum period of time and with the least effort. Explain the different conditions in which the students wish to ensure the correct working of the project.

Chapter 5: Implementation and Testing

Implementation Approaches: Define the plan of implementation, and the standards the students have used in the implementation.

Coding Details and Code Efficiency: Students not need include full source code, instead, include only the important codes (algorithms, applets code, forms code etc). The program code should contain comments needed for explaining the work a piece of code does. Comments may be needed to explain why it does it, or, why it does a particular way.

The student can explain the function of the code with a shot of the output screen of that program code.

- Code Efficiency: The student should explain how the code is efficient and how the students have handled code optimisation.

Testing Approach: Testing should be according to the scheme presented in the system design chapter and should follow some suitable model – e.g., category partition, state machine-based. Both functional testing and user-acceptance testing are appropriate. Explain the approach of testing.

- Unit Testing: Unit testing deals with testing a unit or module as a whole. This would test the interaction of many functions but, do confine the test within one module.
- Integrated Testing: Brings all the modules together into a special testing environment, then checks for errors, bugs and interoperability. It deals with tests for the entire application. Application limits and features are tested here.

Modifications and Improvements: Once the students finish the testing they are bound to be faced with bugs, errors and they will need to modify your source code to improve the system. Define what modification are implemented in the system and how it improved the system.

Chapter 6: Results and Discussion

Test Reports: Explain the test results and reports based on the test cases, which should show that the project is capable of facing any problematic situation and that it works fine in different conditions. Take the different sample inputs and show the outputs.

User Documentation: Define the working of the software; explain its different functions, components with screen shots. The user document should provide all the details of the product in such a way that any user reading the manual, is able to understand the working and functionality of the document.

Chapter 7: Conclusions

Conclusion: The conclusions can be summarised in a fairly short chapter (2 or 3 pages). This chapter brings together many of the points that would have made in the other chapters. **Limitations of the System:** Explain the limitations encountered during the testing of the project that the students were not able to modify. List the criticisms accepted during the demonstrations of the project.

Future Scope of the Project describes two things: firstly, new areas of investigation prompted by developments in this project, and secondly, parts of the current work that was not completed due to time constraints and/or problems encountered.

REFERENCES

It is very important that the students acknowledge the work of others that they have used or adapted in their own work, or that provides the essential background or context to the project. The use of references is the standard way to do this. Please follow the given standard for the references for books, journals, and online material. The citation is mandatory in both the reports. E.g:

Linhares, A., & Brum, P. (2007). Understanding our understanding of strategic scenarios: What role do chunks play? *Cognitive Science*, 31(6), 989-1007.

<https://doi.org/doi:10.1080/03640210701703725>

Lipson, Charles (2011). *Cite right : A quick guide to citation styles; MLA, APA, Chicago, the sciences, professions, and more* (2nd ed.). Chicago [u.a.]: University of Chicago Press. p. 187. ISBN 9780226484648.

Elaine Ritchie, J Knite. (2001). *Artificial Intelligence*, Chapter 2 ,p.p 23 - 44. Tata McGrawHill.

GLOSSARY

If you the students any acronyms, abbreviations, symbols, or uncommon terms in the project report then their meaning should be explained where they first occur. If they go on to use any of them extensively then it is helpful to list them in this section and define the meaning.

APPENDICES

These may be provided to include further details of results, mathematical derivations, certain illustrative parts of the program code (e.g., class interfaces), user documentation etc.

In particular, if there are technical details of the work done that might be useful to others who wish to build on this work, but that are not sufficiently important to the project as a whole to justify being discussed in the main body of the project, then they should be included as appendices.

VI. SUMMARY

Project development usually involves an engineering approach to the design and development of a software system that fulfils a practical need. Projects also often form an important focus for discussion at interviews with future employers as they provide a detailed example of what the students are capable of achieving. In this course the students can choose your project topic from the lists given in Unit 4: Category-wise Problem Definition.

VII. FURTHER READINGS

1. Modern Systems Analysis and Design; Jeffrey A. Hoffer, Joey F. George, Joseph, S. Valacich; Pearson Education; Third Edition; 2002.
2. ISO/IEC 12207: Software Life Cycle Process
(<http://www.software.org/quagmire/descriptions/iso-iec12207.asp>).
3. IEEE 1063: Software User Documentation (<http://ieeexplore.ieee.org>).
4. ISO/IEC: 18019: Guidelines for the Design and Preparation of User Documentation for Application Software.
5. <http://www.sce.carleton.ca/squall>.
6. <http://en.tldp.org/HOWTO/Software-Release-Practice-HOWTO/documentation.html>.
7. <http://www.sei.cmu.edu/cmm/>

PROFORMA FOR THE APPROVAL PROJECT PROPOSAL

(Note: All entries of the proforma of approval should be filled up with appropriate and complete information. Incomplete proforma of approval in any respect will be summarily rejected.)

PNR No.: Roll no: _____

1. Name of the Student

2. Title of the Project

3. Name of the Guide

4. Teaching experience of the Guide _____

5. Is this your first submission? Yes No

Signature of the Student

Date:

Signature of the Guide

Date:

Signature of the Coordinator

Date:

(All the text in the report should be in times new roman)

TITLE OF THE PROJECT
(NOT EXCEEDING 2 LINES, 24 BOLD, ALL CAPS)

A Project Report (12 Bold)
Submitted in partial fulfillment of the
Requirements for the award of Degree of (size-12)

BACHELOR OF SCIENCE (INFORMATION TECHNOLOGY)(14 BOLD, CAPS)

By(12 Bold)

Name of The Student (size-15, title case)
Seat Number (size-15)

Under the esteemed guidance of (13 bold)
Mr./Mrs. Name of The Guide (15 bold, title case)
Designation (14 Bold, title case)

COLLEGE LOGO

DEPARTMENT OF INFORMATION TECHNOLOGY(12 BOLD, CAPS)

COLLEGE NAME (14 BOLD, CAPS)

*(Affiliated to University of Mumbai) (12, Title case, bold, italic)*CITY, PIN CODE(12 bold, CAPS) MAHARASHTRA
(12 bold, CAPS)

YEAR (12 bold)

COLLEGE NAME (14 BOLD, CAPS)

(Affiliated to University of Mumbai) (13, bold, italic)
CITY-MAHARASHTRA-PINCODE(13 bold, CAPS)

DEPARTMENT OF INFORMATION TECHNOLOGY (14 BOLD, CAPS)

College Logo

CERTIFICATE (14 BOLD, CAPS, underlined, centered)

This is to certify that the project entitled, "**Title of The Project** ", is bonafied work of **NAME OF THE STUDENT** bearing Seat.No: **(NUMBER)** submitted in partial fulfillment of the requirements for the award of degree of BACHELOR OF SCIENCE in INFORMATION TECHNOLOGY from University of Mumbai. (12, times new roman, justified)

Internal Guide (12 bold)

Coordinator

(Don't write names of lecturers or HOD)

External Examiner

Date:

College Seal

COMPANY CERTIFICATE (if applicable)

(Project Abstract page format)

Abstract (20bold, caps, centered)

Content (12, justified)

**Note: Entire document should be with 1.5
line spacing and all paragraphs should start with 1 tab space.**

ACKNOWLEDGEMENT (20, BOLD, ALL CAPS, CENTERED)

The acknowledgement should be in times new roman, 12 font with 1.5 line spacing, justified.

(Declaration page format)

DECLARATION (20 bold, centered, allcaps)

Content (12, justified)

I here by declare that the project entitled, “**Title of the Project**” done at **place where the project is done**, has not been in any case duplicated to submit to any other university for the award of any degree. To the best of my knowledge other than me, no one has submitted to any other university.

The project is done in partial fulfillment of the requirements for the award of degree of **BACHELOR OF SCIENCE (INFORMATION TECHNOLOGY)** to be submitted as final semester project as part of our curriculum.

Name and Signature of the Student

TABLE OF CONTENTS (20bold, caps, centered)

Should be generated automatically using word processing software.

Chapter 1: Introduction	01(no bold)
1.1 Background	02(no bold)
1.2 Objectives
1.3 Purpose and Scope
1.2.1 Purpose
1.2.2 Scope	
.....	
.....	

Chapter 2: System Analysis

- 2.1 Existing System**
- 2.2 Proposed System**
- 2.3 Requirement Analysis**
- 2.4 Hardware Requirements**
- 2.5 Software Requirements**
- 2.6 Justification of selection of Technology**

Chapter 3: System Design

- 3.1 Module Division**
- 3.2 Data Dictionary**
- 3.3 ER Diagrams**
- 3.4 DFD/UML Diagrams**

Chapter 4: Implementation and Testing

- 4.1 Code (Place Core segments)**
- 4.2 Testing Approach**
 - 4.2.1 Unit Testing (Test cases and Test Results)**
 - 4.2.2 Integration System (Test cases and Test Results)**

Chapter 5: Results and Discussions (Output Screens)

Chapter 6: Conclusion and Future Work

Chapter 7: References

List of Tables (20 bold, centered, Title Case)

Should be generated automatically using word processing software

List of Figures (20 bold, centered, Title Case)

Should be generated automatically using word processing software.

(Project Introduction page format)

Chapter 1

Introduction (20 Bold, centered)

Content or text (12, justified)

Note: Introduction has to cover brief description of the project with minimum 4 pages.

Chapter 2

System Analysis (20 bold, Centered)

Subheadings are as shown below with following format (16 bold, CAPS)

2.1 Existing System (16 Bold)

2.1.1 ----- (14 bold, title case)

2.1.1.1 ----- (12 bold, title case)

2.2 Proposed System

2.3 Requirement Analysis

2.4 Hardware Requirements

2.5 Software Requirements

2.6 Justification of Platform – (how h/w & s/w satisfying the project)

Table 2.1: Caption

Chapter 3

System Design (20 bold, centered)

Subheadings are as shown below with following format (16 bold, CAPS)

Specify figures as Fig 11.1 – caption

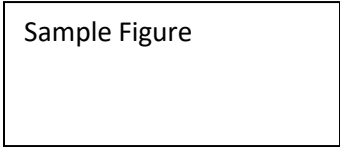
3.1 Module Division

3.2 Data Dictionary

3.3 E-R Diagrams

3.4 Data Flow Diagrams / UML

Note: write brief description at the bottom of all diagrams



Sample Figure

Fig. 3.1: Caption

Chapter 4

Implementation and Testing (20 bold, centered)

4.1 Code (Place Core segments)

Content includes description about coding phase in your project (Font-12)

(* don't include complete code ---- just description)

4.2 Testing Approach

Subheadings are as shown below with following format (16 bold, CAPS)

4.2.1 Unit Testing

4.2.2 Integration Testing

Note:

- Explain about above testing methods
- Explain how the above techniques are applied in your project
Provide Test plans, test cases, etc relevant to your project

Chapter 5

Results and Discussions(20 bold, centered)

Note: Place Screen Shots and write the functionality of each screen at the bottom

Chapter 6

Conclusion and Future Work (20 bold, centered)

The conclusions can be summarized in a fairly short chapter around 300 words. Also include limitations of your system and future scope (12, justified)

Chapter 7

References (20 bold, centered)

Content (12, LEFT)

[1] Title of the book, Author

[2] Full URL of online references

[3]

*** NOTE ABOUT PROJECT VIVA VOCE:**

Student may be asked to write code for problem during VIVA to demonstrate his coding capabilities and he/she may be asked to write any segment of coding used in the in the project. The project can be done in group of at most four students. However, the length and depth of the project should be justified for the projects done in group. A big project can be modularised and different modules can be assigned as separate project to different students.

Marks Distribution:

Semester V: 50 Marks

Documentation: 50 marks

Semester VI: 150 Marks

Documentation: 50 Marks:

Implementation and Viva Voce: 100 Marks

The plagiarism should be maintained as per the UGC guidelines.



Janardan Bhagat Shikshan Prasarak Sanstha's

CHANGU KANA THAKUR

**ARTS, COMMERCE & SCIENCE COLLEGE, NEW PANVEL
(AUTONOMOUS)**

Re-accredited 'A+' Grade by NAAC

**'College with Potential for Excellence' Status Awarded by UGC
'Best College Award' by University of Mumbai**

Program: M.Sc.

**Revised Syllabus of M.Sc. Information Technology(Part-I)
Choice Based Credit & Grading System (60:40)**

w.e.f. Academic Year 2020-2021

**Choice Based Credit Grading and Semester System (CBCGS)
M. Sc. Information Technology Syllabus**

To be implemented from the Academic year 2020-2021

SEMESTER I

Course Code	Course Nomenclature	Credits
PIT1RIC	Research in Computing	4
PIT1DSC	Data Science	4
PIT1CLC	Cloud Computing	4
PIT1SCT	Soft Computing Techniques	4
PIT1RCP	Research in Computing Practical	2
PIT1DSP	Data Science Practical	2
PIT1CCP	Cloud Computing Practical	2
PIT1SCP	Soft Computing Techniques Practical	2
Total		24

Choice Based Credit Grading and Semester System (CBCGS)

**M. Sc. Information Technology Syllabus
To be implemented from the Academic year 2020-2021**

SEMESTER II

Course Code	Course Nomenclature	Credits
PIT2BDA	Big Data Analytics	4
PIT2MNW	Modern Networking	4
PIT2MSA	Microservices Architecture	4
PIT2IGP	Image Processing	4
PIT2BDP	Big Data Analytics Practical	2
PIT2MNP	Modern Networking Practical	2
PIT2MAP	Microservices Architecture Practical	2
PIT2IPP	Image Processing Practical	2
Total		24

M.Sc. Part I, Information Technology Syllabus

Course Code
PIT1DSC

Data Science

Objectives:

- Develop in depth understanding of the key technologies in data science and business analytics: data mining, machine learning, visualization techniques, predictive modeling, and statistics.
- Practice problem analysis and decision-making. Gain practical, hands-on experience with statistics programming languages and big data tools through coursework and applied research experiences.

Expected Learning Outcomes

The learners will be able to

- 1) Recognize and analyze ethical issues in business related to intellectual property, data security, integrity, and privacy.
- 2) Apply ethical practices in everyday business activities and make well reasoned ethical business and data management decisions.
- 3) Demonstrate knowledge of statistical data analysis techniques utilized in business decision making.
- 4) Apply principles of Data Science to the analysis of business problems.
- 5) Demonstrate use of team work, leadership skills, decision making and organization theory

I

Data Science Technology Stack: Rapid Information Factory Ecosystem, Data Science Storage Tools, Data Lake, Data Vault, Data Warehouse Bus Matrix, Data Science Processing Tools ,Spark, Mesos, Akka , Cassandra, Kafka, Elastic Search, R ,Scala, Python, MQTT, The Future
Layered Framework: Definition of Data Science Framework, Cross Industry Standard Process for Data Mining (CRISP-DM), Homogeneous Ontology for Recursive Uniform Schema, The Top Layers of a Layered Framework, Layered Framework for High-Level Data Science and Engineering
Business Layer: Business Layer, Engineering a Practical Business Layer
Utility Layer: Basic Utility Design, Engineering a Practical Utility Layer

12

II

Three Management Layers: Operational Management Layer, Processing-Stream Definition and Management, Audit, Balance, and Control Layer, Balance, Control, Yoke Solution, Cause-and-Effect, Analysis System, Functional Layer, Data Science Process **Retrieve Superstep** : Data Lakes, Data Swamps, Training the Trainer Model, Understanding the Business Dynamics of the Data Lake, Actionable Business Knowledge from Data Lakes, Engineering a Practical Retrieve Superstep, Connecting to Other Data Sources.

12

III

Assess Superstep: Assess Superstep, Errors, Analysis of Data, Practical Actions, Engineering a Practical Assess Superstep

12

IV

Process Superstep : Data Vault, Time-Person-Object-Location-Event Data Vault, Data Science Process, Data Science,
Transform Superstep : Transform Superstep, Building a Data Warehouse, Transforming with Data Science, Hypothesis Testing, Overfitting and Underfitting, Precision-Recall, Cross-Validation Test

12

V

Transform Superstep: Univariate Analysis, Bivariate Analysis, Multivariate Analysis, Linear Regression, Logistic Regression, Clustering Techniques, ANOVA, Principal Component Analysis (PCA), Decision Trees, Support Vector Machines, Networks, Clusters, and Grids, Data Mining, Pattern Recognition, Machine Learning, Bagging Data, Random Forests, Computer Vision (CV) , Natural Language Processing (NLP), Neural Networks, TensorFlow. **Organize and Report Supersteps** : Organize Superstep, Report Superstep, Graphics, Pictures, Showing the Difference.

12

Course Code	Practical List
PIT1DSP	10 Practical based on above syllabus, covering entire syllabus
1	Creating Data Model using Cassandra.
2	Conversion from different formats to HOURS format
3	Utilities and Auditing
4	Retrieving Data
5	Assessing Data
6	Processing Data
7	Transforming Data
8	Organising Data
9	Generating Reports
10	Data Visualisation with Power BI

Reference Books:

1. Practical Data Science Andreas François Vermeulen APress 2018
2. Principles of Data Science Sinan Ozdemir PACKT 2016
3. Data Science from Scratch Joel Grus O'Reilly 2015
4. Data Science from Scratch first Principle in python Joel Grus Shroff Publishers 2017
5. Experimental Design in Data science with Least Resources N C Das Shroff Publishers 2018

Course Code PIT2MSA	Microservice Architecture	
Objectives <ul style="list-style-type: none">• Gain a thorough understanding of the philosophy and architecture of Web applications using ASP.NET Core MVC;• Gain a practical understanding of .NET Core;• Acquire a working knowledge of Web application development using ASP.NET Core MVC 6 and Visual Studio Persist data with XML Serialization and ADO.NET with SQL Server Create HTTP services using ASP.NET Core Web API;• Deploy ASP.NET Core MVC applications to the Windows Azure cloud.		
Expected Learning Outcomes: The learners will be able to <ol style="list-style-type: none">1) Develop web applications using Model View Control. Create MVC Models and write code that implements business logic within Model methods, properties, and events.2) Create Views in an MVC application that display and edit data and interact with Models and Controllers..3) Gaining a thorough understanding of the philosophy and architecture of .NET4) Core Understanding packages, met packages and frameworks5) Acquiring a working knowledge of the .NET programming model		
I	Microservices: Understanding Microservices, Adopting Microservices, The Microservices Way. Microservices Value Proposition: Deriving Business Value, defining a Goal-Oriented, Layered Approach, Applying the Goal-Oriented, Layered Approach. Designing Microservice Systems: The Systems Approach to Microservices, A Microservices Design Process, Establishing a Foundation: Goals and Principles, Platforms, Culture.	12
II	Service Design: Microservice Boundaries, API design for Microservices, Data and Microservices, Distributed Transactions and Sagas, Asynchronous Message-Passing and Microservices, dealing with Dependencies, System Design and Operations: Independent Deployability, More Servers, Docker and Microservices, Role of Service Discovery, Need for an API Gateway, Monitoring and Alerting. Adopting Microservices in Practice: Solution Architecture Guidance, Organizational Guidance, Culture Guidance, Tools and Process Guidance, Services Guidance.	12
III	Building Microservices with ASP.NET Core: Introduction, Installing .NET Core, Building a Console App, Building ASP.NET Core App. Delivering Continuously: Introduction to Docker, Continuous integration with Wercker, Continuous Integration with Circle CI, Deploying to Dicker Hub. Building Microservice with ASP.NET Core: Microservice, Team Service, API First Development, Test First Controller, Creating a CI pipeline, Integration Testing, Running the team service Docker Image. Backing Services: Microservices Ecosystems, Building the location Service, Enhancing Team Service.	12

M.Sc. Part I, Information Technology Syllabus

IV	Creating Data Service: Choosing a Data Store, Building a Postgres Repository, Databases are Backing Services, Integration Testing Real Repositories, Exercise the Data Service. Event Sourcing and CQRS: Event Sourcing, CQRS pattern, Event Sourcing and CQRS, Running the samples. Building an ASP.NET Core Web Application: ASP.NET Core Basics, Building Cloud-Native Web Applications. Service Discovery: Cloud Native Factors, Netflix Eureka, Discovering and Advertising ASP.NET Core Services. DNS and Platform Supported Discovery.	12
V	Configuring Microservice Ecosystems: Using Environment Variables with Docker, Using Spring Cloud Config Server, Configuring Microservices with etcd, Securing Applications and Microservices: Security in the Cloud, Securing ASP.NET Core Web Apps, Securing ASP.NET Core Microservices. Building Real-Time Apps and Services: Real-Time Applications Defined, Websockets in the Cloud, Using a Cloud Messaging Provider, Building the Proximity Monitor. Putting It All Together: Identifying and Fixing Anti-Patterns, Continuing the Debate over Composite Microservices, The Future.	12

Course Code	Practical List
PIT2MAP	10 Practical based on above syllabus, covering entire syllabus
1	Building APT.NET Core MVC Application
2	Building ASP.NET Core REST API.
3	Working with Docker, Docker Commands, Docker Images and Containers.
4	Installing software packages on Docker, Working with Docker Volumes and Networks.
5	Working with Docker Swarm.
6	Working with Circle CI for continuous integration.
7	Creating Microservice with ASP.NET Core.
8	Working with Kubernetes.
9	Creating Backing Service with ASP.NET Core.
10	Building real-time Microservice with ASP.NET Core.

Reference Books:

- 1) Building Microservices with ASP.NET Core ,Kevin Hoffman ,O'Reilly
- 2) Building Microservices: Designing Fine-Grained Systems, Sam Newman ,O'Reilly
- 3)Production-ready Microservices, Susan J. Fowler, O'Reilly



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Program: M.Sc

**Revised Syllabus of M.Sc. Information Technology
Choice Based Credit & Grading System (60:40)
w.e.f. Academic Year 2019-2020**

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Choice Based Credit Grading and Semester System (CBCGS)
M. Sc. Information Technology Syllabus
To be implemented from the Academic year 2019-2020
SEMESTER III

Course Code	Course Nomenclature	Lectures	Credits	Practical Course	Hours	Credits	Total Credits
PIT3EMS	Embedded Systems	60	4	PIT3ESP	60	2	6
PIT3ISM	Information Security Management	60	4	PIT3ISP	60	2	6
Elective 1		60	4	Elective 1	60	2	6
PIT3VIR	Virtualization			PIT3VIP			
PIT3ANN	Artificial Neural Networks			PIT3ANP			
Elective 2		60	4	Elective 2	60	2	6
PIT3DIP	Digital Image Processing			PIT3DPP			
PIT3ETH	Ethical Hacking			PIT3EHP			
Total							24

Choice Based Credit Grading and Semester System (CBCGS)
M. Sc. Information Technology Syllabus
To be implemented from the Academic year 2019-2020
SEMESTER IV

Course Code	Course Nomenclature	Lectures	Credits	Practical Course	Hours	Credits	Total Credits
PIT4ARI	Artificial Intelligence	60	4				4
PIT4IIM	IT Infrastructure Management	60	4				4
Elective 1		60	4	Elective 1	60	2	6
PIT4INS	Intelligent Systems			PIT4ISP			
PIT4RTE	Real Time Embedded Systems			PIT4RTP			
PIT4COF	Computer Forensics			PIT4CFP			
Elective 2		60	4	Elective 2	60	2	6
PIT4DEC	Design of Embedded Control Systems			PIT4DEP			

PIT4AIP	Advanced Image Processing			PIT4APP			
PIT4CLM	Cloud Management			PIT4CMP			
PIT4PRO	Project		2	PIT4PRP		2	4
Total							24

Semester III

Course Code PIT3EMS	Embedded system	
Objectives The objective of this course is to have Skills in analysis, organisation and planning in the fields of electronics, information technology and embedded systems. Skills in oral and written communication of analysis, development and evaluation in the field of embedded systems.		
Expected Learning Outcomes: <div>1) To be able to design, describe, validate and optimize embedded electronic systems in different industrial application areas.</div> <div>2) To be able to define hardware and software communication and control requirements.</div> <div>3) To acquire knowledge of and be able to use tools for the development and debugging of programs implemented on microcontrollers and DSPs.</div> <div>4) To design electronic circuits for the processing of information in communications and control systems.</div> <div>5) To acquire knowledge of sensor properties and apply these in the design of Electronic systems which integrate measurement and actuation in different industrial production contexts.</div>		
I	Introduction What is an Embedded System, Embedded System Vs, General Computing System. The Typical Embedded System Core of Embedded System, Memory, Sensors and Actuators, Communication Interface, Embedded Firmware. Characteristic and quality attributes of Embedded System Characteristics of an Embedded System, Quality Attributes of Embedded System. Embedded product development life cycle What is EDLC, Why EDLC? Objectives of EDLC, Different Phases of EDLC.	12
II	Hardware Software Co-design and Program Modelling Fundamental Issues in Hardware Software Co-Design, Computational Models in Embedded Design, Introduction to Unified Modelling Language (UML), Hardware Software Trade-offs. Embedded Hardware design and development Analog Electronic Components, Digital Electronic Components, Electronic design Automation (EDA) Tools, The PCB Layout design. Embedded Firmware design and development Embedded Firmware Design Approaches, Embedded Firmware Development Languages Real Time Operating System(RTOS) Operating System Basics, Types of Operating Systems, Device Drivers, How to choose an RTOS	12

III	Memories and Memory Subsystem Introduction, Classifying Memory, A general Memory Interface, ROM Overview, Static RAM Overview, Dynamic RAM Overview, Chip Organization, A SRAM Design, A DRAM Design, The DRAM Memory Interface, The Memory Map, Memory Subsystem Architecture, Basic Concepts of Caching, Design a cache system, Dynamic Memory Allocation, Testing Memories.	12
IV	Programming Concept and Embedded Programming in C/C++ and Java Software programming in Assembly Language (ALP) and in High-level Language 'C', C program Elements: Header and Source Files and Pre-processor Directives, Program Elements: Macros and Functions, Program Elements: Types, Data Structures, Modifiers, Statements, Loops and Pointers, Object-Oriented Programming, Embedded Programming in C++, Embedded Programming in Java.	12
V	Trends in the Embedded Industry Processor trends in Embedded System, Embedded OS Trends, Development Language Trends, Introduction of PIC Family of Microcontrollers, Introduction of ARM Family of Microcontrollers, Introduction of AVR Family of Microcontrollers.	12

Course Code	Practical List
PIT3ESP	<p>1 (Compulsory) Study of hardware components</p> <ol style="list-style-type: none"> 1. 8051 Microcontroller 2. Resistors (color code, types) 3. Capacitors 4. ADC, DAC 5. Operational Amplifiers 6. Transistors, Diode, Crystal Oscillator 7. Types of Relays 8. Sensors 9. Actuator 10. Types of connectors <p>2 WAP to blink an LED</p> <p>3 WAP block transfer of data</p> <p>4 WAP to serial data interface</p> <p>5 WAP for the keypad and LCD interface</p> <p>6 Implement mouse driver program using MSDOS interrupt</p> <p>7 WAP to implement ADC0808 with 8051 microcontroller</p> <p>8 WAP to simulate elevator functions</p> <p>9 WAP to interface stepper motor controller</p> <p>10 WAP to simulate traffic signals</p>

Reference Books:

- 1) Introduction to embedded systems, Shibu K. V, 2nd Edition, Tata McGraw-Hill
- 2) Embedded Systems Architecture, Programming and Design, Raj Kamal, 2nd Edition, Tata McGraw-Hill.
- 3) Embedded Systems: A Contemporary Design Tool, James K. Peckol, 1st edition.

Semester IV

Course Code PIT4ARI	Artificial Intelligence	
Objectives: The basic objective of AI is to enable computers to perform intellectual tasks such as decision making, problem solving, perception, understanding human communication. Expected Learning Outcomes: 1) Students will able to Demonstrate knowledge of the building blocks of AI as presented in terms of intelligent agents. 2) Analyze and formalize the problem as a state space, graph, design heuristics and select amongst different search or game based techniques to solve them. 3) Develop intelligent algorithms for constraint satisfaction problems and also design intelligent systems for Game Playing. 4) Attain the capability to represent various real life problem domains using logic based techniques and use this to perform inference or planning. 5) Formulate and solve problems with uncertain information using Bayesian approaches.		
I	Introduction: AI, Components of AI, History of AI, Salient Points, Knowledge and Knowledge Based Systems, AI in Future, Applications. Logic and Computation: Classical Concepts, Computational Logic, FOL, Symbol Tableau, Resolution, Unification, Predicate Calculus in Problem Solving, Model Logic, Temporal Logic. Heuristic Search: Search-Based Problems, Informed Search, Water Jug Problem, TSP, Branch and Bound Method, TSP Algorithm.	12
II	Game Playing: AND/OR Graph, Minimax Problem, Alpha-Beta Search, Puzzle Solving, AI versus Control Robot. Knowledge Representation: Structure of an RBS, Merit, Demerit and Applicability of RBS, Semantic Nets, Frames, Conceptual Graphs, Conceptual Dependency, Scripts. Automated Reasoning: Default Logic, Problem for Default Reasoning, Closed World Assumption, Predicate Completion, Circumscription, Default Reasoning, Model Based Reasoning, Case Based Reasoning, Reasoning Models, Multimodels, Multimodal Reasoning.	12
III	Probabilistic Reasoning: Bayes Theorem, Bayesian Network, Dempster and Shafer Theory of Evidence, Confidence Factor, Probabilistic Logic. Knowledge Acquisition: Knowledge Acquisition process, Automatic Knowledge Acquisition, Machine Learning, Induction, Analogical Reasoning, Explanation-Based Learning, Inductive Learning, Knowledge Acquisition Tools.	12
IV	Planning: Necessity of planning, Planning Agents, Planning generating schemes, Non-hierarchical planning, Hierarchical planning, Script-based planning, Oppurtunistic planning, Algorithm for planning, planning representation with STRIPS an example. Constraint Satisfaction Problem: Constraints and Satisfiability, Basic search strategies for solving CSP, Representation of CSP problem, Examples of constraint satisfaction problem.	12
V	Knowledge-Based Systems: Structure of an Expert System, Expert Systems in different Areas, Expert System Shells, Comparison of Expert Systems, Comparative View, Ingredients of Knowledge-Based Systems, Web-based Expert Systems. Prolog: Prolog programming features, Syntax, Syntax of Rules, LIST, Structure, Some Solutions using TURBO PROLOG.	12

M.Sc. Part II, Information Technology Syllabus

Reference Books:

Artificial Intelligence, R.B.Mishra, EEE, PHI

Artificial Intelligence & Soft Computing for Beginners, Anandita Das Bhattacharjee, SPD

Artificial Intelligence, E.Rich and K.Knight, 2002, TMH

Artificial Intelligence: A Modern Approach, S.Russel, P.Norvig, 2002, Pearson Education

Course Code PIT4PRO	Project
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Program: B.Sc

Syllabus of T.Y.B.Sc. Zoology (Fishery Biology)

Choice Based Credit & Grading System (75:25)

w.e.f. Academic Year 2021-22

Sr. No.	Heading	Particulars
1	Title of Course	Fishery Biology
2	Eligibility for Admission	T.Y.B.Sc. with subject Zoology
3	Passing marks	40%
4	Ordinances/Regulations (if any)	
5	No. of Semesters	Two
6	Level	U.G.
7	Pattern	Semester (75:25)
8	Status	Revised
9	To be implemented from Academic year	2021-22

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1.	Preface
2.	Tables of Courses, Topics, Credits and Workload
3.	Theory Syllabus for Semester V (Course code: USCFB501)
4.	Practical Syllabus for Semester V (Course code: USCFB5P1)
5.	Theory Syllabus for Semester VI (Course code: USCFB601)
6.	Practical Syllabus for Semester VI (Course code: USCFB6P1)
7.	References and Additional Reading (Course code: USCFB501, USCFB601)

Fishery Biology (Applied Component)
(Credit Based Semester and Grading System)
(To be implemented from the Academic Year 2021- 2022)

Semester V

Oceanography, Aquaculture Practices, Marketing and Finance

Theory (Any four units to be opted)				
Course	Unit	TOPIC	Credits	L/Week
USACFBIO501	1	Oceanography	2	4
	2	Crafts and Gear		
	3	Farming of Major Carps		
	4	Introduction to other Commercial Aquaculture Practices in Fresh Water		
	5	Culture of Shell fishes and Fin-Fish		
	6	Quality Control and Packaging		
	7	Marketing and Finance		
	8	Case Study and Simulation		
Practical				
USACFBIO5P1		Practical's based on Course USCFB501	2	4

Semester VI

Marine resources, Post-harvest and Farm Engineering

Theory (Any four units to be opted)				
Course	Unit	TOPIC	Credits	L/Week
USACFBIO601	1	Marine Fin-fish of India	2	4
	2	Marine Shellfish of India		
	3	Nutrition		
	4	Diseases		
	5	Preservation and Processing		
	6	Byproducts and Value-added Products		
	7	Farm Engineering		
	8	Open Unit		
Practical				
USACFBIO6P1		Practicals based on Course USCFB601	2	4

Semester VI: Theory
Course code: USCFB601
Skill Enhancing Course 2
Marine resources, Post-harvest and Farm Engineering

Unit 6: By-products and Value-Added Products

Learning Objective:

- *To acquire knowledge of fish by-products, value-added products and good manufacturing practices*

Desired outcome:

- *Learner will gain sound knowledge about the fish by-products and value-added products*
- *Learner will explore good manufacturing practices while manufacturing these products*

6.1 Proximate composition of fish meat and products

6.2 Introduction to by-products

- Fish protein concentrate**
- Fish maws / Isinglass**
- Fish hydrolysates**
- Chitin, Chitosan**
- Glucosamine hydrochloride**
- Gelatin**
- Fish silage**
- Surimi and imitation products**
- Pearl essence**

6.3 Different types of value-added products from fish and shell fish

- Fish / Prawn / Shrimp pickle**
- Fish wafers**
- Acetes indicus* (Prawn) chutney**
- Fish soup powder**
- Fish / Crab steaks**
- RTE (Ready To Eat)**
- Battered and breaded products**
- Marinated tandoori prawns**

ix) Prawn curry

6.4 Good manufacturing practices: Health and training of personnel, hygiene