



Andhra Christian College, Guntur

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Criterion: **II**

Metric: **2.6.1**

COs, POs & PSOs

PROGRAM OUTCOMES

B.Sc. (Bachelor of Science)

After completing three years for Bachelors in Science (B.Sc.) program, students would:

PO1: Acquired the knowledge with facts and figures related to various subjects in pure sciences such as Physics, Chemistry, Botany, Zoology, Mathematics, and Computer Science etc.

PO2: Understood the basic concepts, fundamental principles, and the scientific theories related to various scientific & Computer phenomena and their relevancies in the day-to-day life.

PO3: Acquired the skills in handling scientific and Computer equipment's, planning and performing in laboratory experiments.

PO4: Analyzed the given scientific data critically and systematically and the ability to draw the objective conclusions.

PO5: Been able to think creatively (divergently and convergent) to propose novel ideas in explaining facts and figures or providing new solution to the problems.

PO6: Realized how developments in any science subject helps in the development of other science subjects and vice-versa and how interdisciplinary approach helps in providing better solutions and new ideas for the sustainable development in Society.

PO7: Imbined ethical, moral and social values in personal and social life leading to highly cultured and civilized personality.

PO8: Developed various communication skills such as reading, listening, speaking, etc., which will help in expressing ideas and views clearly and effectively.

PO9: Realized that pursuit of knowledge is a lifelong activity and in combination with constant efforts and positive attitude and other necessary qualities leads towards a successful life.

PO10: After the completion of this course students have the option to go for higher studies, also offers opportunities for serving in state and central governments in various jobs.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

At the end of the Programme the student will be able to

PSO1	Interpret principles, classifications, concepts, theories and mechanisms.
PSO2	Analyze hypothesis, procedures, properties, experimental facts and draw conclusions.
PSO3	Apply techniques in solving problems, sample analysis and production.
PSO4	Develop communicative competence, creative and critical thinking, practical, technical and employability skills, social sensibility and responsibility

DEPARTMENT OF BOTANY

COURSE OUTCOMES (COs)

Course Code: BOT1SK

Course Name: Fundamentals of Microbes and Non-vascular Plants.

Upon completion of this course, the student will be able to:	
CO 1	Illustrate diversity among the Viruses and Prokaryotic organisms and categorize them.
CO 2	Classify Fungi, Lichens, Algae and Bryophytes based on the structure reproduction and life cycles.
CO 3	Analyze and ascertain the plant disease symptoms due to viruses and Bacteria.
CO 4	Evaluate the ecological and economic value of microbes, thallophytes and bryophytes.

Course Code: BOT2SK

Course Name: Basics of Vascular plants and Phytogeography.

Upon completion of this course, the student will be able to:	
CO 1	Classify and compare Pteridophytes and Gymnosperms based on their morphology, Anatomy reproduction and life cycles.
CO 2	Explain the process of fossilization and compare the characteristics of extinct and extant plants.
CO 3	Analyze the morphological of the most common angiosperm plants of their localities and recognize their families.
CO 4	Locate different Phytogeographical regions of the world and India and can analyze their floristic wealth.

Course Code: BOT3SK

Course Name: Anatomy and Embryology of Angiosperms, Plant Ecology and Biodiversity.

Upon completion of this course, the student will be able to:	
CO 1	Understand on the organization of tissues and tissue systems in plants.
CO 2	Illustrate and interpret various aspects of embryology.
CO 3	Appraise various qualitative and quantitative parameters to study the population and community ecology.
CO 4	Correlate the importance of biodiversity and consequences due to its loss.

Course Code: BOT4SK

Course Name: Plant Physiology and Metabolism.

Upon completion of this course, the student will be able to:	
CO 1	Comprehend the importance of water in plant life and mechanisms for transport of water and solutes in plants.
CO 2	Evaluate the role of minerals in plant nutrition and their deficiency symptoms
CO 3	Critically understand the light reactions and carbon assimilation process responsible for synthesis of food in plants.
CO 4	Evaluate the physiological factors that regulate growth and development in plants.

Course Code: BOT5SK

Course Name: Cell Biology, Genetics and Plant Breeding.

Upon completion of this course, the student will be able to:	
CO 1	Distinguish Prokaryotic and Eukaryotic cells and design the model of a cell.
CO 2	Discuss the basics of Mendelian genetics its variations and interpret inheritance of traits in living beings.
CO 3	Understand the application of principles and modern techniques in plant breeding.
CO 4	Explain the organization of a Eukaryotic chromosome, and structure of genetic material.
CO 5	Explain the procedures of selection and hybridization for improvement of crops.

Course Code: BOT 6C

Course Name: 6 C Plant Tissue Culture

Upon completion of this course, the student will be able to:	
CO 1	Comprehend the basic knowledge and application of tissue culture
CO 2	Identify various facilities required to set up a plant tissue cultural laboratory
CO 3	Acquire a critical knowledge on sterilization techniques related to Plant Tissue culture.
CO 4	Understand the bio transformation technique for production of secondary metabolites.

Course Code: BOT 7C

Course Name: 7C Mushroom cultivation

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

CO 1	Understand the structure and life of a mushroom and discriminate edible and poisonous mushrooms
CO 2	Identify the basic infrastructure to establish a mushroom culture unit.
CO 3	Demonstrate skills in the preparation of compost and spawn
CO 4	Explain the methods of storage preparation of value – added products and marketing

DEPARTMENT OF CHEMISTRY

COURSE OUTCOMES (COs)

COURSE CODE: CHE 1SK- INORGANIC AND PHYSICAL CHEMISTRY.

CO Code	Upon the successful completion of the course, the student will be able to
CO1	Understand the properties of P-block elements and structures of some important compounds of P-block elements, realize the industrial importance and applications of some compounds such as silicones.
CO2	Understand the Properties of d-block elements with special emphasis on their characteristic properties
CO3	Distinguish among Solids, Liquids and gases in terms of intermolecular attractions and demonstrate the interdependence of properties of gases on one another. Understand the concept and applications of Joule-Thomson effect.
CO4	Enrich the basic concepts of solids and able to appreciate the application of diffraction phenomena to understand the internal structure of crystals besides knowing the various applications of defects in crystals
CO5	Understand the fundamental concepts of solutions, Azeotropic mixtures, Critical solution temperature, Nernst Distribution law and its applications
CO6	Have a broad insight into colligative properties, their experimental determination and their application to understand the fate of solute in the solvent.
CO7	Familiarize with the basic concepts associated with qualitative analysis of inorganic mixtures
CO8	Improve the skill of Using Laboratory equipment and chemicals
CO9	Apply the concepts of common ion effect, solubility product and concepts related to qualitative analysis

COURSE CODE: CHE 2SK – INORGANIC, ORGANIC PHYSICAL AND GENERAL CHEMISTRY

CO Code	Upon the successful completion of the course, the student will be able to
CO1	Learn about various elements in the periodic table that are present in the body, and particularly various metals that are used and manufactured in daily life.
CO2	Understand the formation of bonds and interactions between the atom's molecules, ions crystals and other stable substances that are used in attaining the best knowledge about feature projects like quantum mechanics.
CO3	Gain the knowledge about various synthetic techniques and synthesized products that help a lot while working in manufacturing companies.
CO4	Learn about various techniques for the conversion of different states of a substance (Liquefaction of gases, condensation, distillation etc.) that are used in daily life.
CO5	Stereochemistry is useful in understanding the spatial arrangement of atoms that determine the structure of a compound which is fundamental study all the concepts of organic chemistry.
CO6	Identify a type of reaction involving in the formation of a product. The practical knowledge is very essential for the identification of ions and elements.
CO7	Understand the fundamentals of volumetric analysis

COURSE CODE: CHE 3SK ORGANIC CHEMISTRY AND SPECTROSCOPY

CO Code	Upon the successful completion of the course, the student will be able to
CO1	Understand the methods of preparation, properties and reactions of halo alkanes, haloarenes and oxygen containing functional groups
CO2	Apply the concepts of synthetic chemistry to transform one functional group into another
CO3	Learn the mechanisms of various important named reactions and their applications
CO4	Propose the plausible reaction mechanisms
CO5	Understand the basic concepts and underlying principles of Spectroscopy
CO6	Draw important conclusions with regard to structure of molecule from the data of various types of spectra
CO7	Acquire hard skills such as calculating limiting reagent, theoretical yield, percent yield
CO8	How to engage in safe laboratory practices by handling laboratory glassware, equipment and chemical reagents appropriately
CO9	Learn how to perform common laboratory techniques including reflux, distillation, recrystallization, vacuum filtration.
CO10	How to create and carry out work up and separation processes
CO11	How to critically evaluate data collected to determine the identity, purity and percent yield of products and summarize findings in clear and concise manner

**COURSE CODE: CHE4SKA-
INORGANIC, ORGANIC AND PHYSICAL CHEMISTRY**

CO Code	Upon the successful completion of the course, the student will be able to
CO1	Learn the basic concepts of Organo metallic compounds specifically of metal carbonyls-P-acceptor behavior of Carbon monoxide-synergic effects
CO2	Have a Comprehensive idea on the definition, classification, biological importance of carbohydrates. Demonstrate the interconversions of monosaccharides basing the principles of Functional group interconversion
CO3	Acquire the in-depth knowledge of Amino acids and proteins
CO4	Classify heterocyclic compounds into different types and understand their importance in biological science
CO5	Understand the preparation, properties and important reactions of nitro compounds, amines, diazonium salts and their usage in the manufacturing of dyes
CO6	Distinguish between photochemical reaction and thermochemical reaction, understand the laws of photochemistry, quantum yield and its significance. Demonstrate the phenomena such as fluorescence and phosphorescence with the help of Jablonski diagram
CO7	Understand the basic definitions and laws of Thermodynamics and recognize and appreciate its interrelated relevance in bridging the fundamental laws of physics to know the spontaneity of a process
CO8	Understand the application of concepts learnt in theory during the practical sessions
CO9	Display the skill of determining melting and boiling points of organic compounds
CO10	Identify different functional groups in an organic compound by adopting systematic procedure

COURSE CODE: CHE4SKB - INORGANIC AND PHYSICAL CHEMISTRY

CO Code	Upon the successful completion of the course, the student will be able to
CO1	Understand broadly the various theories of coordinate complexes. Apply the concept of isomerism to complexes. Draw various three-dimensional isomers of complexes
CO2	Differentiate between strong and weak field complexes
CO3	Distinguish between SN^1 and SN^2 reaction mechanisms
CO4	Understand the stability measures of complexes and the factors that affect stabilities
CO5	Imbibe the importance of some elements in bio systems and appreciate the functions of hemoglobin and chlorophyll
CO6	Understand the concept of phase rule, draw the phase diagrams of one and two component systems and analyze the phase diagrams to arrive to the conditions of existence of a particular phase.
CO7	Enrich basics of electrochemistry, applications of conductivity measurements in conductometric titrations. learn about electro chemical cells construction and their application in potentiometric titrations. Conceive the concept of fuel-cells and their application as good prospect of alternative source of energy
CO8	Understand the concept of reaction rates and factors affecting it. Assimilate various theories of reaction rates.
CO9	Familiarize with the electroanalytical techniques.

COURSECODE: CHE5 SK6C-INDUSTRIAL CHEMISTRY-1

CO Code	Upon the successful completion of the course, the student will be able to
CO1	Identify the Importance of different surface coatings
CO2	Acquire a critical knowledge on manufacture of ceramics and cement
CO3	Understand the various steps in the manufacture of cane sugar
CO4	Explain the manufacture of pulp and paper

COURSE CODE: CHE5 SK7C-INDUSTRIAL CHEMISTRY-2

CO Code	Upon the successful completion of the course, the student will be able to
CO1	Identify the importance of industrial waste management
CO2	Acquire a critical knowledge on the preparation and applications of organic polymers
CO3	Demonstrate the analysis of water quality parameters
CO4	Explain the sources of Air pollution

DEPARTMENT OF COMMERCE

COURSE OUTCOMES

Course Code: BCO1S-1K

Course Name: FUNDAMENTALS OF ACCOUNTING

Upon completion of this course, the student will be able to:	
CO1	Identify transactions and events that need to be recorded in the books of accounts
CO2	Equip with the knowledge of accounting process and preparation of final accounts of sole trader.
CO3	Develop the skill of recording financial transactions and preparation of reports in accordance with GAAP.
CO4	Analyze the difference between cash book and pass book in terms of balance and make reconciliation.
CO5	Critically examine the balance sheets of a sole trader for different accounting periods
CO6	Design new accounting formulas & principles for business organizations.

Course Code: BCO1S-2K

Course Name: Business Organization and Management

Upon completion of this course, the student will be able to:	
CO1	Understand different forms of business organizations.
CO2	Comprehend the nature of Joint Stock Company and formalities to promote a Company
CO3	Describe the Social Responsibility of Business towards the society.
CO4	Critically examine the various organizations of the business firms and judge the best among them
CO5	Design and plan to register a business firm. Prepare different documents to register a company at his own
CO6	Articulate new models of business organizations.

Course Code: BCO1S-3K

Course Name: Business Environment

Upon completion of this course, the student will be able to:	
CO1	Understand the concept of business environment
CO2	Define Internal and External elements affecting business environment.
CO3	Explain the economic trends and its effect on Government policies.
CO4	Critically examine the recent developments in economic and business policies of the Government
CO5	Evaluate and judge the best business policies in Indian business environment
CO6	Develop the new ideas for creating good business environment

Course Code: BCO2S-1K

Course Name: Financial Accounting

Upon completion of this course, the student will be able to:	
CO1	Understand the concept of consignment and learn the accounting treatment of the various aspects of consignment.
CO2	Analyze the accounting process and preparation of accounts in consignment and joint venture.
CO3	Distinguish Joint Venture and Partnership and to learn the methods of maintaining records under Joint Venture
CO4	Determine the useful life and value of the depreciable assets and maintenance of Reserves in business entities
CO5	Design an accounting system for different models of businesses at his own using the principles of existing accounting system

Course Code: BCO2S-2K

Course Name: Business Economics

Upon completion of this course, the student will be able to:	
CO1	Describe the nature of economics in dealing with the issues of scarcity of resources.
CO2	Analyze supply and demand analysis and its impact on consumer behavior.
CO3	Evaluate the factors, such as production and costs affecting firms' behavior
CO4	Use economic analysis to evaluate controversial issues and policies.
CO5	Apply economic models for managerial problems, identify their relationships, and formulate the decision-making tools to be applied for business.

Course Code: BCO2S-3K

Course Name: Banking Theory and Practice

Upon completion of this course, the student will be able to:	
CO1	Understand the basic concepts of banks and functions of commercial banks.
CO2	Demonstrate an awareness of law and practice in a banking context.
CO3	Engage in critical analysis of the practice of banking law
CO4	Organize information as it relates to the regulation of banking products and services
CO5	Critically examine the current scenario of Indian Banking system.

Course Code: BCO3S-1K

Course Name: Advanced Accounting

Upon completion of this course, the student will be able to:	
CO1	Understand the concept of Non-profit organizations and its accounting process
CO2	Comprehend the concept of single-entry system and preparation of statement of affairs
CO3	Familiarize with the legal formalities at the time of dissolution of the firm
CO4	Prepare financial statements for partnership firm on dissolution of the firm.
CO5	Employ critical thinking skills to understand the difference between the dissolution of the firm and dissolution of partnership

Course Code: BCO3S-2K

Course Name: Business Statistics

Upon completion of this course, the student will be able to:	
CO1	Understand the importance of Statistics in real life
CO2	Formulate complete, concise, and correct mathematical proofs.
CO3	Frame problems using multiple mathematical and statistical tools, measuring relationships by using standard techniques
CO4	Build and assess data-based models
CO5	Learn and apply the statistical tools in day life.

Course Code: BCO3S3K

Course Name: Marketing

Upon completion of this course, the student will be able to:	
CO1	Develop an idea about marketing and marketing environment.
CO2	Understand the consumer behavior and market segmentation process
CO3	Comprehend the product life cycle and product line decisions.
CO4	Know the process of packaging and labeling to attract the customers.
CO5	Formulate new marketing strategies for a specific new product.

Course Code: BCO4S-1K

Course Name: Corporate Accounting

Upon completion of this course, the student will be able to:	
CO1	Understand the Accounting treatment of Share Capital and aware of process of book building
CO2	Demonstrate the procedure for issue of bonus shares and buyback of shares.
CO3	Comprehend the important provisions of Companies Act, 2013 and prepare final accounts of a company with Adjustments.
CO4	Participate in the preparation of consolidated accounts for a corporate group
CO5	Understand analysis of complex issues, formulation of well-reasoned arguments and reaching better conclusions.

Course Code: BCO4S-2K

Course Name: Cost and Management Accounting

Upon completion of this course, the student will be able to:	
CO1	Understand various costing methods and management techniques.
CO2	Apply Cost and Management accounting methods for both manufacturing and service industry
CO3	Prepare cost sheet, quotations, and tenders to organization for different works...
CO4	Analyze cost-volume-profit techniques to determine optimal managerial decisions
CO5	Compare and contrast the financial statements of firms and interpret the results.

Course Code: BCO4S-3K

Course Name: Income Tax

Upon completion of this course, the student will be able to:	
CO1	Acquire the complete knowledge of the tax evasion, tax avoidance and tax planning.
CO2	Understand the provisions and compute income tax for various sources.
CO3	Grasp amendments made from time to time in Finance Act.
CO4	Compute total income and define tax complications and structure.
CO5	Prepare and File IT returns of individual at his own. Compare and contrast the financial statements of firms and interpret the results.

Course Code: BCO4S-4K

Course Name: Business Law

Upon completion of this course, the student will be able to:	
CO1	Understand the legal environment of business and laws of business.
CO2	Highlight the security aspects in the present cyber-crime scenario.
CO3	Apply basic legal knowledge to business transactions.
CO4	Understand the various provisions of Company Law
CO5	Engage critical thinking to predict outcomes and recommend appropriate action on issues relating to business associations and legal issues...
CO6	Integrate concept of business law with foreign trade.

Course Code: BCO4S-5K

Course Name: Auditing

Upon completion of this course, the student will be able to:	
CO1	Understanding the meaning and necessity of audit in modern era
CO2	Comprehend the role of auditor in avoiding the corporate frauds.
CO3	Identify the steps involved in performing audit process
CO4	Determine the appropriate audit report for a given audit situation
CO5	Apply auditing practices to different types of business entities.
CO6	Plan an audit by considering concepts of evidence, risk and materiality

Course Code: BCO4S-6K
Course Name: Goods and Service Taxes

Upon completion of this course, the student will be able to:	
CO1	Understand the basic principles underlying the Indirect Taxation Statutes.
CO2	Examine the method of tax credit. Input and Output Tax credit and CrossUtilization of Input Tax Credit.
CO3	Identify and analyze the procedural aspects under different applicable statutesrelated to GST.
CO4	Compute the assessable value of transactions related to goods and services forlevy and determination of duty liability.
CO5	Develop various GST Returns and reports for business transactions in Tally

Course Code: BCO6S-18A
Course Name: MANAGEMENT ACCOUNTING AND PRACTICE

Upon completion of this course, the student will be able to:	
CO1	Understand the nature and scope of management accounting and differentiate management accounting, financial accounting and cost accounting.
CO2	Compute ratios and draw inferences
CO3	Analyze the performance of the organization by preparing funds flowstatement and cash flow statements
CO4	Prepare cash budget, fixed budget and flexible budget.

Course Code: BCO6S-19A
Course Name: COST CONTROL TECHNIQUES

Upon completion of this course, the student will be able to:	
CO1	Differentiate cost control, cost reduction concepts and identify effective techniques.
CO2	Allocate overheads on the basis of Activity Based Costing
CO3	Evaluate techniques of cost audit and rules for cost record.
CO4	Appraise the application of marginal costing techniques to evaluate performances, fix selling price, make or buy decisions

Course Code: BCO6S-16B
Course Name: . ADVERTISING AND MEDIA PLANNING

Upon completion of this course, the student will be able to:	
CO1	Understand the role of advertising in Business environment
CO2	Understand the legal and ethical issues in advertising
CO3	Acquire skills in creating and developing advertisements
CO4	Understanding up-to date advances in the current media industry
CO5	Acquire the necessary skills for planning and advertising media campaign

Course Code: BCO6S-17B

Course Name: SALES PROMOTION AND PRACTICE

Upon completion of this course, the student will be able to:	
CO1	Analyze various sales promotion activities
CO2	Get exposed to new trends in sales promotion
CO3	Understand the concepts of creativity in sale promotion
CO4	Enhance skills to motivate the sales person to reach their Targets.
CO5	Develop the skills of designing of sale promotion event to reach their targets

Course Code: BCO6S-20 C

Course Name: E-COMMRCE

Upon completion of this course, the student will be able to:	
CO1	Understand the mechanism of e-commerce
CO2	Equip specialization in web site designing for e-commerce
CO3	Enhance their skills in operational services of E-commerce
CO4	Involve in activities of E-commerce

Course Code: BCO6S-21C

Course Name: E-FILING

Upon completion of this course, the student will be able to:	
CO1	Understand and apply basic knowledge of Indian tax system
CO2	Equip specialization in Taxation system
CO3	Enhance their skills in presenting returns
CO4	File returns of Income tax and GST.

DEPARTMENT OF ECONOMICS

PROGRAMME SPECIAL OUTCOMES (PSOs)

PSO 1:

Understand the basic concepts like National Income, Poverty, Employment, International trade, Fiscal and Monetary policies, Economic conditions of various historic periods,

PSO 2:

To analyze the economic importance of various sectors like agriculture, Industrial sector and service sector in different dynasties. To promote values such as sustainable development, Optimum utilization of resources, patriotism, respecting freedom struggle and responsible citizenship, political participation

PSO 3:

To understand the impact of agriculture and foreign trade in economic development that attracts foreign invaders towards India, resulting in changed administration in due course up to and after independence

PSO 4:

How the consumers and producers will take rational decisions in the context of unlimited needs and availability of scarce resources; to provide life skills required for gainful employment by using domain knowledge such as Economic Service, writing and bureaucrats at various levels.

PSO 5:

He/she will get a basic understanding of Statistical Methods with a view to applying them to economics and real life situations, To promote values such as sustainable development, Optimum utilization of resources,

PSO 6:

Agriculture economy from a to modern times and their role in administration for formulating relevant policies for effective utilization of resources and tackling various problems like unemployment and improved standard of living.

COURSE OUTCOMES

Course Code: ECO1SK

Course Name: MICRO ECONOMICS

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

CO 1	Student will be able to knowledge about the differences between microeconomic analysis and macroeconomic analysis various laws of microeconomic theory under consumption,
CO 2	various terms and concepts relating to microeconomic analysis with the help of examples of real life Consumer's equilibrium and consumer's surplus using indifference curve analysis. various laws and principles of consumption, production, and income distribution
CO 3	various laws and principles of microeconomic analysis and market conditions application of the concept of demand elasticity and its relation with Average and Marginal Revenue Determination of price and output discriminating different market conditions in short term and long term
CO 4	the relationship between average and marginal cost/revenue both in long term and Draws critical diagrams and graphs to explain and examine the application of various laws and principles of microeconomic analysis

Course Code: ECO2SK
Course Name: MACRO ECONOMICS

At the end of the course, the student is expected to demonstrate the following cognitive abilities and psychomotor skills: Student can able to:

CO 1	Various concepts, definitions, laws and principles of macroeconomic theory with reference to income, employment, money, banking and finance
CO 2	The difference between various concepts and components of national income with illustrations and methods of measuring national income various terms, concepts, laws and principles, theories relating to income, employment, consumption, investment, money, price-level and phases of trade cycles
CO 3	In order to understand the interrelationship between various components of national income The theories of macroeconomics with reference to their assumptions, implications and applicability Empirical evidences of Consumption and Investment Functions and factors influencing them
CO 4	Consumption and investment functions; concepts of multiplier and accelerator, Price indices, inflation and trade cycles, functions of commercial banks and central bank, creation and control of credit

Course Code: ECO3S

Course Name: DEVELOPMENT ECONOMIES

<i>Upon completion of this course the student will be able to:</i>	
CO 1	Various concepts and definitions and indicators relating to economic growth and Development including recent developments
CO 2	Distinction between growth and development with examples Characteristics of developing and developing economies and distinction between the two factors contributing to development, Choice of Techniques and a few important models
CO 3	The theoretical aspects of a few models and strategies of economic growth, role and importance of various financial and other institutions in the context of India's economic development
CO 4	To explain the models and strategies Highlight empirical evidences to support the strategies

Course Code: ECO4S

Course Name: ECONOMIC DEVELOPMENT- INDIA AND ANDHRA PRADESH

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

CO 1	leading issues of Indian economic development with reference to potential for growth, obstacles and policy responses Objectives, outlays and achievements of economic plans and growth strategies
CO 2	Sector specific problems, remedial policies and their effectiveness relating to Agriculture and Industrial Sectors of Indian and AP economy and infrastructure issues of AP economy Indian Tax system, recent changes, issues of public expenditure and public debt, recent finance commissions and devolution of funds
CO 3	Leading issues of current importance relating to India and AP economy, major policies and programs. Covid- 19 and its impact on Indian economy
CO 4	To explain the achievements of Indian economy with reference to the objectives of planning and policy and make critical evaluation Major issues of economic development of Andhra Pradesh after bifurcation and Central assistance

Course Code: ECO4S1

Course Name: STATISTICAL METHODS FOR ECONOMICS

<i>Upon completion of this course the student will be able to:</i>	
CO 1	The definitions, terms and their meaning relating to statistical methods, Various formulae used to measure central tendency, correlation regression and Indices
CO 2	Importance of statistics and its applications The method of classification of primary data Uses of Correlation and Regression analysis, time series and index numbers in economic analysis
CO 3	Different kinds of statistical problems using various principles and formulae relating to central tendency, correlation, regression, time series and indices, To interpret data and suggest solutions to economic problems
CO 4	Histogram, Frequency Polygon and Frequency Curve More than cumulative and less than cumulative frequency curves c. Different types of Bar diagrams, Pie Diagram and its uses

Course Code: ECO6C

Course Name: INSURANCE SERVICES

<i>Upon completion of this course the student will be able to:</i>	
CO 1	Risk Management: Risk and Uncertainty, Risk Classification - Concept, Importance and Types of insurance- Principles of Insurance - Role of IRDA and Insurance Ombudsman
CO 2	Life Insurance: Nature and Features - Major Life Insurance Companies in India Conventional, Unit Linked, Annuities, Group Policies - Medical Examiner
CO 3	General Insurance: Nature, Features and Types - Major General Insurance Companies in India - Important General Insurance Products/Policies and their Features - Surveyor - Health Insurance: Nature and Features - Health Insurance Companies in India
CO 4	Insurance Contract and Terms of Insurance Policy - Registration of Insurance Agency with the Company - Procedure to issue a Policy: Application and Acceptance - Policy Lapse and Revival - Premium Payment, Assignment, Insurance Customer and Categories - Understanding Customer Mindset and Satisfaction - Addressing the Grievances. of the Customer -

Course Code: ECO7C

Course Name: BANKING AND FINANCIAL SERVICES

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

CO 1	Meaning of Banking - Principles of Banking - Functions of Banking - Structure of Indian Banking System - Regulations of Banking in India - Role of RBI in Banking - Anti-money Laundering - Basics of Financial literacy
CO 2	Bank Deposit Account Types - Account Opening and Closing - Banking Customer types - KYC Norms - Negotiable Instruments: Different categories of Loans - Mortgaging - Priority Sector Lending - E-Banking facilities: Debit Card, Credit Card, Net Banking, Mobile Banking, Tele-banking, Micro ATMs, Digital Currency
CO 3	Banking Correspondent Model - Activities of Banking Correspondent: Deposit Mobilization. identification of Borrowers, Collection and Recovery Loan, Other Banking Services - Common Services - Provision of Services bi CSC
CO 4	Types and Major Players of NBFIs in India - Important Financial Services offered by NBFIs and their Features - Concept of EMI - Micro Finance: Concept and Operation - Customer of FSC: Types and Needs - Procedures and Requirements in FSC's Loan Sanction - Collection and Recovery of FSC Loans

DEPARTMENT OF ENGLISH

COs & PSOs

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO1: Apply the knowledge of Grammar and appropriate Vocabulary in the spoken and written communication effectively.

PSO2: Participate confidently and speak fluently in any social interaction and professional discourse.

PSO3: Read, Comprehend and analyze different literary pieces in an effective manner.

PSO4: Understand the dynamics of Paragraph Writing and Write meaningfully on the topics of interest or relevance.

PSO5: Acquisition of the ability to utilize Soft Skills and Communication Skills in the Professional and daily life.

PSO6: Acquire the ability to think critically in the professional and personal spheres

COURSE OUTCOMES (Cos)

Paper Code: ENGISK

Paper Name: A Course in Communication Skills & Soft Skills

CO1	Use grammar effectively in writing and speaking.
CO2	Demonstrate the use of good vocabulary
CO3	Demonstrate an understating of writing skills
CO4	Acquire ability to use Soft Skills in professional and daily life.
CO5	Confidently use the tools of communication skills

Paper Code: ENG2SK

Paper Name: A Course in Reading & Writing

CO1	Use reading skills effectively
CO2	Comprehend, Interpret different types of texts & Analyze what is being read
CO3	Build up a repository of active vocabulary
CO4	Use good writing strategies and write well for any purpose
CO5	Improve writing skills independently for future needs

Paper Code: ENG3S

Paper Name: A Course in Conversational Skills

CO1	Speak fluently in English
CO2	Participate confidently in any social interaction
CO3	Face any professional discourse
CO4	Demonstrate critical thinking
CO5	Enhance conversational skills by observing the professional interviews

DEPARTMENT OF HISTORY

CO's and PSO's



PROGRAMME SPECIFIC OUTCOMES (PSOs)

Department of History ANDHRA CHRISTIAN COLLEGE, GUNTUR Offers Three years (comprising 6 semesters) under graduate programme in History with objective of empowering students to acquire all-inclusive understanding of History as an academic discipline upon completion of B A History Degree programme successfully. The students shall acquire the following skills and competencies.

PSO 1 Understand the basic concept and issues concerning human rights and challenges

PSO 2 Understand the culture, social, political, economic and constitutional environments as a historical perspective of Indian administration

PSO 3 Understand the basic concept and ideological orientation of History discipline

PSO 4 Understand the process and process and of Indian government and political also familiarize with the vital contemporary emerging issues center state relation political emergence for new leadership different levels demand for a movement ethnic conflict etc.

PSO 5 Encourage the students to develop a range of generic skill helpful in employment, internship and social activities.

COURSE OUTCOMES (COs)

Course code: HIS1SK

Course name: ANCIENT INDIAN HISTORY&CULTURE

Co code	After successful completion of this course, the student will be le to
CO1	Identify and define various kinds of sources and understand how history books are shaped
CO2	Compare and contrast various stages of progress from IVC to Vedic age
CO3	analyze the Jain, Buddhist and Vedic faiths
CO4	Increase the Increase the awareness and appreciation awareness of Transition from Territorial States to appreciation Emergence of Empires
CO5	Analyze the emergence of the Mauryan and Gupta empires during the “classical age” in India
CO6	Evaluate the key facets of ancient society, polity and culture in South India—the
CO7	feudalism, and the rise of technology and commerce
CO8	Critically examine the nature of monarchic rule and develop an comprehensive
CO9	understanding of cultural evolution during ancient period
CO10	Visualize where places are in relation to one another through map pointing

Course code: HIS2SK

Course name: **Medieval Indian History & Culture (1206 A.D To 1764 A.D)**

Co code	After successful completion of this course, the student will be able to
CO1	Understand the socio, economic and cultural conditions of medieval India.
CO2	Describe the advent of Islam in India and study the traces of political and cultural expansion of Turks & Afghans.
CO3	Explain the Administration and art and architecture of Vijayanagar Rulers, Mughals and also analyze the rise of the Marathas and the contribution of Shivaji.
CO4	Evaluate the establishment of the British rule in India and understand the dangerous consequences of disunity at all levels.
CO5	Analyze the emergence of composite culture in Indian
CO6	Visualize where places are in relation to one another through map pointing.

Course code: HIS3SK

Course name: **Modern Indian History & Culture (1764- 1947 A. D)**

Co code	After successful completion of this course, the student will be able to
CO1	Unearth the true nature of the British rule and its disastrous impact on Indian economy and society
CO2	Gauge the disillusionment of people against the Company's rule even during the early 19th century
CO3	Assess the causes and effects of Reformation movements and also inspire the public to overthrow inequalities of the present-day society
CO4	Rise above petty parochial issues after understanding the sacrificial saga of freedom struggle

Course code: HIS4SK

Course name; **History & Culture of Andhra (from 1512 to 1956 AD)**

Co code	After successful completion of this course, the student will be able to
CO1	Interpret social and political and cultural transformation from medieval to modern Andhra.
CO2	Relate key historical developments during medieval period occurring in coastal Andhra and Telangana regions and analyze socio - political and economic changes under Qutb Shahi rulers.
CO3	Understand gradual change, or change in certain aspects of society in Andhra, rather than rapid or fundamental changes
CO4	Explain how the English East India Company became the most dominant power and outline the impact of colonial policies on different aspects in Andhra.
CO5	Outline the issues related to caste, women, widow marriage, child marriage, social reforms and the laws and policies of colonial administration towards these issues
CO6	Take pride in the non-violence struggle Indian Independence and relate the importance of peace in everyday life.
CO7	Apply the knowledge of the regional history to understand the regional, linguistic and other cultural aspirations of the present-day society.
CO8	Visualize where places are in relation to one another through map pointing.

Course code: HIS5SK

Course name; **History of Modern World (From 15th Cent. AD to 1945 AD)**

Co code	After successful completion of this course, the student will be able to
CO1	Demonstrate advanced factual knowledge of world histories, politics, and cultures
CO2	Assess and appraise the developments in art, literature, and society during the Renaissance and utilize content knowledge of the Reformation and Counter Reformation to make predictions about the evolution of Christianity in Europe and abroad.
CO3	Evaluate the causes for the Glorious Revolution and American Revolution and identify the background for the evolution of human rights movement
CO4	Understand the main events of the French Revolution and its significance in the shift in European culture from Enlightenment to Romanticism
CO5	Think how Russia's traditional monarchy was replaced with the world's first Communist state.
CO6	Know how the world was affected by people all over the world and the destruction they caused.
CO7	Develop the intellectual curiosity and habits of thought that will lead to life-long learning and continued engagement with European history, literature, culture, languages, and current affairs and acquire advanced international and intercultural competency through coursework in international studies.

Course code:6B

Course name: Tourism and Hospitality Services

Co code	Students after successful completion of the course will be able to:
CO1	Understand hospitality as a career
CO2	Inculcate interpersonal skills
CO3	Develop the ability for multitasking and crisis management
CO4	Understands the spirit of teamwork
CO5	Acknowledge the importance of guest service and satisfaction

Course 7B:

COUSE NAME: Tourism Guidance and Operating Skills

Co code	Students after successful completion of the course will be able to:
CO1	Acquire tour guiding, operating and soft skills
CO2	Understand different situations under which one has to work
CO3	Cultivate cultural awareness and flexibility
CO4	Understand and apply team spirit
CO5	Plan and organize tour operations efficiently



PROGRAMME SPECIFIC OUTCOMES (PSOs)

The Department of Mathematics, Andhra Christian college, Guntur, offers Three Year (comprising 6 semesters) Undergraduate Programme in Mathematics with objective of empowering students to acquire all-inclusive understanding of Mathematics as an academic discipline. Upon completion of B. Sc. Mathematics Degree Programme successfully, the students shall acquire the following skills and competencies.

PSO 1	Create deep interest in learning mathematics.
PSO 2	Develop broad and balanced knowledge and understanding of definitions, concepts, principles and theorems.
PSO 3	Familiarize the students with suitable tools of mathematical analysis to handle issues and problems in mathematics and related sciences.
PSO 4	Enhance the ability of learners to apply the knowledge and skills acquired by them during the programme to solve specific theoretical and applied problems in mathematics.
PSO 5	Provide students/learners sufficient knowledge and skills enabling them to undertake further studies in mathematics and its allied areas on multiple disciplines concerned with mathematics
PSO 6	Encourage the students to develop a range of generic skills helpful in employment, internships and social activities.

COURSE OUTCOMES (COs)

Course Code: MAT1SK

Course Name: Differential Equations

Upon completion of this course, the student will be able to:	
CO 1	Solve linear differential equations. Convert non-exact homogeneous equations to exact differential equations by using integrating factors.
CO 2	Know the methods of finding solutions of differential equations of the first order but not of the first degree.
CO 3	Solve higher-order linear differential equations, both homogeneous and nonhomogeneous, with constant coefficients.
CO 4	Understand the concept and apply appropriate methods for solving differential equations.

Course Code: MAT2SK

Course Name: Three-Dimensional Analytical Solid Geometry

Upon completion of this course, the student will be able to:	
CO 1	Get the knowledge of planes.
CO 2	Basic idea of lines, sphere and cones.
CO 3	understand the properties of planes, lines, spheres and cones.
CO 4	express the problems geometrically and then to get the solution.

Course Code: MAT3SK

Course Name: Abstract Algebra

Upon completion of this course, the student will be able to:	
CO 1	Acquire the basic knowledge and structure of groups, subgroups and cyclic groups. Get the significance of the notation of a normal subgroup.
CO 2	Get the behavior of permutations and operations on them. study the homomorphisms and isomorphisms with applications
CO 3	Understand the ring theory concepts with the help of knowledge in group theory and to prove the theorems.
CO 4	understand the applications of ring theory in various fields.

Course Code: MAT4SK

Course Name: Real Analysis

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

CO 1	Get clear idea about the real numbers and real valued functions.
CO 2	Obtain the skills of analyzing the concepts and applying appropriate methods for testing convergence of a sequence/ series.
CO 3	Test the continuity and differentiability and Riemann integration of a function.
CO 4	Know the geometrical interpretation of mean value theorems.

Course Code: MAT4SKB

Course Name: Linear Algebra

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

CO 1	Understand the concepts of vector spaces, subspaces, basis's, dimension and their properties
CO 2	understand the concepts of linear transformations and their properties
CO 3	Apply Cayley- Hamilton theorem to problems for finding the inverse of a matrix and higher powers of matrices without using routine methods
CO 4	Learn the properties of inner product spaces and determine orthogonality in inner product spaces.

Course Code: MAT5SKA

Course Name: NUMERICAL METHODS

Upon completion of this course, the student will be able to:	
CO 1	Students can able to Understand the subject of various numerical methods that are used to obtain approximate solutions
CO 2	Students can able to learn various finite difference concepts and interpolation methods.
CO 3	Students can able to analyze and work out numerical differentiation and integration whenever and wherever routine methods are not applicable.
CO 4	Students can able to Find numerical solutions of ordinary differential equations by using various numerical methods.
CO5	Students can able to Analyze and evaluate the accuracy of numerical methods

Course Code: MAT5SKB

Course Name: Integral transforms with Applications

Upon completion of this course, the student will be able to:	
CO 1	Evaluate Laplace transforms of certain functions, find Laplace transforms of derivatives and of integrals. Determine properties of Laplace transform which may be solved by application of special functions namely Dirac delta function, error function, Bessel function and periodic function.
CO 2	Understand properties of inverse Laplace transforms, find inverse Laplace transforms of derivatives and of integrals.
CO 3	Solve ordinary differential equations with constant/ variable coefficients by using Laplace transform method.
CO 4	Comprehend the properties of Fourier transforms and solve problems related to finite Fourier transforms.

Course Code: MAT5SKB

Course Name: SPECIAL FUNCTIONS

Upon completion of this course, the student will be able to:	
CO 1	Students must understand the Beta and Gamma functions, their properties and relation between these two functions, understand the orthogonal properties of Chebyshev polynomials and recurrence relations.
CO 2	Students must find power series solutions of ordinary differential equations.
CO 3	Students must be able to solve Hermite equations and write the Hermite Polynomial of order (degree) n , also find the generating function for Hermite Polynomials, study the orthogonal properties of Hermite Polynomials and recurrence relations
CO 4	Students must be able to solve Legendre equation and write the Legendre equation of the first kind, also find the generating function for the Legendre polynomial, Understand the orthogonal properties of Legendre polynomials
CO5	Students must be able to solve Bessel equation and write the Bessel equation of the first kind of order n , also find the generating function for Bessel function and understand the orthogonal properties of Bessel equation.

PROJECT	
CO 1	Analyze and interpret and take appropriate decisions in solving real life problems using statistical tools.
CO 2	Use different Statistical packages for graphical interface, data analysis and interpretation
CO 3	Write a systematic Statistical project report.

PHYSICS COURSE OUTCOMES(COS)

Course Code: PHY1SK

Course Name: Mechanics, Waves & Oscillations

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

CO 1	Understand Newton's laws of motion and motion of variable mass system and its application to rocket motion and the concepts of impact parameter, scattering cross section.
CO 2	Apply the rotational kinematic relations, the principle and working of gyroscope and its applications and the precessional motion of a freely rotating symmetric top.
CO 3	Comprehend the general characteristics of central forces and the application of Kepler's laws to describe the motion of planets and satellite in circular orbit through the study of law of Gravitation.
CO 4	Understand postulates of Special theory of relativity and consequences such as length contraction, time dilation, relativistic mass and mass-energy equivalence.
CO 5	Examine phenomena of simple harmonic motion and the distinction between undamped, damped and forced oscillations and the concepts of resonance and quality factor with reference to damped harmonic oscillator.
CO6	Appreciate the formulation of the problem of coupled oscillations and solve them to obtain normal modes of oscillation and their frequencies in simple mechanical systems.
CO7	Figure out the formation of harmonics and overtones in a stretched string and acquire the knowledge on Ultrasonic waves, their production and detection and their applications in different fields.
CO8	Perform experiments on Properties of matter such as the determination of moduli of elasticity viz., Young's modulus, Rigidity modulus of certain materials; Surface tension of water, Coefficient of viscosity of a liquid, Moment of inertia of some regular bodies by different methods and compare the experimental values with the standard values.
CO9	Know how to determine the acceleration due to gravity at a place using Compound pendulum and Simple pendulum.
CO10	Notice the difference between flat resonance and sharp resonance in case of volume resonator and sonometer experiments respectively.
CO11	Verify the laws of transverse vibrations in a stretched string using sonometer and comment on the relation between frequency, length and tension of a stretched string under vibration.

Course Code: PHY2SK

Course Name: Wave
optics

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Upon completion of this course, the student will be able to:	
CO 1	Understand the phenomenon of interference of light and its formation in (i) Lloyd's single mirror due to division of wave front and (ii) Thin films, Newton's rings and Michelson interferometer due to division of amplitude.
CO 2	Distinguish between Fresnel's diffraction and Fraunhofer diffraction and observe the diffraction patterns in the case of single slit and the diffraction grating.
CO 3	Describe the construction and working of zone plate and make the comparison of zone plate with convex lens.
CO 4	Explain the various methods of production of plane, circularly and polarized light and their detection and the concept of optical activity.
CO 5	Comprehend the basic principle of laser, the working of He-Ne laser and Ruby lasers and their applications in different fields.
CO 6	Explain about the different aberrations in lenses and discuss the methods of minimizing them.
CO 7	Understand the basic principles of fiber optic communication and explore the field of Holography and Nonlinear optics and their applications.
CO 8	Gain hands-on experience of using various optical instruments like spectrometer, polarimeter and making finer measurements of wavelength of light using Newton Rings experiment, diffraction grating etc.
CO 9	Understand the principle of working of polarimeter and the measurement of specific rotatory power of sugar solution
CO 10	Know the techniques involved in measuring the resolving power of telescope and dispersive power of the material of the prism.
CO 11	Be familiar with the determination of refractive index of liquid by Boy's method and the determination of thickness of a thin wire by wedge method.

Course Code: PHY3SK

Course Name: Heat & Thermodynamics

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

CO 1	Understand the basic aspects of kinetic theory of gases, Maxwell-Boltzmann distribution law, equipartition of energies, mean free path of molecular collisions and the transport phenomenon in ideal gases
CO 2	Gain knowledge on the basic concepts of thermodynamics, the first and the second law of thermodynamics, the basic principles of refrigeration, the concept of entropy, the thermodynamic potentials and their physical interpretations.
CO 3	Understand the working of Carnot's ideal heat engine, Carnot cycle and its efficiency
CO 4	Develop critical understanding of concept of Thermodynamic potentials, the formulation of Maxwell's equations and its applications.
CO 5	Differentiate between principles and methods to produce low temperature and liquefy air and also understand the practical applications of substances at low temperatures.
CO 6	Examine the nature of black body radiations and the basic theories.
CO 7	Perform some basic experiments in thermal Physics, viz., determinations of Stefan's constant, coefficient of thermal conductivity, variation of thermo-emf of a thermocouple with temperature difference at its two junctions, calibration of a thermocouple and Specific heat of a liquid.

Course Code: PHY4SKA

Course Name: Electricity, Magnetism & Electronics

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

C0 1	Understand the Gauss law and its application to obtain electric field in different cases and formulate the relationship between electric displacement vector, electric polarization, Susceptibility, Permittivity and Dielectric constant.
C0 2	Distinguish between the magnetic effect of electric current and electromagnetic induction and apply the related laws in appropriate circumstances.
C0 3	Understand Biota and Savart's law and Ampere's circuital law to describe and explain the generation of magnetic fields by electrical currents.
C0 4	Develop an understanding on the unification of electric and magnetic fields and Maxwell's equations governing electromagnetic waves.
C0 5	Phenomenon of resonance in LCR AC-circuits, sharpness of resonance, Q-factor, Power factor and the comparative study of series and parallel resonant circuits.
C06	Describe the operation of p-n junction diodes, Zener diodes, light emitting diodes and transistors
C07	Understand the operation of basic logic gates and universal gates and their truth tables
C08	Measure the current sensitivity and figure of merit of a moving coil galvanometer.
C09	Observe the resonance condition in LCR series and parallel circuit
C010	Learn how a sonometer can be used to determine the frequency of AC-supply.
C011	Observe the variation of magnetic field along the axis of a circular coil carrying current using Stewart and Gee's apparatus.
C012	Understand the operation of PN junction diode, Zener diode and a transistor and their V-I characteristics.
C013	Construct the basic logic gates, half adder and full adder and verify their truth tables. Further, the student will understand how NAND and NOR gates can be used as universal building blocks

Course Code: PHY4SKB

Course Name: Modern Physics

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

C0 1	Develop an understanding on the concepts of Atomic and Modern Physics, basic elementary quantum mechanics and nuclear physics.
C0 2	Develop critical understanding of concept of Matter waves and Uncertainty principle.
C0 3	Get familiarized with the principles of quantum mechanics and the formulation of Schrodinger wave equation and its applications.
C0 4	Examine the basic properties of nuclei, characteristics of nuclear forces, salient features of nuclear models and different nuclear radiation detectors.
C0 5	Classify Elementary particles based on their mass, charge, spin, half life and interaction.
C06	Get familiarized with the nano materials, their unique properties and applications.
C07	Increase the awareness and appreciation of superconductors and their practical applications
C08	Measure charge of an electron and m value of an electron by Thomson method.
C09	Understand how the Planck's constant can be determined using Photocell and LEDs.
C010	Study the absorption of α-rays and β-rays, Range of β-particles and the characteristics of GM counter
C011	Determine the Energy gap of a semiconductor using thermistor and junction diode.

Course Code: PHY5SCA

Course Name: Electricity, Magnetism & Electronics

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

CO 1	Understand the Gauss law and its application to obtain electric field in different cases and formulate the relationship between electric displacement vector, electric polarization, Susceptibility, Per activity and Dielectric constant.
CO 2	Distinguish between the magnetic effect of electric current and electromagnetic induction and apply the related laws in appropriate circumstances.
CO 3	Understand Biota and Savart's law and Ampere's circuital law to describe and explain the generation of magnetic fields by electrical currents.
CO 4	Develop an understanding on the unification of electric and magnetic fields and Maxwell's equations governing electromagnetic waves.
CO 5	Phenomenon of resonance in LCR AC-circuits, sharpness of resonance, Factor, Power factor and the comparative study of series and parallel resonant circuits.
CO6	Describe the operation of p-n junction diodes, Zener diodes, light emitting diodes and transistors
CO7	Understand the operation of basic logic gates and universal gates and their truth tables
CO8	Measure the current sensitivity and figure of merit of a moving coil galvanometer.
CO9	Observe the resonance condition in LCR series and parallel circuit
CO10	Learn how a sonometer can be used to determine the frequency of AC-supply.
CO11	Observe the variation of magnetic field along the axis of a circular coil carrying current using Stewart and Gee's apparatus.
CO12	Understand the operation of PN junction diode, Zener diode and a transistor and their V-I characteristics.
CO13	Construct the basic logic gates, half adder and full adder and verify their truth tables. Further, the student will understand how NAND and NOR gates can be used as universal building blocks

Course Code: PHY5SCB

Course Name: Modern Physics

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

C0 1	Develop an understanding on the concepts of Atomic and Modern Physics, basic elementary quantum mechanics and nuclear physics.
C0 2	Develop critical understanding of concept of Matter waves and Uncertainty principle.
C0 3	Get familiarized with the principles of quantum mechanics and the formulation of Schrodinger wave equation and its applications.
C0 4	Examine the basic properties of nuclei, characteristics of nuclear forces, salient features of nuclear models and different nuclear radiation detectors.
C0 5	Classify Elementary particles based on their mass, charge, spin, half life and interaction.
C06	Get familiarized with the nano materials, their unique properties and applications.
C07	Increase the awareness and appreciation of superconductors and their practical applications
C08	Measure charge of an electron and /m value of an electron by Thomson method.
C09	Understand how the Planck's constant can be determined using Photocell and LEDs.
C010	Study the absorption of α-rays and β-rays, Range of β-particles and the characteristics of GM counter
C011	Determine the Energy gap of a semiconductor using thermistor and junction diode.

Course Code: PHY6SC

Course Name: Renewable Energy (Elective)

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

CO 1	The learner will be able to describe the environmental aspects of non-conventional energy sources, in comparison with various conventional energy sources.
CO 2	Tell the need of renewable energy sources.
CO 3	Describe the use of solar energy in various applications like solar heating, cooling, desalination, drying, cooking and power generation.
CO 4	Explain the applications of wind energy using wind turbines. Describe the advantages and disadvantages of Ocean energy.
CO 5	Explain the applications of Bio gas plants.

Course Code : PHY6SC1

Course Name: Solar Thermal & Photovoltaic Aspects (Cluster-C1)

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

CO 1	The learner will be able to describe the solar intensity measurement using Angstrom's Pyrheliometer.
CO 2	Describe the construction, working and efficiencies of different solar collectors.
CO 3	Explain the efficiency, fill factor of a solar cell.
CO 4	Analyze the working of Solar PV system.
CO 5	Differentiate various thermal applications of solar energy like solar heaters, coolers, dryers, desalinators, cookers, power generators.

Course Code: PHY6SC2

Course Name: Wind, Hydro and Ocean energies (Cluster-C2)

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

CO 1	The student can Identify Winds energy as alternate form of energy and to know how it can be tapped.
CO 2	Explain about the various wind energy conversion systems
CO 3	Student can able to know various Wind energy applications
CO 4	Understand the Ocean thermal, Wave & Tidal energy, its mechanism of production and its applications
CO 5	Distinguish the micro, mini and small hydro power systems.

Course Code: PHY6SC3

Course Name: Energy Storage devices (Cluster-C3)

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

CO 1	Student able to know about need of energy Storage
CO 2	The student can able to differentiate the primary, secondary batteries.
CO 3	Explain the various applications of SMES systems, and their performance.
CO 4	Discuss the construction and working principle of Fuel Cell and differentiate the different types of fuel cells.
CO 5	Describe the various applications of Fuel Cells.

<u>S.No</u>	Dept	Course Code	Course Name	CO Number	Course Outcome
1	POLITICAL SCIENCE	POL1S	Introduction to Political Science	1	Recall the previous knowledge about Political Science and understand the nature and scope, traditional and modern Approaches of Political Science.
				2	Understand concepts intrinsic to the study of Political Science.
				3	Have solid theoretical understanding of Rights and its theories along with the basic aspects of certain political ideologies
				4	Apply the knowledge to observe the field level phenomena.
2	Political Science	POL12S	Basic Organs of the Government	1	Understand of Origin and Evolution of the concept of Constitutionalism and classification of Constitutions.
				2	Acquaint themselves with different theories of origin of State.
				3	Understand and analyses organs and forms of Governments along with a deep insight into the various agents involved in the political process.
				4	Apply the knowledge to analyze and evaluate the existing systems.
3	Political Science	POL3S	INDIAN GOVERNMENT AND POLITICS	1	Acquire knowledge about the historical background of Constitutional development in India, appreciate philosophical and salient features of Indian Constitution.
				2	Analyze the relationship Between State and individual interims of Fundamental Rights and Directive Principles of State Policy.
				3	Understand the composition of and function Union Government as well as State Government and finally.

				4	Acquaint themselves with the judicial system of the country and its emerging trends such as judicial reforms.
4	Political Science	POL4S	INDIAN POLITICAL PROCESS	1	Know and understand the federal system of the country and some of the vital contemporary emerging issues.
				2	Evaluate the electoral system of the country and to identify the areas of electoral reforms.
				3	Know the constitutional base and functioning of local governments with special emphasis on 73rd & 74th Constitutional Amendments factors.
				4	Understand the dynamics of Indian politics, challenge faced and gain a sensitive comprehension to the contributing factors.
				5	Apply the knowledge and critically comprehend the functioning of some of the regulatory and governance institutions.
				6	Propose theoretical outline alternate models.
5	Political Science	POL5S	WESTERN POLITICAL THOUGHT	1	Understand the fundamental contours classical, western political philosophy, basic features of medieval political thought and shift from medieval to Modern era.
				2	Understand the Social Contract Theory and appreciate its implications on the perception of State in terms of its purposes and role.
				3	Acquaint with the Liberal and Marxist philosophy some trends in Western Political Thought.
				4	Critically analyze the evolution of western political thought.
6	Political Science	6B	ELECTORAL POLITICS AND VOTING BEHAVIOUR	1	Acquaint student with the structure and manner of functioning of Election commission of India.
				2	Understand the Political issues in electoral politics.
				3	Provide an overview on voter turnout, voting behavior.

				4	Aware of the role of new media and Technology in Election Campaign.
				5	Develop an understanding of the required skills for data collection, Research in election Management.
7	Political Science	6B	LEGISLATIVE PROCEDURES AND PRACTISES	1	Make familiar with Legislative procedures and practices.
				2	Equip the students with the adequate skills of participation in deliberative process and democratic decision making.
				3	Understand complex policy issues draft new legislation and analyze on going bills, make speeches and floor statements.
				4	Provide skills part of legislative support team and expose them to real life legislative work.
				5	Enhance understanding of procedures, practices, different committees and motions in the house.

POLITICAL SCIENCE

Programme Outcomes:

Po1: Students can understand the world in which they are living

Po2: Students will have comprehensive knowledge and understanding on the national and international issues.

Po3: Students will be able to choose the best among the opportunities available to bring wise and desirable changes in the political system.

Po4: Students will develop knowledge of theories, concepts and research methods in humanities and social sciences.

Po5: Political knowledge and consciousness will be developed in students.

Po6: Students will possess basic subject knowledge for higher studies and will be able to compete the competitive examinations successfully.

Programme Specific Outcomes:

Ps01: Students should be able to understand concepts intrinsic to the study of political science

Ps02: Students should be in a position to understand and follow changes in patterns of political behavior, ideas and structures

Ps03: Students should have to apply the political knowledge to observe the field level phenomena.

Ps04: Students should be able to understand the cultural, social, political, economic and constitutional environment as historical perspective of Indian administration.

Ps05: Students should understand the processes and dynamics of Indian government and politics.

Ps06: Students should be able to apply their skills to work effectively in multi-disciplinary teams

Ps07: Enabling students to develop a positive attitude towards political science as an interesting and valuable subject of study.



ANDHRA CHRISTIAN COLLEGE: GUNTUR

DEPARTMENT OF PSYCHOLOGY

Programme Specific Objective: To provide exceptional value based education equivalent to the international standards of professionally train students, who gradually become proficient in fundamentals of psychology and make career in psychology and allied fields. The emphasis of Under Graduation programme in psychology is on the excellence developed amongst students leading to analytical skills, interdisciplinary collaboration and contribution to the wide-ranging humanistic services to focus on preventive and curative approaches to stimulate positive mental health in society. Enabling the creation of specialized work-force trained to offer services in educational institutions, corporates, primary health care setting etc.

S.No.	Course Code	Course Title	Course Objectives	Course Outcomes
B.A.(SS) & B.A.(S.S.) Honours				
1	PYH101	INTRODUCTION TO PSYCHOLOGY	The objective of this course is to study the key concepts, principles approaches and themes in psychology.	• Develop a working knowledge of Psychological contents, areas and applications of psychology. • Develop a base in cognitive psychology with the help of relevant examples of everyday life. • Comprehend and analyse situations in real life appropriately and enable others to exercise in the same way. • Appreciate and apply various theories of learning in the practical world. • Identify the importance of experiments in the field of memory and other cognitive aspects and analyse the way it shaped cognitive psychology
2	PYH102	APPLIED PSYCHOLOGY	The objective is to study major applied areas of psychology (e.g., clinical, industrial, school, forensic, human factors, health, community etc.)	• Understand how psychological theories and principles relate to everyday life and apply knowledge of Behaviour modification and life skill training to solve everyday problems. • Students are exposed to the elementary scientific research methods, techniques, counselling skills, ethics and evaluating skills of Psychology. • Apply psychological principles to understand personal as well as social issues and problems.
3	PYW101	W/S PRACTICE &	Use scientific knowledge	• Enables students to understand procedures of scientific

		FABRN. OF APPARATUS	of different apparatus to interpret and provide rationale to the psychological phenomena.	reasoning and knowledge and help in interpreting psychological phenomena. • Understanding the ways of functioning and maintenance of psychological instruments and apparatus in the labs. • Gain the necessary basic knowledge related to science for understanding the mechanism behind the functioning of different apparatus.
4	PYM101	GENERAL PSYCHOLOGY I	This course offers a strong foundation for Psychological principles, theories and methods covering the areas of learning, memory, forgetting etc.	• Understanding and application of psychological principles, theories and methods of different psychological areas (like learning, memory, etc.) to understand the complexity of human behaviour. • Knowledge of the fundamental physiological functional mechanism behind the Nervous system in the human body. • It also correlates to the understanding of historical context of different studies and researches.
5	PYM102	CHILD PSYCHOLOGY	To assemble an objective knowledge base that provides insight into both the nature of childhood generally along with the distinguishing characteristic of individual children.	• Review, appraisal and applications of theory of child psychology in various settings. • Ability to construct and interpret a historical overview of Child psychology. • This course introduces the students to the biological foundations, various developmental stages and theories from prenatal to childhood stages.
6	PYM103	PRACTICUM I	The course aims to deliver practical and in-depth experience in accordance to the principles learnt in the theory courses covering the areas of	• Ability to administer, analyse and interpret results from various psychological tools. • Expanded knowledge of various assessment procedures • Learning regarding conduction of experiments

			verbal learning, memory, forgetting etc.	
7	PYM104	SEMINAR & GROUP DISCUSSION	To provide an opportunity to the students for demonstrating the ability of comprehending the information for public speaking while applying the theoretical knowledge to a real life situation.	• Provide students with opportunities to apply the concepts learnt in the class-room to real-life situations. • Enable students to understand and concise information to be presented before the audience and discuss the issues raised in the class. • The learning process brings out and focuses attention on many latent attributes that do not surface in the normal class room situation.
8	PYM105	INTRODUCTION TO COGNITION I	Primary goal for this course is to introduce cognitive processes, sensory process, perception, thinking, language.	• Expanded knowledge of various aspects of cognition. • Students are able to understand the basic and higher cognitive processes of the information processing. • Development of the cognitive skills facilitated in the students. • Comprehend and analyse situations in life better and to enable others in the same way. • Knowledge regarding basic and higher cognitive processes in the information processing developed. •
9	PYH251/291	INTRODUCTION TO PSYCHOLOGY	The objective of this course is to study the key concepts, principles and predominant themes in psychology.	• Develop a working knowledge of Psychology's content domains and applications of psychology. • Develop a base for fundamental psychology with the help of relevant examples from everyday life. • Gain knowledge and appreciate various theories of learning and other aspects of human behaviour in the practical world. • Identify the importance of experiments in the field of memory and how it shapes cognitive functions at large and their impact on human psychology
10	PYH252/292	APPLIED PSYCHOLOGY	The objective is to study major applied areas of	• Understand how psychological theories and principles relate to everyday life and applied Knowledge of Behaviour

			psychology (e.g., clinical, industrial, school, forensic, human factors, health etc.)	modification and life skill training. - Students are exposed to basic scientific research methods, techniques, counselling skills, ethics and evaluate skills of Psychology. - Apply psychological principles to personal and social issues and problems.
11	PYW201	W/S PRACTICE & FABRN. OF PSY.APPARATUS	Use scientific knowledge and different apparatus to interpret psychological phenomena.	- Students are able to understand how scientific reasoning and knowledge of apparatus helps in interpreting psychological phenomena. - Students learn to install and operate advanced instruments like physiopac, and apparatus that are used in psychological experiments and research studies
12	PYM201	GENERAL PSYCHOLOGY II	The purpose of the course is to provide an advanced theoretical and conceptual knowledge regarding the Foundations of Psychology.	- Extensive knowledge about different theories and principles of Cognition and Behaviour concerning the areas of Motivation, Emotion, Intelligence, Thinking, and Personality etc. - Understand the measures involved in different aspects of human behaviour. - Develop ability to relate the psychological concepts to everyday life events
13	PYM202	ABNORMAL PSYCHOLOGY	Students are introduced to major issues and scientific principles underlying abnormal human behaviour.	- This course will impart in students an appreciation of the complex issues surrounding abnormal behaviour both as experts and novices think about it. - Students would be able to diagnose a disorder, prescribe a treatment, and make a prognosis. They would also get an insight into the skills which are required by a psychologist. - The type of knowledge this course imparts is precisely the type used by professional practitioners. - Students can review current research findings and trends relative to the development and description of maladaptive

				behaviour, as well as gender and demographic influences on the prevalence of psychological illness. Students also learn to describe the diagnostic criteria, symptoms, course, incidence, prevalence, etiology, prognosis and correlates of major mental disorders and learn the psychological, biological, and sociocultural theoretical perspectives of abnormal behaviour.
14	PYM203	PRACTICUM II	The course aims to deliver practical and in-depth experience in accordance to the principles learnt in the theory of general psychology.	- Ability to administer, analyse and interpret results from various psychological tools. - Expand knowledge of various assessment procedures - Knowledge of the ways to interpret the scores obtained through experiments and learn to discover the difference in between experimental and non- experimental set-up
15	PYM204	SEMINAR & GROUP DISCUSSION	To provide an opportunity to students to demonstrate the ability to comprehend material and present it to an audience.	- Provide students with opportunities to apply the concepts learnt in the class-room. - Enable students to understand importance of experiential learning through presentations. - The learning process exhibits and focuses attention on many latent attributes of the students. - Develop the ability to express learnt concepts according to their own understanding.
16	PYM301	EXPERIMENTAL PSYCHOLOGY I	Experimental psychology is part of the very core of the discipline of psychology. Students are introduced to basic methods used in experimental psychology.	- Review the concepts of psychology through the mediums of the experiments. - Understand the rationale, strengths and limitations of the experimental method of gaining knowledge about mental and behavioural processes. - Develop skills of conducting and documenting experiments in

			It aims to explain different research methods used by psychologists.	the field of psychology. • Learn how to design experimental and non-experimental studies. • To enhance the scientific temper of the students by providing them with the experimental knowledge of psychology.
17	PYM302	STATISTICS IN PSYCHOLOGY	This course aims to help students understand basic concepts of statistics and quantitative techniques as applied to psychology.	• Understand the basic concept of statistics in psychology. • Explore and get introduced to the various statistical tools (parametric and non-parametric) used for analysis. • Learn categorization and presentation of data; graphical representation used to communicate data • Knowledge about hypothesis testing • Execute qualitative and quantitative data analysis
18	PYM303	SOCIAL PSYCHOLOGY	The objective of Social Psychology is acquisition of knowledge to use certain basic concepts and philosophies involved in social behaviour and an awareness of the major problems and issues in the discipline of social psychology.	• Develop insight and analyze the contribution of social psychologists to the understanding of human society. • Evaluate effective strategies in socialization, group processes (both inter and intra-group) and helping behavior. • Ability to register the progression of theories in major areas in Social Psychology. • Interpret attitude formation and various methods to be used to change the attitude. • Understand aspects related to social psychology
19	PYM304	PRACTICUM III	To provide the students with the practical knowledge of conducting various experiments and Psychological Tests in sync with experimental	• Ability to administer, analyse and interpret results from various psychological tests i.e. personality, intelligence sociometric data etc. • Expanded knowledge of various assessment procedures • Also make them learn to qualitatively and quantitatively

			and social psychology.	analyse the data and interpret the scores obtained. • Enables students to learn the importance of psychological testing and the types of tests used.
20	PYM305	SEMINAR & GROUP DISCUSSION	To provide an opportunity to students to demonstrate the ability to express, devise, select and apply the theoretical knowledge to a real life situation.	• Provide students with opportunities to apply the concepts learnt in the class-room to actual situations • Enable students for an experiential learning and better understanding outside classroom through research, discussions and expressing their viewpoints • Make students confident about public speaking • Learn to comprehend the material as per the given time
21	PYM306	NEUROPSYCHOLOGY OF COGNITION	To introduce the basic principles of Neuropsychology for a specialized area of psychology	• Describe the nature and basic principles of neuropsychology. • Identify the brain's levels and structures and summarize the functions of its parts. • Plan and Execute assessments and rehabilitation for individuals with neurocognitive dysfunctions • Understand the complexities associated with the nervous system and its command centre – the brain. • To equip students with skills to consider and rule out a neuropsychological origin of the psychopathology
22	PYM401	EXPERIMENTAL PSYCHOLOGY II	To develop experimental expertise in Psychology students so that they understand the significance of designing and conducting experiments	• Learn, review, understand and to apply of the concepts of psychology through the medium of the experiments • Develop the skills of conducting and documenting experiments in the field of psychology. • Knowledge about the experiments that lead towards the development of the field of psychology and explanation of the contributions of various thinkers in the field.
23	PYM402	PSYCHOLOGICAL TESTING &	Psychological measurement and testing	• Analyze and apply the understanding of psychological testing. • Interpret and assess the role of psychological testing in various

		MEASUREMENT	promotes competence in theories and method of psychological assessment, construction and standardization of psychological test.	settings. - Effectively synthesize and apply the variations in scales and tests. - Recognize the various types of psychological tests - Organize the various steps in construction of a psychological test - Review the ethical issues surrounding psychometric evaluation, testing and interpretation in day to day life
24	PYM403	INDUSTRIAL ORGANISATIONAL PSYCHOLOGY	This course applies behavioural science knowledge to professional organizations.	- Students will be able to describe concepts of psychology in the process of manpower training. - Design training & development process of an organizations, apply various methods in organizational setting - The goal of this course is to understand how psychological principal improve efficiency and quality of employee life - Students gain knowledge about the history of I/O psychology, job analysis, motivation, leadership, job satisfaction, work stress and health.
25	PYM404	PRACTICUM IV	To provide the students with the practical knowledge of conducting various experiments and Psychological Tests in sync with their theoretical courses offered.	- Ability to administer, analyse and interpret results from various psychological tools. - Expanded knowledge of various assessment procedures - Knowledge about qualitatively and quantitatively analyse the data.
26	PYM405	SEMINAR & GROUP DISCUSSION	To provide an opportunity to students to demonstrate the ability to devise, select and use methods and skills to express theoretical knowledge in a real life	- Provide students with opportunities to apply the concepts learnt in the class-room to real-life situations - Enable students to understand Research and its importance in experiential learning - Learning about justifying a topic - Developing skills related to formal presentations

			situation.	• Experiential Learning apart from classroom teaching • Focus attention on many latent attributes, which do not surface in the normal class room situations
27	PYM501	SENSORY & PERCEPTUAL PROCESSES	To enthuse in students the importance of sensory modalities and perceptual processes that help in understanding and formation of behaviour	• Students will demonstrate knowledge of major concepts related to sensation and perception • Knowledge of theoretical perspectives and empirical findings in understanding the biological basis of behaviour • Application of principles of perceptual organisation in situations faced in life
28	PYM502	ADVANCED STATISTICS	This course enables students understand basic concepts of statistics and qualitative techniques as applied to psychology	• Analyse the basic concepts of statistics in psychology • Description and communication of data through advanced methods • Explore parametric and non- parametric statistical tools for analysis and interpretation • Illustrate hypothesis testing by use of inferential tools • Apply qualitative data analysis for in depth explorations
29	PYM503	DEVELOPMENTAL PSYCHOLOGY	The course aims to familiarize the students to the social, emotional and physical development of a child through various stages	• Appraise the students to the shades of development as a process. • Explain and analyze the theoretical viewpoints in relation to Developmental Psychology • Develop the skills to analyze etiology, symptoms and prognosis of developmental disorders • Developing knowledge and skills in different aspects of Learning and Motivation as implied in Educational Settings.
30	PYM504	PHYSIOLOGICAL PSYCHOLOGY	Aims at providing an in-depth knowledge relating to the response generated for an activity or behaviour in an individual.	• Analyze the importance of the most essential fundamental physiological process underlying psychological events • Explore the various techniques used to examine brain tissue and their examination techniques • Understand the structure and functions of Nervous system and

				its governing factor in context to various behaviours • Enables the study and analysis relating to the structure and functions of brain cells, glands etc. • Extensively covers the basic mechanisms of Physiological processes involved during learning, memory, ingestion, reproduction and sleep etc. • Deals with the issues that many physiological psychologists consider in understanding how the brain and behaviour interact
31	PYM505	PRACTICUM V	This course is based on the practical application of the principles of classical as well as modern psychophysics	• Ability to administer, analyse and interpret results from various psychological tools. • Expanded knowledge of various assessment procedures like rating scales and calculation of errors associated with it • A wide array of analytical techniques is learnt and their application understood
32	PYM601	COGNITIVE PROCESSES	To study the concept of cognition and its application in cognitive psychology .	• Getting theoretically and practically focused on concepts of attention, perception, memory, learning, thinking, concept formation, language formation. • Analyze each situation rationally and take decisions better and faster than others. • Comprehend the role of mental processing in day -to- day life for solving problems. • Identify the building blocks that enable students to identify their strengths and weaknesses so that they can further help others in doing so • Cultivate cognitive skills to understand the mind and behavior. • Explore and comprehend the concepts, principles and themes of cognitive psychology. • Facilitate the students to develop the cognitive skills in themselves and others.

33	PYM602	AFFECTIVE PSYCHOLOGY	To acquaint the students with the emotional and motivational framework of psychology	• Students can appreciate the emotional and motivational state in the broad areas of psychology • Students can identify the emotional and motivational state of a person • Students are able to distinguish between emotional and motivational state. • Students will learn about emotional and motivational regulation.
36	PYM603	PERSONALITY	This course focuses on Integrated concepts of different theories of personality. This paper covers the different theories including Psychodynamic, Behavioural, Humanistic, Trait and Type, Existential social Learning etc. It also covers the different measures involved in Personality assessment.	• Illustrate various theories of personality. • Develop capability to apply knowledge of personality theories for self and societal growth • It enables students to become familiar with the major theories and traditions related to the study of personality and personal growth. • It further enables the student to articulate the underlined themes, methodology and assumption of each theory to enhance understanding of personality and behaviour.
37	PYM604	PSYCHOPATHOLOGY	The focus of this course includes Etiology, Prognosis, Epidemiology, Diagnosis and Differential Diagnostic criteria for various behavioural disorders including Anxiety, Affective and	• Identify different types of anxiety and mood disorders, their clinical picture and management • Analyse Impact of socio-occupational & personal functioning. • Formulate the case with the help of psychological testing. • Plan Therapeutic programs for management based on goals of therapy • The students will understand signs and symptoms of

			different Psychotic disorders, etc. through case history. It also discusses new age psychological disorders. This course helps to assess and observe clusters of psychiatric symptoms and robustly categorize them into DSM IV-TR /DSM 5diagnostic categories, using the multiaxial assessment.	psychopathology. • They will be able to assess the symptoms, nature, causes and dysfunctions associated with these disorders • They will be able to understand the intervention programs with regard to the goals of therapy. • Develop an understanding of etiology of various mental health symptoms and illnesses. • Develop familiarity with the usual clinical course of each specific mental illness.
38	PYM605	PRACTICUM VI	This course is based on the practical application of the principles of classical as well as modern psychophysics	• Ability to administer, analyse and interpret results from various psychological tools. • Expanded knowledge of various assessment procedures like rating scales and calculation of errors associated with it • A wide array of analytical techniques is learnt and their application understood
M.A. (S.Sc.)				
1	PYM701	EXPERIMENTAL DESIGNS	This course deals with the research designs and their applications in research	• Students will think critically about research in psychology by using basic research methods and analysing and interpreting data. • Interpret, design, and conduct basic psychological research. • Understand to apply an appropriate technique or statistical tool
2	PYM702	ORGANISATIONAL BEHAVIOUR	This course will provide To enable students to understand concepts,	Students will be able to • Describe concepts of psychology in the process of manpower training.

			theories and research of industrial psychology.	• Design training & development process of an organizations • apply various methods in organizational setting • Know applications of industrial psychology in various organizational settings.
3	PYM703	EXPERIMENTAL SOCIAL PSYCHOLOGY	This course enables students to achieve integrative understanding of social psychological theory and research.	• Develop insight and analyze the contribution of social psychologists towards the understanding of human society • Evaluate effective strategies in socialization, group processes (both inter and intra-group), and interpersonal processes and helping behaviour Ability to chart the progression of theories in major areas in Social Psychology. • Interpret attitude formation and various methods to be used to change the attitude. • . It also helps in acquiring a thorough familiarity with methodological issues and thinking critically and analytically about experimental research in social psychology. • It also helps in inculcating in the students the sense of adjustment in all the spheres of life (personal and professional) to maintain and sustain the competitive excellence.
4	PYM704	CHILDHOOD DISORDERS	The primary objective of this course is to focus on creating awareness among students about the emotional and behavioural problems of children related to Learning, Attention, Habit, Conduct, Anxiety, Elimination, and	• Student will have relevant knowledge and information related to the causative factors • Students will be able to understand measures involved in minimizing childhood disorders. • Students will be able to diagnose the childhood disorders • Students understand etiology, prevalence of childhood disorders

			Mood etc.	
5	PYM705	PRACTICUM I	This course is based on the practical application of the principles of classical as well as modern psychophysics	• Ability to administer, analyse and interpret results from various psychological tools. • Expanded knowledge of various assessment procedures like rating scales and calculation of errors associated with it • A wide array of analytical techniques is learnt and their application understood
6	PYM706	SEMINAR & GROUP DISCUSSION	To provide an opportunity to students to demonstrate the ability to devise, select and use methods and skills to express theoretical knowledge in a real life situation.	• Provide students with opportunities to apply the concepts learnt in the class-room to real-life situations • Enable students to understand Research and its importance in experiential learning • Learning about justifying a topic • Developing skills related to formal presentations • Experiential Learning apart from classroom teaching • Focus attention on many latent attributes, which do not surface in the normal class room situations
7	PYM801	CLINICAL PSYCHOLOGY	This course will provide each student with an exposure to crucial aspects basic clinical psychology. The students would be able to grasp the nature and scope of the domain and learn about skills that one needs to inculcate in order to take on clinical practice as a profession. Knowledge of various mental disorders would also enable them to	• Express the nature and scope of clinical psychology and its linkages to other fields of healthcare and management • Analyze the current state of clinical psychology in India vis-à-vis the west • Develop insight various categories of psychological disorders with an emphasis on diagnosis and prognosis • Illustrate and analyze the ethical issues in clinical practice. • Identify and inculcate the skills to become a professional in the field of clinical psychology

			like theory to practice and understand the various issues related to the same.	
8	PYM802	PSYCHOLOGY OF CONCIOUSNESS	The main objective of this course is to develop knowledge and skills in students for an overall perspective of Consciousness and to apply this understanding in developing a positive integrated lifestyle construct.	• Identify the concept of consciousness and its functionality • Synchronize the understanding of spirituality and various religious teachings and integrating them into one's and other's lifestyle. • Design and carry out researches in the field of consciousness and related issues. • Student will be able to apply this understanding in developing a positive integrated life style and help others to do so.
9	PYM803	PSYCHOMETRIC METHODS	The objective of this course is to explain students the concepts, historical evolution and ethical consideration of administering psychometric testing. On completion of this course the student should be able to appraise testing in psychology.	• Analyze and apply their understanding of psychological testing. • Interpret and assess the role of psychological testing in various settings. • Effectively synthesize and apply the variations in scales and tests. • Recognize the various types of psychological tests • Organize the various steps in construction of a psychological test • Review the ethical issues surrounding psychometric evaluation in day to day life • On completion of this course the student should be able to

				appraise testing in psychology. • Apply psychological testing, and various tests to assess intelligence and personality. • Demonstrate ways to measure personality and various scales and tests that are used for the purpose. To enable students to understand the concepts and methodology for its application in research work and human behaviour. Students will be able to apply psychometric methods in psychological testing.
10	PYM804	ENVIRONMENTAL PSYCHOLOGY	The paper on Environmental Psychology <i>offers</i> a research-based introduction to the psychological relationship between humans and their built and natural environments and discusses how sustainable environments can be created to the benefit of both people and nature.	• Apply an awareness, knowledge, and appreciation of the intrinsic values of environmental study and its conservation and demonstrate an integrative approach to environmental issues with a focus on its sustainability • Develop an ability to integrate the many disciplines and fields that intersect with environmental concerns. • Implement the various theoretical concepts learnt • Build the critical thinking skills in relation to environmental conservation • Explore the environment's effects on human wellbeing and behaviour, factors influencing environmental behaviour and ways of encouraging pro-environmental action • This course will enable students to apply psychological theories – broadly defined to include attitudes, values and ethics – to the relationships between humans and the natural environment. • Integrate the various theories with environmental politics

				and policy and develop an idea of how human psychology, preferences and values, as well as resulting behaviour, aids or hinders solutions to environmental pollution and natural resource problems. • Develop an awareness of how one's own thoughts and actions impact the environment (and vice versa), and one may also acquire greater environmental concern. • Students will be able to identify and analyse environmental problems as well as the risks associated with these problems and understand what it is to be a steward in the environment, studying how to live their lives in a more sustainable manner.
11	PYM805	PRACTICUM II	This course will provide each student with an exposure to the general concepts of psychology through experimentation and testing. Every student is expected to perform and write 6 practicals.	• Ability to administer, analyze and interpret results from various psychological tools. • Expanded knowledge of various assessment procedures
12	PYM806	SEMINAR & GROUP DISCUSSION	To provide an opportunity to students to demonstrate the ability to devise, select and use a range of methodologies and tools to the Chosen/Given project, applying the theoretical knowledge to a real life situation.	• Provide students with opportunities to apply the concepts learnt in the class-room to real-life situations. • Enable students to understand Research and its importance in experiential learning through NTCC. • The learning process in the NTCC seeks out and focuses attention on many latent attributes, which do not surface in the normal class room situations.

13	PYM001	BASIC RESEARCH METHODS, STATISTICAL TOOLS & ANALYSIS	The main objectives of this course is to introduce the basic principles of Research Methodology, to discuss in-detail the sampling, data collection, analysis of data and report writing, to equip students with skills of various methods and techniques for scientific conduct of social science research.	• On completion of the course the student will be able to understand, participate and conduct various steps involved in research. • Differential understanding of appropriate techniques to be used in various types of scientific research in social sciences. • Analyse & comprehend research and its application. • Design and Develop the strategy, to conduct research. • Comprehend the inter relation between parameters under study. • Develop insight into procedural scientific steps of conducting a research. • The students will have skills of various methods and techniques for scientific conduct of social science research • Students will know the principles of Research Methodology and apply research methods in psychology. • Students will be able to design research, do sampling, data collection and report writing • Students will have skills of various methods and techniques for scientific conduct of research in psychology
14	PYM002	PRE-DISSERTATION	Determine that the student is able to undertake the work of the dissertation	• Find conceptual framework of the research • Students demonstrate effective presentation skills. • Able to critically review research literature. Identify a suitable research problem • Clearly state and elaborate the objectives, research

				question(s) and proposed outcomes for the dissertation. • Express the rationale for undertaking the dissertation • Elucidate and justify the proposed method for undertaking the dissertation
15	PYM901	DISSERTATION	Assess the student's mastery of the factual information, the theoretical concepts, and the methodological approaches in his/her field	• Student will be able to conduct original research including: • Literature review and generation of hypothesis • Understand and apply an appropriate technique or research methodology • Statistical analysis of data, incorporate findings into the existing literature and identify implications of study. • Produce final dissertation outcomes of a high professional standard.
16	PYM902	COUNSELLING	The course offers good progression to those seeking to attain an initial step towards being an accredited counsellor status and further enhance their functional role at work and in a personal capacity. It also aims to provide students with a sound level of competence in the use of counselling skills. This course will provide each student to develop and	• Apply and develop conceptual difference between guidance counseling & psychotherapy. • Develop technique and implication of applied counseling skills in areas of practice. • Evaluate counseling theories & their application to the outside world. Classify the role and responsibilities of a professional counsellor Student will be able to: ▪ Evaluate various psychotherapies and schools in counselling techniques. ▪ Develop skills of eclectic therapeutic plans.

			demonstrate theoretical models supported by a substantial body of idea related to approaches to counselling skills. Emphasis will be placed upon enabling students to develop a theoretical foundation upon which to base a counselling approach.	Identify the techniques to practice in the therapy encounter and how those techniques should be implemented with a variety of disorders and psychosocial issues
17	PYM903	CLINICAL CASE STUDY	This course provides an opportunity to students to demonstrate the ability to devise, select and analyse a case and apply the theoretical knowledge to a real life situation.	- Provide students with opportunities to apply the concepts learnt in the class-room to real-life situations - Enable students to understand Research and its importance in experiential learning through Case study.
18	PYM904	COMPUTER APPLICATIONS IN PSYCHOLOGY PRACTICAL	The main objective of this course is to develop understanding of computer softwares/ Applications used in psychological researches.	- Students are able to evaluate data statistically on computer softwares. - Able to use existing software and databases specific to creating experimental materials, collecting data in various paradigms in psychology and statistically evaluating those data
M.Phil. (Psychology)				
1	PYM951	DISSERTATION I	Determine that the student is able to undertake the	- Find conceptual framework of the research - Students demonstrate effective presentation skills.

			work of the dissertation	• Able to critically review research literature. Identify a suitable research problem • Clearly state and elaborate the objectives, research question/s and proposed outcomes for the dissertation. • Express the rationale for undertaking the dissertation • Elucidate and justify the proposed method for undertaking the dissertation
2	PYM952	DISSERTATION II	Assess the student's mastery of the factual information, the theoretical concepts, and the methodological approaches in his/her field	• Student will be able to conduct original research including: • Literature review and generation of hypothesis • Understand and apply an appropriate technique or research methodology • Statistical analysis of data, incorporate findings into the existing literature and identify implications of study. • Produce final dissertation outcomes of a high professional standard.
3	PYM953	SELF STUDY COURSE	The objective is to inculcate the habit of self study in students without any external help.	Students will demonstrate: ▪ Effective presentation skills. ▪ Consulting skills ▪ Able to critically review research literature ▪ Refine project management skills
4	PYM954	ADVANCED RESEARCH METHODOLOGY & ANALYSIS	The objectives of this course is to introduce the basic principles of Research Methodology, to discuss in-detail the sampling, data collection, analysis of data and report	• On completion of the course the student will be able to understand, participate and conduct various steps involved in research. • Differential understanding of appropriate techniques to be used in various types of scientific research in social sciences.

			writing, to equip students with skills of various methods and techniques for scientific conduct of social science research.	• Analyse & comprehend research and its application. • Design and Develop the strategy, to conduct research. • Comprehend the inter relation between parameters under study. • Develop insight into procedural scientific steps of conducting a research.
5	PYM955	HEALTH PSYCHOLOGY	This course will provide each student to explore many ways in which psychological theory can impact on health, behaviour and health care systems.	• Analyzing Historical perspective on Health & Illness • Introduction on how theoretical and empirical findings are applied to improve the lives and development of individuals and groups with the help of health psychology. • Analyze and critically evaluating fundamental issues, with a particular focus on how to promote health across a range of settings this course will be relevant for students who want to work in health settings. • The course will provide an insight into how psychology can be used to understand important health issues for example – patient adjustment to chronic illness, how to motivate patients to change their health-related behaviour or how lifespan influences shape our health beliefs and behaviours, arguments, and points of view in health psychology



ANDHRA CHRISTIAN COLLEGE: GUNTUR DEPARTMENT OF SOCIOLOGY

Program Outcomes

Learning outcomes for the Sociology Under-graduate Program.

- Student will demonstrate knowledge of core sociology concepts.
- Student will demonstrate knowledge of how to use theory to conceptualize a sociological problem.
- Student will demonstrate the ability to communicate sociological knowledge to others.
- Student will develop an ability to use social scientific research methods to address sociological questions.
- Student will develop the knowledge, skill and attitude necessary to be engaged member of the community.
- Student will possess analytical skills in areas such as policy analysis, administration analysis and problem solving.

Sociology is the study of how we live together and how our lives are structure by social institutes, cultures and history. You will find sociologist studying people in their naturel habits in schools, medical facilities, sporting event, parties, wedding, during disaster and many more.

Sociology helps you to understand and improve you and your interaction, organizations, social institutions.

Our program student learning outcomes are that student recall information about demonstrate understanding of apply and evaluate information in these key areas:-

1. Sociology Research Methods and Statistics.
2. Critical Thinking
3. Social Institutions
4. Social Theory
5. Race, Class and gender
6. Industrial Sociology
7. Social Anthropology
8. Labour legislation and social welfare
9. Social psychology
10. Social movements
11. Globalization

Learning goals and Outcomes

The following learning goal and outcomes identify the means by which the preceding general statements of purpose are to be accomplished.

- Identify and apply sociological concepts and theories to understand social phenomena.
- Critically evaluate explanations of human behaviors, social phenomena and social processes locally and globally.
- Apply social scientific Principles to understand the social world.
- Evaluate the quality of social scientific data.
- Rigorously analyze social scientific data Demonstrate the ability to understand, interpret and analyze qualitative and quantitative data.
- Communicate in a clear and coherent manner in both written and oral communication.
- Use sociological knowledge to inform public understanding and policy debates.

Our degree programs are designed to produce graduates who can engage the world thoughtfully, critically and creatively. Our hope is that the coursework we require will not only provide solid base of sociology knowledge and a set of skills to collect and evaluate information , but also that our assignments reading and classroom discussions will foster a sense of engagement as citizens committers to making the world more humane and livable.

More specifically, each of our programs has articulated a set of learning outcomes for basis for our ongoing assessment of the effectiveness of our course and our curricula.

COURSE OUTCOMES

SEMESTER – I

Introduction of Sociology (CC-01)

Learning Outcomes-

- Student will be able to explain social facts and society relates concepts.
- Student will be able to define and explain social concepts, social facts and student will be able to express empirical observations with sociology concepts.
- Student will be able to define and explain main characteristics of social institutions.
- Student will be able to convey the historical development of sociology.
- It also provides a foundation for the other more detailed and specialized course in sociology.

Indian Society and change (CC-02)

- The mandate of the course is to introduce the society and culture of India.
- This paper is expected to bring familiarity in a student about Indian Society
- It will present a comprehensive, integrated and empirically – based profile of Indian society.
- This paper focuses on the culture, personality, joint family, Varna system, Vaste system & Panchayti Raj.

SEMESTER – II

Introduction of Sociology (CC-03)

The course introduces the general Principles of research methodology.

- Differentiate between four kinds of research methods, surveys, field research, experiments and secondary data analysis.
- Understand why different topics are better suited to different research approaches.
- The course aims to build scientific perspective attitude and skill for systematic enquiry by developing understanding of philosophical foundations of research, various elements of research design and methods and tool for data collection and analysis.
- Student would be able to carry out independent research pertaining to any specific issue.
- Design a research, justifying use of various methods / tool to carry out the same.
- Collect, analyze and interpret both quantitative and qualitative data.

Pioneers of social thinkers (CC-04)

The mandate of the course is to introduce the through of pioneers sociologist.

- Asses social and sociological theories, Phenomenon and perspectives, Influence of industrial and French revolution on sociological through and contributions of August Comte.
- Analyse life & Major works of Karl Mark.
- Explain contributions of Emile Durkheim.
- Describe the contribution of Herbert Spence Vilfredo Pareto.
- Elaborate on contributions of Max Waber.

Social Problem In India (CC-05)

The Couse introduces the student to some major theoretical debates and concept in social problem in contemporary India. A key thrust of the paper is towards developing a comparative understanding of different contemporary social problems in India.

- Elaborate on Caste, Minorities, and Problems in Modern India.
- Discuss Dowry death and legislation.
- Elaborate Poverty and poverty elevation programmers.
- Explain unemployment, types and remedies.
- Describe child and woman labour problem and legislation.
- Understand violence against women, meaning and provision forremedies.

Urban Sociology (CC-06)

The objective of this course is to understand about the urban scenario.

- Explain nature, scope, importance of urban sociology.
- Describe town and characteristic.
- Understand relation between Rural – urban continuum.
- Explain Migration and Urbanization. Emigration trends, factors.
- Analyse the Urban ecology and its theories.
- Understanding the Urban community meaning and characteristics.

Rural Sociology (CC-07)

The objective of this course is to understand about the rural scenario.

- Describing Nature and Scope of rural sociology.
- Develop on understanding of Rural social system, concept ofvillage, characteristics of rural social society.
- Elaborating on Rural family concept and types.
- Understand the caste system and its characteristics.
- Understanding Panchayati Raj System.
- Describe rural reconstruction and planning.

Sociology of Tribes (CC-08)

The objective of this course is to give clear understanding about the tribal society studying the course student will be able to.

- Introduce them with the concept of tribe.
- Develop an understanding about classification of tribal people.
- Define socio culture profile: Ethnic and cultural diversity.
- Learn about tribal society, family, marriage, kinship and languages.
- Know the problems faced by the tribes and social mobility and change.
- Learn about tribal movement.

Industrial Sociology (CC-09)

The course aims to introduce industrial and society.

Describe the nature and scope of industrial sociology, growth of industrialization, industrial revolution and its impact on society.

- Understand labour meaning, problems.
- Understand impact of globalization on industry and labour.
- Describe Trade Union Movement in India.
- Worker Participation in Management and Collective Bargaining.

Social Anthropology (CC-10)

The course aims to introduce tribal society in India.

- Elaborate on meaning, nature and scope of social Anthropology.
- Explain anthropological thinkers, Evolutionary and functional thinkers.
- Analyse the social institutions in terms of types and functions.
- Understand tribal economy, Law and justices.

Indian Social Thinker (CC-11)

This course aims to introduce Indian thinkers of Sociology.

- Explain the contributions of G.S Ghurey.
- Learn about structural functional perspective of M. N. Srinivas. S. C. Dubey.
- Explain Marxist perspective of B. R. Ambedkar, Devid Haardiman.
- Understand the concept and contributions of Mahatma Gandhi in the reform of Indian society.
- Know the contributions of K. M. Kapadia in the field work.

Sociology of Development and change (CC-12)

The objective of this course is to understand the different aspect of development and changes in sociology it also gives the understanding about the meaning and types of social change factors.

- Explain the meaning and types of social change.
- Describe the forms of social changes.
- Explain linear, Cyclical, Demographic theories.
- Understand the process of social change.
- Explain human development, social development sustainable development.
- Describe capitalist, mixed economy, NGO.

Labour and social welfare (CC-13)

This course is aims to introduce labour legislation and social welfare in India.

- Define Labour and social welfare – meaning and subject matter.
- Explain Productive legislation like factory act – 1948, Minimum Act – 1948.
- Elaborated Regulative legislation like Trade Union Act – 1926. Industrial Dispute Act 1947
- Explain Social security, meaning and types.
- Describe social security legislation Maternity benefit Act 1961 Payment of gratuity Act - 1972
- Analyse the labour administration in Jharkhand.

Social Psychology (CC-14)

The objective of this course to introduce the social psychology.

- Explaining Nature, Scope and subject matter of social psychology, relationship with other social sciences.
- Describe leadership meaning and types.
- Understand definitions, formation and changes in attitude.
- Explain Public opinion and mean of public opinion.
- Describe, Crowd and deference between group and crowd.
- Discuss Rummour.

Sociology of Religion (DES 01)

This course exposes student to the distinctiveness of the sociological approach to the study of religion.

- Student will be acquainted with representative texts that symbolize the development of knowledge in the field of sociology of religion.
- They will be able to identify different theories, approaches and concepts that make up the study of religion, distinguish between them and also use terms specific to the field in specific context.
- By encompassing contemporary developments, the course enable student to think about linkages between religion and society at various levels.

Social Movement in India (DES 02)

The course will equip student to visualize the transition from traditional to contemporary social movements. The course envisage that studying social study movement would ultimately foster an understanding of the dynamics of power, justices and human agency in transforming societies and cultures. To that extent it is a course that has a universal relevance and appeal.

- At the end of the course student should be able to distinguish the central principles of different theoretical perspectives in the sociology of social movements and relate them to specific historical and empirical contexts.
- Learn to use sociological theories on social movement to identify a phenomenon as is.
- Understanding the dynamics and motivations.
- Discuss and ask questions about social movement theories and methodologies with insight and precision.

Globalization and Society (DES 03)

Globalization means the speedup of movement and exchanges (of human beings goods and services, capital, technologies or cultural practices) all over the planet.

- Describe Globalization history of Globalization and its characteristics.
- Evaluate the Role of information and communication technology.
- Globalization and Indian culture contributes to the exchange of culture value of different countries, the convergence of Globalization.
- Explain advantages and disadvantages of Globalization.
- Describe Agencies of Globalization like Media, Market, International Monetary fund, World Bank.
- For the tribal, globalization is associated with rising prices, loss of job security and lack of health care and tribal development programs.

Field Work (DES 04)

- The course is an introductory course on how research is actually done.
- Field work is an applied part of social research methods.
- This paper aims to acquaint students with empirical field data collection, analysis and writing analytical and standard dissertation or research report in sociology.
- Student will be able to learn about how to collect, analyze data and how to write a field report.

Basic Concept in Sociology (GE-1)

The course is intended to introduce the student to a sociological way of thinking. It provides an understanding of the discipline of sociology and sociology perspective student will be able to –

- Define sociology and demonstrate nature, scope and subject – matter, relationship with other social science.
- Acquaint themselves with the basic concept of sociology like society, community, association, institution, social structure, culture, status & role, Norms & values.
- Explain social groups.
- Know the basic social institution like family, Economy, Polity kinship and religion.

Sociology of Kinship, Marriage & Family (GE-2)

- Impart comprehensive study of concepts relevant for understanding kinship, marriage and family.
- Look beyond the surface of issues to discover the “why” and “how” of kinship.
- Group the historical evolution of kinship theories from a biological deterministic approach to culture of relatedness.
- Develop an analytical perspectives kinship theories from a biological deterministic approach to culture of relatedness.
- Comprehend the coexistence of multiple perspectives in the study of family, marriage and kinship.

Rural Sociology (GE-3)

The course explores substantive issues in Rural sociology. It gives attention to Indian themes. Studying the course student will be able to

- Define Rural sociology and demonstrate its origin, nature, subject matter and importance of studying rural sociology.
- Demonstrate how caste system operates and its importance in rural society.
- Understand and analyze social, economic and political aspect of rural society.
- Define and demonstrate rural political structure like traditional caste Panchayati Raj and Empowerment of peoples.

Rural Sociology (GE-3)

- Urbanization is an important aspect of modern society. This course will provide an exposure to key theoretical perspectives for understanding urban phenomena in historical and contemporary contexts.
- The course seeks to evolve critical thinking and develop a policy perspective on the urban.
- To appreciate the significance of the city and the process of urbanization and its consequence across the globe, through cross disciplinary texts and ethnographic studies.
- To learn about key urban process such as migration, displacement and urban slums.

COURSE OUTCOMES
Faculty of Sociology B.A (Program
Course)
SEMESTER – I

Introduction of Sociology-I (DSC-1A)

The mandate of the course is to introduce the discipline to students from diverse academic and social background, trainings and capabilities.

The course is intended to introduce the student to a sociological way of thinking. They learn how to apply sociological concepts to the everyday life.

- It also provides a foundation for the other more detailed and specialized course in sociology.
- The students learn to apply the sociological perspective in understanding how society shapes our individual lives.

SEMESTER – II
Introduction of Sociology-II (DSC-1B)

The course aims to provide a general introduction to sociology through.

- The students are introduced to the relationship between theory and perspectives.
- The students learn critical thinking skills.
- The students will be able to understand meaning of norms, value, culture and social stratification and its theories social mobility and social structure.

SEMESTER – III
Classical Sociology thinkers (DSC-1C)

Objective of teaching sociological thinkers to undergraduate student is to enable them to apply theory to their own everyday life experiences.

- Understanding the grand foundational themes of sociology.
- Appreciation of the classical concepts and theories to develop awareness of the limits of current knowledge.
- Understanding the basic methodological approaches of the thinkers, through some original text and their role in building sociological knowledge.

SEMESTER – IV
Research Methodology and Statistics (DSC-1D)

The Course is a general introduction to the methodologies of sociological research.

- Student are introduced to sociological research both from a theoretical and methodological perspective.
- They understand the importance of research in social science.
- Student learns that research methods are universal and not bound by cultural location.

ANDHRA CHRISTIAN COLLEGE: GUNTUR

DEPARTMENT OF ZOOLOGY

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO 1	Interpret principles, classifications, concepts, theories and mechanisms.
PSO 2	Analyze hypothesis, procedures, properties, experimental facts and draw conclusions.
PSO 3	Apply techniques in solving problems, sample analysis and production.
PSO 4	Develop communicative competence, creative and critical thinking, practical, technical and employability skills, social sensibility and responsibility

COURSE OUTCOMES (COs)

Semester: I

Course Code: ZOO1SK

Course Name: Animal Diversity – Biology of Non-Chordates

By the completion of the course the graduate should able to:	
CO 1	Describe general taxonomic rules on animals' classification.
CO 2	Classify protozoa to Coelenterate with taxonomic keys.
CO 3	Classify phylum platy helminths to Annelid phylum using examples from parasitic adaptation and vermin composting.
CO 4	Describe phylum Arthropoda to Mollusca using examples and important of insects and, Molluscans.
CO 5	Describe Echinodermata to Hemichordate with suitable examples and laurel stages in relation to the phylogeny.

Semester: II

Course Code: ZOO2SK

Course Name: Animal Diversity - Biology of Chordates.

By the completion of the course the graduate should able to:	
CO 1	Describe general taxonomic rules on animal classification of chordates.
CO 2	Classify protochordate to mammalian with taxonomic keys.
CO 3	Understand mammals with specific structural adaptations.
CO 4	Understand the significance of dentition and evolutionary significance.
CO 5	Understand the origin and evolutionary relationship of different phyla from prochordata to mammalian.

Semester: III

Course Code: ZOO3SK

Course Name: Cell Biology, Genetics, Molecular Biology and Evolution.

By the completion of the course the graduate should able to:	
CO 1	To understand the basic unit of the living organisms and to differentiate the organisms by their cell structure.
CO 2	Describe fine structure and functions of plasma membrane and different cell organelles of eukaryotic cell.
CO 3	To understand the history of origin of branch of genetics, gain knowledge on heredity, interaction of genes various types of inheritance patterns existing in animals.
CO 4	Acquiring in depth knowledge on various of aspects of genetics involved in sex determination human karyotyping and mutations of chromosomes resulting in various disorders.
CO 5	Understand the central dogma of molecular biology and flow of genetic information from DNA to proteins.

Semester: IV

Course Code: ZOO4SKA

Course Name: Animal Physiology, Cellular Metabolism and Embryology.

By the completion of the course the graduate should able to:	
CO 1	Understand the functions of important animal physiological system including digestion Cardio- Respiratory and Renal system.
CO 2	Understand the muscular system and the neuro endocrine regulation of animal growth, development and metabolism with a special knowledge of hormonal control of human reproduction.
CO 3	Describe the structure, classification and chemistry of biomolecules and enzymes responsible for sustenance of life in living organisms.
CO 4	Develop broad understanding the basic metabolic activities pertaining to the catabolism and anabolism of various biomolecules.

Semester: IV

Course Code: ZOO4SKB

Course Name: Immunology and Animal Bio-Technology.

By the completion of the course the graduate should able to:	
CO 1	To get knowledge of the organs of immune system, type of immunity, cells and organs of immunity.
CO 2	To describe immunological response as to how it is triggered (Antigens) and regulated (Antibodies)
CO 3	Understand the applications of biotechnology in the fields of industry and agriculture including animal cell/tissue culture, stem cell technology and genetic engineering
CO4	Get familiar with the tools and techniques of animal biotechnology.

Semester: V

Course Code: ZOO5SA

Course Name: Biotechnology.

By the completion of the course the graduate should able to:	
CO 1	Imparts the knowledge to culture animal cells in artificial media.
CO 2	Knowledge of animal cell in culture growth of cell lines.
CO3	Use in recombinant DNA technology, genetic manipulations and in a variety of Industrial process.

COURSE OUTCOMES (Cos)

Semester V

Course Code: ZOO 6A

Course Name: 6 A Sustainable Aquaculture Management

	By the completion of course the graduate should able to
CO1	Evaluate the present status of aquaculture at the Global level and national level
CO2	Classify different types of ponds used in aquaculture
CO3	Demonstrate induced breeding of crops
CO4	Acquire critical knowledge on commercial importance of shrimps

Semester V

Course Code: ZOO 7A

Course Name: 7 A Post harvest technology of fish and fisheries

	By the completion of course the graduate should able to
CO1	Identify the types of preservation methods employed in aquaculture
CO2	Choose the suitable processing methods in aquaculture
CO3	Maintain the standard quality control protocols laid down in aqua industry
CO4	Identify the best sea food quality assurance system

COMPUTER SCIENCE

I	C1	Problem solving in c	CO1	Understand the basic terminology used in computer programming
			CO2	Write, compile and debug programs in C language.
			CO3	Use different data types in a computer program
			CO4	Design programs involving decision structures, loops and functions
			CO5	Understand the dynamics of memory by the use of pointers and Structures.
			CO6	Apply different operations in File handling.
		Problem solving in c lab	CO1	Write, compile and debug programs in C language.
			CO2	Implement different data types in a computer program
			CO3	Design programs involving decision structures, loops and functions
			CO4	Write simple programs on pointers and Structures.
			CO5	Write operations in File handling.
II	C2	Data Structures	CO1	Identify data structures suitable to solve problems
			CO2	Developing algorithms
			CO3	Identifying the use of Time and Space Complexity.
			CO4	Implementing different sorting & searching techniques.
		Data Structures lab	CO1	Implement data structures suitable for liner & non liner structures.
			CO2	Design a program on linear Data structures.
			CO3	Write simple programs on different sorting & searching techniques.
III	C3	Data Base Management System	CO1	Gain knowledge of Database, DBMS and SQL
			CO2	Learn SQL as best analysis tool for extract data in different ways
			CO3	Create a small database using SQL.
			CO4	Able to construct SQL queries to Store, Retrieve data in database
			CO5	Model database using ER Diagrams and design database schemas based on the model
		Data Base Management System lab	CO1	Create a small database using SQL.
			CO2	Write commands on SQL queries to Store, Retrieve data in database
			CO3	Draw the ER Diagrams and design database schemas based on the model
IV	C4	Object Oriented Programming through Java	CO1	Understand the concept and underlying principles of Object-Oriented Programming
			CO2	Understand how object-oriented concepts are incorporated into the Java programming

				language
			CO3	Develop problem-solving and programming skills using OOP concept
			CO4	Understand the benefits of a well-structured program
			CO5	Develop the ability to solve real-world problems through software development in high-level programming language like Java
			CO6	Develop efficient Java applets and applications using OOP concept
		Object Oriented Programming Through Java lab	CO1	Develop problem-solving and programming skills using OOP concept
			CO2	Design a well-structured program .
			CO3	Develop the ability to solve real-world problems through software development in high-level programming language like Java
			CO4	Develop efficient Java applets and applications using OOP concept
IV	C5	Operating System	CO1	Understand the main components and Structure of Operating System& their functions
			CO2	Analyze various ways of Process Management & CPU Scheduling Algorithms
			CO3	Evaluate various device and resources like Memory,Time and CPU Management techniques in distributed systems.
			CO4	Apply different methods for Preventing Deadlocks in a Computer System.
		Operating System lab	CO1	Design Process Management & CPU Scheduling Techniques.
			CO2	Write CPU Management techniques in distributed systems.
			CO3	Apply different techniques for Preventing Deadlocks in a Computer System.
V	C6	Web Interface Designing Technologies	CO1	To understand the web architecture and web services.
			CO2	To practice latest web technologies and tools by conducting experiments
			CO3	To design interactive web pages using HTML and Style sheets.
			CO4	To study the framework and building blocks of Integrated Development Environment
			CO5	To provide solutions by identifying and formulating IT related problems.
		Web Interface Designing Technologies lab	CO1	To Write latest web technologies and tools by conducting experiments
			CO2	To design interactive web pages using HTML and Style sheets.
			CO3	To framework and building blocks of Integrated Development Environment
	C7	Web Application designing With PHP	CO1	To understand the web architecture and web services.
			CO2	To practice latest web technologies and tools by conducting experiments

		&MySQL	CO3	To design interactive web pages using HTML and Style sheets.
			CO4	To study the framework and building blocks of Integrated Development Environment
		Web Application designing With PHP &MySQL lab	CO1	Write a simple program in PHP
			CO2	Write simple programs on handle and validate data using PHP
			CO3	Write programs to create dynamic &interactive web-based applications using PHP & MYSQL.
		VI		PROJECTS
CO2	Use different Statistical packages for graphical interface, data analysis and interpretation			
CO3	Write a systematic Statistical project report.			



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Criterion: II

Metric: 2.6.1

SANSKRIT

I	1105-1	Poetry, Prose, Grammar Sanskrit-I	CO1	इतिहासस्य प्रसस्त्यम् जानन्ति । नित्यं नूतन धर्मानुसरन्ति । नैतिका मूल्यान् अधिगच्छन्ति ।
			CO2	मानाव धर्मान्, सामाजिका परिणामान् अधिगच्छन्ति ।
			CO3	नीतिकथां द्वारा मानाव विचक्षणा ग्नानं अधिगम्यन्ते ।
			CO4	भाषा परिग्नानम् अधिगच्छन्ति ।
II	1105-2	Poetry, Prose, Grammar Sanskrit-II	CO1	वामसगौरव रक्षणं, नायकत्वलक्षणं आध्यात्मिकमूल्यान् विद्यार्थिनाह अधिगम्यन्ते ।
			CO2	इतिहासानं प्रआसस्त्यं, युवकानं परिणामक्रमे व्यक्तित्व विकासं विद्यार्थिनः अभिजानन्ति ।
			CO3	धर्मिक मूल्यान्, राजाधर्मान्, धात्रुत्व भवान् विद्यार्थिना अवलम्बन्ति ।
			CO4	भाषा परिग्नानं अभिजानन्ति ।
III	1105-3	Poetry, Prose, Grammar Sanskrit-III	CO1	नैतिका मूल्यान्, धर्मिक चिन्तनं गणनं लभते । प्राचीन नाटका विषये ग्नान सम्पादनं ।
			CO2	आत्मविश्वासं, व्याक्तिगतसमर्द्धं महत्वां ग्नायते ।
			CO3	आत्मविश्वासं, व्याक्तिगतसमर्द्धं महत्वां ग्नायते ।
			CO4	सातिविका भावान् ग्नान सम्पादनं ।
			CO5	प्राचीन सास्त्रकारणं परिचयः ग्नायते ।

TELUGU

I	1103-1K	ప్రాచీన తెలుగు కవిత్వం	CO1	ప్రాచీన తెలుగు సాహిత్యం యొక్క ప్రాచీనతను, విశిష్టతను గుర్తిస్తారు. తెలుగు సాహిత్యంలో ఆదికవి నన్నయ కాలంనాటి భాష సంస్కృతులను, ఇతిహాసకాలం నాటి రాజనీతి విషయాల పట్ల పరిజ్ఞానాన్ని సంపాదించగలరు.
			CO2	శివకవుల కాలంనాటి మతపరిస్థితులను, భాష విశేషాలను గ్రహిస్తారు. తెలుగు నుడికారం, సామెతలు, లోకోక్తులు మొదలైన భాషాంశాల పట్ల పరిజ్ఞానాన్ని పొందగలరు.
			CO3	తిక్కన భారతంనాటి మత, ధార్మిక పరిస్థితులను, తిక్కన కవితాశిల్పాన్ని, నాటకీయతను అవగాహన చేసుకోగలరు.

			CO4	ఎఱ్ఱన సూక్ష్మవైచిత్ర్యాని, ఇతిహాస కవిత్యంలోని విభిన్న రీతులపట్ల అభిరుచిని పొందగలరు. శ్రీనాథుని కాలం నాటి కవితావిశేషాలను, మొల్ల కవితా విశిష్టతను గుర్తించగలరు.
			CO5	తెలుగు పద్యం స్వరూప స్వభావాలను, సాహిత్యాభిరుచిని పెంపొందించుకుంటారు. ప్రాచీన కావ్య భాషలోని వ్యాకరణాంశాలను అధ్యయనం చేయడం ద్వారా భాషా సామర్థ్యాన్ని రచనల మెళకువలను గ్రహించగలరు.
II	1103-2k	ఆధునిక తెలుగు సాహిత్యం	CO1	ఆంగ్లభాష ప్రభావం కారణంగా తెలుగులో వచ్చిన ఆధునిక సాహిత్యాన్ని, దాని విశిష్టతను గుర్తిస్తారు.
			CO2	సమకాలీన ఆధునిక సాహిత్య ప్రక్రియలైన వచన కవిత్యం, కథ, నవల, నాటకం, విమర్శలపై అవగాహన పొందుతారు.
			CO3	భావకవిత, అభ్యుదయ కవితాలక్ష్యాలను గూర్చిన జ్ఞానాన్ని పొందుతారు. అస్తిత్వవాద ఉద్యమాలపుట్టుకను, ఆవశ్యకతను గుర్తిస్తారు.
			CO4	కథాసాహిత్యం ద్వారా సామాజిక చైతన్యాన్ని పొందుతారు. సిద్ధాంతాల ద్వారా కాకుండా, వాస్తవ పరిస్థితులను తెలుసుకోవడం ద్వారా సిద్ధాంతాన్ని సమీక్షించగలరు.
			CO5	ఆధునిక తెలుగు కల్పనాసాహిత్యం ద్వారా సామాజిక, సాంస్కృతిక, రాజకీయ చైతన్యాన్ని పొందుతారు.
III	2103-3k	సృజనాత్మక రచన	CO1	తెలుగు సాహిత్య అభ్యసన ద్వారా నేర్చుకున్న నైపుణ్యాలను, సృజనాత్మక నైపుణ్యాలుగా మార్చుకోగలరు.
			CO2	విద్యార్థులు భాషాతత్వాన్ని, భాష యొక్క ఆవశ్యకతను, భాష యొక్క ప్రాధాన్యాన్ని గుర్తిస్తారు. మనిషి వ్యక్తిగత జీవనానికి, సామాజికవ్యవస్థ పటిష్టతకు భాష ప్రధానమని తెలుసుకుంటారు. తెలుగుభాషలోని కీలకాంశాలైన 'వర్ణం - పదం - వాక్యా'ల ప్రాధాన్యాన్ని గుర్తిస్తూ, వాగ్రూప- లిఖితరూప వ్యక్తీకరణ ద్వారా భాషానైపుణ్యాలను మెరుగుపరచుకోగలరు.
			CO3	భాషానైపుణ్యాలను అలవరచుకోవడంతో పాటు వినియోగించడం నేర్చుకుంటారు. రచనా, భాషానైపుణ్యాలను సృజనాత్మక రూపంలో వ్యక్తీకరించ గలరు.
			CO4	ప్రాచీన పద్యరచనతో పాటు ఆధునిక కవిత, కథ, వ్యాసం, మొదలైన సాహిత్య ప్రక్రియల నిర్మాణాలకు సంబంధించిన సిద్ధాంత విషయాలను నేర్పడంతో పాటు వారిలో రచనా నైపుణ్యాలను పెంపొందించుకోగలరు.
			CO5	సృజన రంగం, ప్రసారమాధ్యమ రంగాల్లో ఉపాధి అవకాశాలను అందిపుచ్చుకోగలరు. అనువాద రంగంలో నైపుణ్యం సంపాదించగలరు.



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Criterion: II

Metric: 2.6.1

DEPARTMENT OF ZOOLOGY(PG)

POs & COs

PROGRAM OUTCOMES

The program outcomes for a Master of Science (MSc) in Zoology

PO1: Develop an understanding of the fundamental principles of zoology, including animal taxonomy, anatomy, physiology, and behavior.

PO2: Demonstrate advanced research skills in the field of Zoology, including experimental design, data collection and analysis, and scientific communication.

PO3: Understand the principles of ecology, including population dynamics, community interactions, and ecosystem processes, and their application to current environmental challenges.

PO4: Analyze current research in Zoology, including primary research articles and scientific reviews, and apply this knowledge to address scientific questions and solve problems.

PO5: Develop critical thinking skills in designing and evaluating experiments related to Zoology, and applying ethical principles to animal research.

PO6: Communicate scientific ideas effectively in writing and oral presentations, using appropriate scientific terminology and referencing conventions.

PO7: Demonstrate the ability to work independently and collaboratively on research projects, and to manage data and other resources effectively.

PO8: Understand the role of Zoology in addressing current environmental challenges, such as habitat loss, climate change, and invasive species, and the application of Zoology to conservation biology.

PO9: Demonstrate an understanding of the principles of evolution, including the mechanisms of natural selection, genetic drift, and speciation, and their application to animal behavior, physiology, and morphology.

PO10: Apply knowledge and skills acquired in the program to a range of professional and academic settings, such as careers in academia, conservation biology, environmental consulting, and science journalism.

PSOs (Program Specific Outcomes) for an MSc Zoology course might include:

PSO1: Understanding of animal diversity and classification, and ability to identify and classify different animal species based on their morphological and molecular characteristics.

PSO2: Proficiency in various laboratory techniques and field methods used in Zoology research, including molecular biology, ecology, and animal behavior studies.

PSO3: Ability to critically analyze scientific literature and to design and conduct independent research projects in the field of Zoology.

PSO4: Knowledge of the conservation challenges facing different animal species and ecosystems, and ability to develop effective conservation strategies.

PSO5: Understanding of the ethical and legal issues related to animal research and conservation, and ability to apply ethical principles to scientific research and professional practices.

Overall, the PSOs for an MSC Zoology course aim to provide students with a comprehensive understanding of Zoology and its applications, while also developing their critical thinking, research, and professional skills. By achieving these PSOs, students will be well-prepared for careers in a wide range of fields related to animal biology, conservation, and research.

ACHARYA NAGARJUNA UNIVERSITY: NAGARJUNA NAGAR
DEPARTMENT OF ZOOLOGY
TWO YEAR M.Sc. COURSE IN ZOOLOGY (2022-2023)
COURSE STRUCTURE AND EXAMINATION SCHEME

Semester -I

S.No	Components of Study	Title of the Course	Title of the Paper	No. of Credits	Internal Assessment Marks	Semester end Examinations Marks	Total Marks	No. of hours/ week
1.	Mandatory Core	ZOO 1.1(22)	Structure and Function of Invertebrates and Vertebrates	4	30	70	100	
2.		ZOO 1.2(22)	Biodiversity and Systematics	4	30	70	100	
3.	Compulsory Foundation	ZOO 1.3 (a) (22)	Developmental Biology	4	30	70	100	
4.	Elective Foundation	ZOO 1.4 (a) (22)	Molecular Cell Biology	4	30	70	100	
		ZOO 1.4 (b) (22)	Endocrinology					
		ZOO 1.4 (c) (22)	Marine and Brackish water ecology					
5.	Practical -I	ZOO 1.5(22)	Invertebrates, Vertebrates and Biodiversity	4	30	70	100	
6.	Practical-II	ZOO 1.6(22)	Developmental Biology and Molecular Biology	4	30	70	100	
	Total			24	180	420	600	

- Elective Foundation – Choose one paper.

Semester –II

S.No	Components of Study	Title of the Course	Title of the Paper	No. of Credits	Internal Assessment Marks	Semester end Examinations Marks	Total Marks	No. of hours/ week
1.	Mandatory Core	ZOO 2.1(22)	Genetics and Evolution	4	30	70	100	
2.		ZOO2.2(22)	Comparative Animal Physiology	4	30	70	100	
3.	Compulsory Foundation	ZOO 2.3 (a) (22)	Principles of Ecology	4	30	70	100	
4.	Elective Foundation	ZOO 2.4 (a) (22)	Tools and Techniques in Biology	4	30	70	100	
		ZOO 2.4 (b) (22)	Fish Physiology					
		ZOO 2.4 (c) (22)	Aquatic microbiology					
5.	Practical -I	ZOO 2.5(22)	Genetics and Animal Physiology	4	30	70	100	
6.	Practical-II	ZOO 2.6(22)	Ecology and Tools & Techniques in Biology	4	30	70	100	
7.	Skill Development Course ZOO 2.7 (22) MOOCs/SDC			4	00			
	Total			28	180	420	600	

Elective Foundation – Choose one paper.

Semester-III

S.No	Components of Study	Title of the Course	Title of the Paper	No. of Credits	Internal Assessment Marks	Semester end Examinations Marks	Total Marks	No. of hours/week
1.	Mandatory Core	ZOO 3.1(22)	Animal Biotechnology and Microbiology	4	30	70	100	
2.		ZOO 3.2(22)	Ichthyology	4	30	70	100	
3.	Elective-I	ZOO 3.3 (a) (22)	Limnology	4	30	70	100	
		ZOO 3.3 (b) (22)	Water quality management					
		ZOO 3.3 (c) (22)	Environmental Biology					
4.	Elective -II	ZOO 3.4 (a) (22)	Aquatic Toxicology	4	30	70	100	
		ZOO 3.4 (b) (22)	Aquaculture Engineering					
		ZOO 3.4 (c) (22)	Taxonomy and Functional Anatomy of Shellfish					
5.	Practical - I	ZOO 3.5(22)	Biotechnology, Microbiology and Ichthyology	4	30	70	100	
6.	Practical- II	ZOO 3.6(22)	Limnology and Toxicology	4	30	70	100	
7.	Skill Enhanced Course	ZOO 3.7 (22)	MOOCs/SDC	4	00	00		
	Total			28	180	420	600	

- Elective I– Choose one paper
- Elective II– Choose one paper.

Semester-IV

S.No	Component of Study	Title of the Course	Title of the Paper	No. of Credits	Internal Assessment Marks	Semester end Examinations Marks	Total Marks	No. of hours/ week
1.	Mandatory Core	ZOO 4.1(22)	Fish Pathology	4	30	70	100	
2.		ZOO 4.2(22)	Immunology	4	30	70	100	
3.	Elective-I	ZOO 4.3 (a) (22)	Aquaculture	4	30	70	100	
		ZOO 4.3 (b) (22)	Taxonomy and Anatomy of Finfish					
		ZOO 4.3 (c) (22)	Fish Nutrition					
4.	Elective-II	ZOO 4.4 (a) (22)	Aquaculture Management	4	30	70	100	
		ZOO 4.4 (b) (22)	Fish processing technology					
		ZOO 4.4 (c) (22)	Economic Zoology					
5.	Practical -I	ZOO 4.5(22)	Fish Pathology and Immunology	4	30	70	100	
6.	Practical-II	ZOO 4.6(22)	Aquaculture and Aquaculture Management	4	30	70	100	
7.	ZOO 4.7 (22) Project			4	00	00	100	
	Total			28	180	420	700	

- Elective I– Choose one paper
- Elective II– Choose one paper

1. Slightly Justified
2. Moderately Justified
3. Substantially Justified

Acharya Nagarjuna University
M.Sc. ZOOLOGY, SEMESTER -I
STRUCTURE AND FUNCTION OF INVERTEBRATES AND VERTEBRATES
(CODE No. Z 1.1) 22
(w.e.f.2022-2023 admitted batch)

Course Type: Theory
Course Category: Mandatory core
Credits:4

Course Objectives/ Course outcomes:

This course is designed to

CO :1 Understand the general characteristics of all invertebrates of coelom and about the nutrition, digestion, respiration.

CO :2 To discuss about Larval forms of free-living invertebrates and Minor phyla general characters.

CO :3 Remembering the biology and life cycles of Parasites and insects and its importance in environment.

CO :4 Elucidate the comparative accounts of respiratory and circulatory systems of vertebrates.

CO :5 Comparative anatomy and function of Nervous, sensory and urinogenital systems among different vertebrates.

UNIT – I

1. Invertebrates: General characters of invertebrates; Coelom - Origin and functions, acoelomates, pseudocoelomates and coelomates (Protostomia and Deuterostomia).
2. Nutrition and Digestion: Patterns of feeding and digestion in Cnidarians; filter feeding in Polychaeta, Mollusca and Echinodermata.
3. Respiration: Structure and function of respiratory organs in Annelida, Arthropoda and Mollusca - gills, lungs and tracheae.

Learning Outcome:

Students will understand the

General characteristics of all invertebrates, and origin, functions and types of Coeloms, Patterns of feeding and digestion, and structure and function of respiratory organs in invertebrates.

UNIT – II

1. Invertebrate Larvae: Larval forms of free-living invertebrates;
2. Larval forms of parasites.
3. Minor Phyla: Organization and general characters of Rotifera, Phoronida and Chaetognatha.

Learning Outcome:

Students will be familiar with the Larval forms of free-living and parasitic invertebrates, Organization and general characters of minor phyla like Rotifera, Phoronida and Chaetognatha

UNIT – III

1. Parasites: Life cycle and biology of *Trypanosoma gambiense*, *Leishmania donovani*, *Wuchereria bancrofti* and *Schistosoma haematobium*.
2. Insects: Insects and diseases;
3. Economic importance of insects.

Learning Outcome:

Students will be familiar with the

Life cycle, biology and diseases caused by protozoan and helminthic parasites.

Diseases caused by harmful insects and economic importance of beneficial insects.

UNIT – IV

1. Vertebrates: Important characters, nature of vertebrate morphology.
2. Respiratory system: Comparative account of respiratory organs invertebrates.
3. Circulatory system: Evolution of heart among vertebrates; Evolution of aortic arches and portal systems among vertebrates.

Learning Outcome:

Students should be able to describe the

- ☐ Salient features and morphology of vertebrates
- ☐ Comparative account of respiratory organs; evolution of heart, aortic arches and portal systems among vertebrates.

UNIT – V

1. Nervous system: Comparative anatomy and function of brain and cranial nerves in vertebrates. Comparative anatomy of spinal cord, spinal nerves and autonomous nervous system invertebrates.
2. Urinogenital system: Evolution of urinogenital systems among vertebrates.
3. Sensory organs: Olfactory and taste organs in vertebrate series; Lateral line system in fishes.

Learning Outcome:

Students will have a knowledge on the

Anatomy and function of nervous system, evolution of urinogenital system and sensory organs among vertebrates.

REFERENCE BOOKS

1. Barrington EJW. Invertebrate Structure and Function. 1976. Thomas Nelson and Sons Ltd. London.
2. Hyman LH. The Invertebrates. 1955. Vol.1 to 8, McGraw Hill Co., New York.
3. Parker TJ and Haswell WA. 1972. Text Book of Zoology. Vol. 2, Vertebrates (Eds.), AJ. Marshall, ELPS and MacMillan.
4. Read CP. 1972. Animal Parasitism. Prentice Hall, Inc. New Jersey.
5. Ruppert EE, Fox RS & Barnes RD. 2004. Invertebrates Zoology, 7th edition, Thomson, Brooks/Cole.
6. Young JZ. The Life of Vertebrates. 1962. Marion Nixon from Amazon.com
7. Young JZ. 1966. The Life of Mammals, Clarendon Press.

CO-PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	2	1	3	2	1	2	2	1	2	3
CO2	2	1	3	1	1	2	2	1	3	1
CO3	2	3	2	2	3	2	3	2	2	2
CO4	1	2	2	1	2	3	2	1	2	2
CO5	2	1	1	1	2	1	2	3	2	2

M.Sc. ZOOLOGY, SEMESTER -I
BIODIVERSITY AND SYSTEMATICS
(CODE No. Z 1.2) 22
(w.e.f.2022-2023 admitted batch)

Course Type: Theory

Course Category: Mandatory core

Credits:4

Course Objectives/ Course outcomes:

CO-1: To introduce basic concepts and significance of biodiversity and distribution of world.

CO-2: To analyze Hierarchical components of biodiversity, values and losses.

CO-3: Create awareness about systematics and species identification scientifically.

CO-4: Create knowledge about biodiversity management; in-situ and ex-situ conservation through technical aspects.

CO-5: Applied biotechnology in biodiversity including molecular taxonomy, GIS.

UNIT –I

1.**Biodiversity:** Definition and significance; biodiversity at global, national and local levels; magnitude and distribution of biodiversity.

2. **Patterns of biodiversity:** Latitudinal and altitudinal gradients; species area relationship

3. **Biogeographic realms** of the world.

4. Biogeographic zones of India and faunal diversity; Hotspots in the world and in India.

Learning outcome:

Being aware of the significance and faunal diversity, distribution of hotspots in biogeographic realms at international, national, local levels and their patterns in respect of their latitude and altitudinal gradients. Analyze species area relationship.

UNIT – II

1.**Hierarchical components** of biodiversity: Species diversity, genetic diversity and ecosystem diversity.

2. **Biodiversity values:** Direct values and indirect values.

3. Biodiversity in peril: Causes of biodiversity losses and extinction; anthropogenic impact on biodiversity.

Learning outcome:

Students have a good understanding of the Hierarchical components of the biodiversity, analyse and evaluate the values of biodiversity and investigate the losses and extinction of biodiversity through anthropogenic activity.

UNIT – III

1. **Systematics:** Species concept. Taxonomy and its components—classification and phylogeny, Cladistic classification.
2. **Identification:** Keys, biodiversity documentation, species identification and identification tools.
3. **Nomenclature:** International Code of Zoological Nomenclature (ICZN); Types: Holotype, Paratype, Neotype, Lectotype, Syntype, Homonymy and Synonymy.

Learning outcome:

Upon completion of this unit Student be aware about systematics, concepts, classification and phylogeny. Examine and execute species identification through tools by follow ICZN.

UNIT – IV

Biodiversity management and conservation

1. IUCN classification of wildlife.
2. Biodiversity threats; *In-situ* conservation and *Ex-situ* conservation.
3. Gene banks; conservation of genetic resource; cryopreservation.
4. Wildlife protection acts; organizations involved in protection of Biodiversity.

Learning outcome:

Student will learn about status of biodiversity through IUCN classification and implementation of various wildlife protection acts for conservation and management.

UNIT- V

1. **Biodiversity and biotechnology:** DNA based wildlife forensics; genetically modified organisms (GMOs) and Bioremediation.
2. **Molecular taxonomy:** DNA fingerprinting.
3. Satellite Remote Sensing and GIS programs; Environmental Impact Assessment (EIA).

Learning outcome:

Knowledge applied through biotechnology helps the DNA based wildlife forensics, GMOs, molecular taxonomy and also GIS program helps in the observation of movement of wild animals and evaluate environmental problems through EIA.

REFERENCE BOOKS

1. Agarwal KC. 1998. *Biodiversity*. India.
2. *International Code of Zoological Nomenclature*. 1985. Third edition adopted by XX General

assembly of the International Union of Biological Sciences, University of California Press, Berkeley and Los Angeles Edition.

3. Kormondy EJ. 1996. *Concepts of Ecology*. Eastern Economy Edition.
 4. Oliver S&OwenMc. *Natural Resource Conservation: An Ecological Approach*. Macmillan Publ. Co. New York.
 5. Peggy I. Fieldler and Perer M. Kareiva. 1997. *Conservation Biology*.
 6. Prabodh K. Maiti and Paulami Maiti. 2011. *Biodiversity: Perception, Peril and Preservation*.
 7. Saharia VV. 1982. *Wildlife in India*. Natraco Publishers, Dehradun.
- TandonRK.1999. *Biodiversity, Taxonomy & Ecology*. Prithipalsingh Scientific Publishers, Jodhpur.

CO-PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	2	1	3	2	1	2	2	1	2	3
CO2	2	1	3	1	1	2	2	1	3	1
CO3	2	3	2	2	3	2	3	2	2	2
CO4	1	2	2	1	2	3	2	1	2	2
CO5	2	1	1	1	2	1	2	3	2	2

M.Sc. ZOOLOGY, SEMESTER -I
DEVELOPMENTAL BIOLOGY
CODE No. Z 1.3 (a) 22
(w.e.f.2022-2023 admitted batch)

Course Type: Theory

Course Category: Compulsory foundation

Credits:4

Course Objectives/ Course outcomes:

CO 1: The students can be able to remember the process of gametogenesis, including mitosis, meiosis and gamete formation in males and females.

CO2: Understanding the genetic and phenotypic variation that can arise from gamete formation, fertilization and the role of gametes in sexual reproduction and inheritance.

CO 3: By applying the differences between gametes and somatic cells in terms of chromosome number and DNA content.

CO 4: To analyze the evolutionary changes of gamete size , shape, factors that can influence gamete competition and mate choice .

CO 5: The reproductive strategies of different organisms including Mogami, promiscuity, asexuality and the ethical social implications of technologies related to gamete and embryo manipulations such as IVF, cloning and gene making.

UNIT – I:

1. Origin and migration of primordial germ cells (PGCs) to the genital ridges, differentiation of gonads in mammals.

2. Spermatogenesis: Sperm – formation, structure and types; Leydig cells – endocrine regulation of spermatogenesis.

3. Oogenesis: Formation and maturation of ovum, previtellogenesis, vitellogenesis, formation of yolk, functions of egg and types of eggs.

Learning outcome:

From the topic's gametogenesis the gonadal action with dual origin which helps in the maternal gene product with germ cell speciation in all invertebrates and vertebrates, which they confined with cytoplasmic bridges the during the yolk formation and function.

UNIT – II:

1. Fertilization: Cell surface molecules in sperm-egg recognition in animals, mechanism of fertilization, molecular events during fertilization and post fertilization.

2. Early Development: Zygote formation, cleavage, blastulation, gastrulation and formation of germ layers in animals; Fate maps and cell lineage.

Learning outcome:

By learning the process of fertilization, the gametes play an important role in different mammals and insects with the formation (or) development during fertilization process in mammals and basic approach to life of gametes is the outcome work during fertilization process in animals.

UNIT – III:

1. Cell aggregation and differentiation; axes and pattern formation in Drosophila, amphibian and chick.

2. Differentiation of neurons, post embryonic development.

3. Larval formation, metamorphosis in insects and amphibians.

Learning outcome:

In cell aggregation and differentiation, the development of nervous system, embryos, larval development metamorphosis and the role of endocrine system play an important role regulation system in formation of Drosophila, amphibians, chick and mammals in development biology.

UNIT – IV:

1. Programmed cell death: Incidence of apoptosis, apoptosis during animal development; apoptosis during limb development.

2. Aging and senescence; Dietary restriction and anti-aging action; Age related diseases.

Learning outcome:

The detailed out come in this chapter with apoptosis in animal development and apoptosis role in development process with special reference to aging and senescence's with life expectancy disorders and to know the diseases in human related factors.

UNIT – V:

1. Potency, commitment, Specification, Induction, Competence, Determination and differentiation.

2. Hormonal regulation of Meta morphosis in insects and amphibians.

Learning outcome:

The detailed outcome in this unit with potency and specification and hormonal regulation in insects and amphibians.

REFERENCE BOOKS:

1. Austen CR and Short RV. 1980. Reproduction in Mammals. Cambridge University Press.
2. Gilbert SF. 2006. Developmental Biology, 8th Edition. Sinauer Associates Inc., Publishers, Sunderland, USA.
3. Longo FJ. 1987. Fertilization. Chapman & Hall, London.
4. Rastogi VB and Jayaraj MS. 1989. Developmental Biology. Kedar Nath Ram Nath Publishers, Meerut, Uttar Pradesh.
5. Schatten H and Schatten G. 1989. Molecular Biology of Fertilization. Academic Press, New York.
6. Sree Krishna V. 2005. Biotechnology –I, Cell Biology and Genetics. New Age International Publ. New Delhi, India.
7. Subramonian T. 2008. Molecular Developmental Biology. Narosa Publishing House.

CO-PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	2	2	1	2	1	2	2	1	2	3
CO2	2	2	2	1	1	2	2	1	3	1
CO3	2	3	2	2	3	2	3	2	2	2
CO4	1	2	2	1	2	3	2	1	2	2
CO5	2	1	2	1	2	3	2	2	2	2

M.Sc. ZOOLOGY, SEMESTER -I
MOLECULAR CELL BIOLOGY
CODE No. Z 1.4 (a) 22
(w.e.f.2022-2023 admitted batch)

Course Type: Theory

Course Category: Elective foundation

Credits:4

Course Objectives/ Course outcomes:

CO1: Understand the basic principles of molecular biology and how they apply to cellular processes.

CO2: Explain the molecular mechanisms of DNA replication, transcription, and translation.

CO3: Analyze the structure and function of proteins, enzymes, and other macromolecules involved in cell signaling, metabolism, and regulation.

CO4: Understand the principles of genetic inheritance, including gene expression and regulation, and how these processes are involved in cellular differentiation and development.

CO5: Discuss current research in molecular cell biology and the applications of this knowledge to biotechnology, medicine, and other fields.

UNIT – I

1. Composition, Structure and Functions of Carbohydrates and Proteins.
2. Composition, Structure and Functions of Lipids and Nucleic Acids.

Learning outcome:

Students are able to understand the basic principles of molecular biology and cellular processes

UNIT – II

1. Membrane Structure and Function: Phospholipid Bilayer and Membrane Proteins, Diffusion, Osmosis, Active Transport, Ion channels, Ion pumps, Electrical Properties of Membrane.
2. Bioenergetics, Glycolysis, Oxidative Phosphorylation.

Learning outcome:

Students are aware with molecular mechanisms of DNA replication, transcription, and translation.

UNIT – III

RNA Synthesis and Processing: Transcription Factors and Machinery, Formation of Initiation Complex, Transcription Activators and Repressors, RNA Polymerases, Capping, Elongation and Termination (RNA Processing, RNA Editing, Splicing and Polyadenylation), RNA transport.

Protein Synthesis and Processing: Translation, Ribosome, Formation of Initiation Complex, Initiation Factors and their Regulation, Elongation and Elongation Factors, Termination, Aminoacylation of tRNA, Aminoacyl tRNA Synthetase and Translational Proofreading, Translational Inhibitors: Antibiotics, Post-translational Modification of Proteins.

Learning outcome:

Students are able to understand the structure and function of proteins, enzymes, and other macromolecules involved in cell signaling, metabolism, and regulation.

UNIT – IV

Control of Gene Expression at Transcription and Translation Level: Prokaryotic and Eukaryotic Gene Expression.

Regulation of Expression of Viral and Phage Genes, Role of Chromatin in Gene Expression, Gene Silencing.

Learning outcome:

Students are aware with principles of genetic inheritance, including gene expression and regulation, and how these processes are involved in cellular differentiation and development.

UNIT – V

Organization of Gene and Chromosome: Structure of Gene and Chromosomes, Unique and Repetitive DNA, Heterochromatin vs. Euchromatin, Operon Concept, Interrupted Genes, Gene Families, Transposons.

Cell Cycle and Cell Division: Steps in Cell Cycle, Control of Cell Cycle, Mitosis and Meiosis.

Learning outcome:

Students are able to go for current research in molecular cell biology and the applications of this knowledge to biotechnology, medicine, and other fields.

REFERENCE BOOKS

1. Bourne GH. 1970. *Division of Labor in Cells*. Academic Press, New York.
2. De Robertis RMF and Saez RDP. 1970. *Cell Biology*. Academic Press, New York.
3. Gilman M, Witkowski JA and Watson MZJD. 1992. *Recombinant DNA*. 2nd Edition. Scientific American Books, W.H. Freeman and Company, New York.
4. Levine L. 1973. *Biology of the Gene*. 2nd Edition.
5. Pragma Khanna. 2008. *Cell and Molecular Biology*. I.K. International Publ. House Pvt. Ltd. New Delhi
6. White MJD. 1973. *Animal Cytology and Evolution*. Cambridge University Press.
7. Weaver. 1999. *Molecular Biology*. WCB McGraw Hill.

CO-PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	1	2	1	2	2	2	2	1	3	3
CO2	1	2	2	2	3	1	1	2	2	2
CO3	2	2	1	3	1	2	1	3	1	2
CO4	1	2	2	1	2	3	2	1	2	2
CO5	2	1	1	1	2	1	2	3	2	3

M.Sc. ZOOLOGY, SEMESTER -I
ENDROCRINOLOGY, CODE No. Z 1.4 (b) 22
(w.e.f.2022-2023 admitted batch)

Course Type: Theory

Course Category: Elective foundation

Credits:4

Course Objectives/ Course outcomes:

- CO1:** To introduce the basic concepts about biosynthesis of hormones and the factors influencing the secretions.
- CO2:** To understand the Hormones as messengers and the evolution of essential endocrine glands and their structure.
- CO3:** Analyzing the evolution of structural and functional organization of thyroid hormone action in different phylum.
- CO4:** To discuss about the Evolution, Synthesis and structural diversity of steroid hormones on human health.
- CO5:** To understand the growth, development and reproductive regulation of hormones.

Unit 1:

1. Classification of hormones. Brief account of structural features of endocrine glands. Hormonal effects and regulation – basic concepts and methods
2. Biosynthesis and secretion of pituitary. Factors influencing secretion.
3. Endocrine disorders - brief description

Learning Outcome: Students will get awareness about the origin of Endocrine glands, Biosynthesis and influencing factors of Pituitary.

Unit 2:

1. Biosynthesis and secretion of pancreas, adrenal hormones. Factors influencing secretion.
2. Peptide hormones, Steroid hormones. Hormones as messengers. Cell surface receptors. Cascade of reaction linked to signal transduction.
3. Evolution of pituitary gland; Physiological actions of pituitary hormones. Urophysis and action of its hormone(s). Pancreatic hormones and glucose homeostasis.

Learning Outcome: Upon completion of the above unit, they are able to understand the role of hormones in human physiology.

Unit 3:

1. Evolution, Biosynthesis and Secretion of thyroid gland.
2. Thyroid hormone synthesis and its regulation, paradigms of thyroid hormone action in poikilotherms and homeotherms.
3. A comparative account of parathyroid gland and ultimobranchial body/C cells, synthesis of parathyroid hormone, calcitonin and of vitamin D3.

Learning Outcome: On completion of this unit students are able to differentiate the hormonal synthesis and their functions.

Unit 4:

1. Evolution of discrete adrenal gland; Synthesis of corticosteroid
2. Structural diversity of glucocorticoids among vertebrates.
3. Hormones and human health

Learning Outcome: Students acquire knowledge about the evolution of adrenal gland, synthesis of different steroids and their regulation on human health.

Unit 5

- 5.1 Hormones growth and development.
- 5.2 Hormone's role in Reproduction.
- 5.3 Hormones regulating reproduction.

Learning Outcome: Significant role of hormones on growth, development and reproduction.

SUGGESTED READING MATERIAL:

1. Barrington. E.J.W. General and comparative Endocrinology Cambridge Press, Oxford.
2. Bentley, P.J. Comparative Vertebrate Endocrinology, Cambridge Press, Oxford.
3. Martin, C.R. Endocrine Physiology. Oxford Univ. Press, Oxford.
4. Prakash S. Lohar. Endocrinology-Hormones and human health-2005. MJP Publishers-Chennai.
5. Williams, R.H. Text Book of Endocrinology, W.B. Saunders Co., Philadelphia.

CO-PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	2	2	3	3	1	2	3	2	2	1
CO2	2	1	2	2	3	2	2	2	2	1
CO3	3	2	1	1	1	1	2	2	1	2
CO4	2	1	3	2	2	2	2	2	2	2
CO5	2	1	2	1	1	2	2	2	1	1

M.Sc. ZOOLOGY, SEMESTER -I
MARINRE AND BRACKISH WATER ECOLOGY
CODE No. Z 1.4 (c) 22
(w.e.f.2022-2023 admitted batch)

Course Type: Theory

Course Category: Elective foundation

Credits:4

Course Objectives/ Course outcomes :

CO1: To study the classification and distribution of life and their adaptations in marine environment.

CO2: To know about the organic production and Human impact in coastal ecosystem.

CO3: To discuss about the classification and Ecology of some typical brackish water habitats of India.

CO4: To create awareness about structure, functions and adaptations of fauna in estuarine ecosystem.

CO5: To know about the Human impact on coastal and estuarine management in the 21st century.

UNIT – I: Marine Ecology

1. Classification of the marine environment and salient features of different zones.
2. Classification of marine organisms and their characteristic features.
3. Shore environment: Physio-chemical and biological factors of intertidal zone; distribution of life on rocky, sandy, mud shores and their characteristic features; fauna and their adaptations.

Learning Outcome: Students are able to learn about the classification of marine environment and characteristic features of shore environment.

UNIT – II

1. Organic production of the sea: Primary, secondary and tertiary production; factors affecting primary production; measurement of organic production.
2. Marine food chains and food webs.
3. Human impact and management of coastal ecosystems.

Learning Outcome: Upon completion of the above unit they are able to understand the organic production and Human impact and management of coastal ecosystem.

UNIT – III: Brackish water Ecology

1. Classification of brackish water habitats and salient features of different zones: Estuaries, mangroves, lakes, lagoons and marshes/ wetlands.
2. Ecology of some typical brackish water habitats of India: Estuaries – Hooghly-Matla, Mahanadi, Godavari, Krishna, Cauvery and west coast estuaries; lakes- Chilka, Pulicat.

Learning Outcome: Students are able to know about the classification and ecology of some typical brackish water habitats of India.

UNIT – IV

1. Structure and function of estuarine ecosystems: Physico-chemical features, mineral cycling (CNP), biotic communities, estuarine food webs and energy flow.
2. Estuarine fauna and their adaptations.

Learning Outcome: Students are able to understand the structure and function and faunal adaptations in estuarine ecosystem.

UNIT – V

1. Human impact and management of estuarine ecosystems.
2. Changes in Biotic structure due to harvest and introduction of new species.
3. Coastal and estuarine management in the 21st century.

Learning Outcome: Students are able to identify the human impact and significance of coastal and estuarine management in the 21st century.

REFERENCE BOOKS

1. Balakrishnan Nair N and Thampi DM. 1980. *A Text Book of Marine Ecology*. Macmillan Company of India Ltd. Delhi.
2. Clark JR. 1992. *Integrated Management of Coastal Zones*. FAO Fisheries Tech. No. 327, Rome.
3. Goudie A. 1993. *The Human Impact on the Natural Environment*. MIT Press.
4. Lewis JR. 1964. *The Ecology of Rocky Shores*. The English Universities Press Ltd. London.
5. Reid GK and Wood RD. 1976. *Ecology of Inland waters and Estuaries*. Van Nostrand Company.
6. Sverdrup HV, Johnson MW and Fleming RH. 1942. *The Oceans: their physics, chemistry and general biology*. Prentice Hall, Inc. New York.
7. Santhanam R and Srinivasan A. 1994. *A Manual of Marine Zooplankton*. Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi

CO-PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	2	1	3	2	2	1	1	2	2	1
CO2	1	2	1	2	1	2	3	1	2	1
CO3	1	2	1	2	1	1	2	2	3	2
CO4	2	1	2	3	3	2	1	2	1	1
CO5	1	2	1	2	3	2	1	1	2	1

M.Sc. ZOOLOGY, SEMESTER -II
GENETICS AND EVOLUTION
(CODE No. Z 2.1) 22
(w.e.f.2022-2023 admitted batch)

Course Type: Theory

Course Category: Mandatory core

Credits:4

Course Objectives/ Course outcomes:

CO :1. To provide fundamental knowledge in Mendelian principles.

CO :2 To evaluate human genome project quantitative and qualitative traits of human beings.

CO :3 Remembering the concepts of evolution, and Hardy-Weinberg law of equilibrium.

CO :4 Elucidate the mega evolution and models of speciation.

CO :5 Analyze the convergent and divergent evolution and adaptive radiation in vertebrates.

UNIT – I

1. **Genetic Principles:** Mendelian principles; interaction of genes, linkage and crossing over, sex linkage and sex determination; Extra chromosomal inheritance.
2. Behavioral genetics in *Drosophila* and bees.

Learning Outcome: Students will be familiar with the Mendelian laws, other genetical processes common in animals and Behavioral genetics in insects.

UNIT – II

1. **Human Genetics:** Human Genome Project, Pedigree analysis, Quantitative and qualitative traits of human beings, blood group inheritance, concepts of eugenics.
2. Inborn errors of metabolism; Chromosomal abnormalities.

Learning Outcome: Students should be able to know the Human genetics including Human genome project and genetic disorders.

UNIT – III

1. **Concepts of Evolution:** Theories of organic evolution – Lamarckism, Darwinism, Modern synthetic theory, Mutations.
2. Hardy-Weinberg law of equilibrium; genetic drift – random genetic drift.

Learning Outcome: Students will understand the Theories of organic evolution, modern synthetic theory, mutations, Hardy-Weinberg law of equilibrium and genetic drift.

UNIT – IV

1. **Mega Evolution:** Isolation, pattern and mechanisms of reproductive isolation;
2. Mechanism of speciation, phylogenetic and biological concepts of species; models of speciation – allopatric, parapatric and sympatric.

Learning Outcome: Students will learn the Isolation, pattern, mechanisms and models of speciation

UNIT – V

1. Convergent and divergent evolution;
2. Adaptive radiation in amphibians, reptiles and mammals.

Learning Outcome: Students will learn the Convergent & divergent evolution and adaptive radiation in animals.

REFERENCE BOOKS

1. Burns GW. 1972. *The Science of Genetics. An Introduction to Heredity*. Mac Millan Publ.Co.Inc.
2. Gardner EF. 1975. *Principles of Genetics*. John Wiley & Sons, Inc. NewYork.
3. Harth and Jones EW. 1998. *Genetics – Principles and Analysis*. Jones and BarHett Publ.Boston.
4. Levine L. 1969. *Biology of the Gene*.Toppan.
5. Pedder IJ. 1972. *Genetics as a Basic Guide*. W. Norton & Company,Inc.
6. Rastogi VB. 1991. *A Text Book of Genetics*. Kedar Nath Ram Nath Publications, Meerut, Uttar Pradesh, India.
7. Rastogi VB. 1991. *Organic Evolution*. Kedar Nath Ram Nath Publications, Meerut,Uttar Pradesh,India.
8. Stahl FW. 1965. *Mechanics of Inheritance*.Prentice-Hall.
9. White MJD. 1973. *Animal Cytology and Evolution*. CambridgeUniv.Press.

CO-PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	2	1	2	1	2	2	1	2	1	1
CO2	1	2	1	1	2	1	3	1	2	1
CO3	2	1	2	1	2	2	3	1	2	2
CO4	2	1	1	2	1	1	2	3	2	1
CO5	1	2	2	3	2	1	2	1	1	2

M.Sc. ZOOLOGY, SEMESTER -II
COMPARATIVE ANIMAL PHYSIOLOGY
(CODE No. Z 2.2) 22
(w.e.f.2022-2023 admitted batch)

Course Type: Theory

Course Category: Mandatory core

Credits:4

Course Objectives/ Course outcomes:

CO1: Ability to compare and contrast the physiological adaptations of different animals in different environments

CO2: Understanding the challenges in animals face in maintaining homeo- stasis such as thermo regulatory and various physiological such as metabolism, respiration, circulation, Osmoregulation and excretory system

CO 3: To recognize and analyze the mechanisms in animals to regulate their internal; environment in response to external stimuli.

CO 4: To integrate knowledge of molecular, cellular and organosomal physiology to understand the animal function.

CO 5: Appreciation of diversity of life and the remarkable adaptations that allow animals to survive and thrive in different environments.

UNIT – I

Transformation of energy in animals: Bio-energetics; diversity in operations, Factors regulating enzyme activity, energy producing reactions, proteolytic enzymes, pathways of cellular metabolism. Nutrition impairment and stress.

Learning outcome

In the topic of transformation of energy in the environment and diversity in operations can be regulation and the energy reactions with the enzymes in the cellular metabolic can be estimated in their unit.

UNIT – II

1. Digestion: Process of digestion and absorption; energy balance; Basal Metabolic Rate.
2. Respiration: Mechanism of gaseous exchange in animals; neural and chemical regulation.
3. Blood: Composition and function of blood; respiratory pigments and their functions.
4. Circulation: Comparative account of circulatory system in animals.

Learning outcome

In the process of digestion, we can learn regarding the food digested in body, respiration through different necessary organs the way of circulation in different living organisms can be identified.

UNIT – III

1. Thermoregulation in poikilotherms and homeotherms.
2. Muscles: Structure and function of muscles; Theories of muscle contraction.
3. Nervous system: Neurons, action potential, neural control of muscle tone and posture; propagation of nerve impulse and synaptic transmission in animals.

Learning outcome

Thermoregulation is the process to different temperature adaptations in the environment that how living organisms can live in different environment conditions through movement and nervous system and propagation in different animals by the students can learn regarding the above said themes.

UNIT – IV

1. Excretion and Osmoregulation: Comparative account of structure and function of kidneys in animals; regulation of water and electrolyte balance.
2. Endocrinology and reproduction: Endocrine glands in animals, mechanism of hormonal action; Hormonal regulation in reproduction; growth and development – Regeneration, molting and metamorphosis.

Learning outcome

The detailed out comes from this chapters in regarding sensory organs, excretory and osmoregulation and endocrinology and reproductive process in different living organisms which are confined to aquatic and terrestrial organisms

UNIT – V

Chromatophores and Significance of chromatophores and color change in animals--Photo-receptors, Phono- receptors, Tango receptors, and Chemoreceptor's occurrence and Functional significance of Bioluminescence.

Learning outcome

The detailed out comes from this chapters in regarding sensory organs, excretory and osmoregulation and endocrinology and reproductive process in different living organisms which are confined to aquatic and terrestrial organisms

REFERENCE BOOKS

1. Eckert H. Animal Physiology: Mechanisms and Adaptation. W.H. Freeman & Company.
2. Floray E. An Introduction to General and Comparative Animal Physiology. W.B. Saunders Co., Philadelphia.
3. Goel KA and Satish KV. 1989. A Text Book of Animal Physiology, Rastogi Publications, Meerut, U.P.
4. Hoar WS. General and Comparative Physiology. Prentice Hall of India, New Delhi.
5. Leininger AL. Nelson and Cox. Principles of Biochemistry. Lange Medical Publications, New Delhi.
6. Prosser CL and Brown FA. Comparative Animal Physiology. W.B. Saunders Company, Philadelphia.
7. Schmidt-Nielson K. Animal Physiology. Cambridge University Press, Cambridge.

CO-PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	2	2	1	2	1	2	1	3	2	1
CO2	1	2	2	1	2	2	3	2	1	2
CO3	1	2	2	1	2	1	2	3	2	1
CO4	1	2	3	1	2	1	2	1	2	2
CO5	2	2	1	2	1	1	2	1	2	3

M.Sc. ZOOLOGY, SEMESTER -II
PRINCIPLES OF ECOLOGY
CODE No. Z 2.3 (a) 22
(w.e.f.2022-2023 admitted batch)

Course Type: Theory

Course Category: Compulsory foundation

Credits:4

Course Objectives/ Course outcomes:

CO-1: To introduce the scope, structure, function of composition of ecosystems.

CO-2: To understand the trophic dynamics of ecosystem, limiting factors and concept of habitat and niche.

CO-3: Understanding population ecology through applying mathematical methods.

CO-4: The course is also aimed to evaluate about the community ecology, population regulation, for sustainable development of ecosystems.

CO-5: To understand the concept of productivity, biomagnification, biomonitoring and conservation of ecosystems.

UNIT – I

1. **Ecology:** Nature and scope of ecology; ecosystem structure and function.

2. **Composition:** Abiotic and biotic components; classification of ecosystem with examples; feedback loop.

3. Major terrestrial biomes; ecotone, edge effect and advantages and disadvantages.

Learning outcome:

Acquire fundamental knowledge and understanding the important ecological components and their function. recognize terrestrial biomes.

UNIT – II

1. **Trophic dynamics of ecosystem:** Energy flow; food chain; food web; trophic levels; ecological pyramids

2. **Limiting factors:** Liebig's law of the minimum and Shelford's law of tolerance.

3. **Habitat and niche:** Concept of habitat and niche, niche width and overlap, fundamental and realized niche, resource partitioning and character displacement.

Learning outcome:

Acquire knowledge about the habitat and niche of organisms under different trophic levels of ecosystem the energy flow. Applying concept of limiting factors in ecosystem.

UNIT – III

1. **Population ecology:** Population characteristics – density, natality, mortality, immigration and emigration; life tables generation

2. **Population growth:** Population growth of organisms with non-overlapping generations; Verhulst-Pearl logistic growth models; stochastic and time log models of population growth; net reproductive rate and reproductive value.

3. Stable distribution; population growth projection using Leslie Matrix method.

4. Life history strategies: *r-k* selection; survivorship curves.

Learning outcome:

Students shall acquire knowledge about population dynamics through mathematical, statistical analysis and understanding the critical stages of organisms in population growth.

UNIT – IV

1. **Community ecology:** Nature of communities; community structure and attributes; levels of species diversity and its measurement

2. **Population regulation:** Inter specific relationships and intra specific relationships (extrinsic and intrinsic mechanism of population regulation).

3. An overview on **sustainable development** of ecosystems.

Learning outcome:

Students have a good Understanding the concept of community ecology, population regulation and acquire knowledge in sustainable development.

UNIT-V**1.Biological magnification.**

2.**Productivity:** Concept of productivity – primary, secondary, tertiary; Recycling of materials.

3.**Biomonitoring:** Biological monitoring programme; principles of conservation and conservation of ecosystems.

Learning outcome:

Student have Learning the concepts of productivity, materials recirculation and ecosystem conservation. Create awareness about bio magnification and bio monitoring

REFERENCE BOOKS

1. Chapman JL and Reiss MJ. 1995. *Ecology Principles and Application*. Cambridge Univ. Press.
2. Kormondy EJ. *Concepts of Ecology*. Eastern Economy Edition.
3. Krebs CJ. *Ecology*. Harper and row, New York.
4. Krebs CJ. *Ecological Methodology*. Harper and Row, New York.
5. Odum EP. 1983. *Basic Ecology*. Saunders Publishing.
6. Sharma PD. 1991. *Ecology and Environment*.
7. TrivedyRK, Goel and Trisa. 1997. *Practical methods in Ecology & Environmental Science*.

CO-PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	1	2	2	1	2	2	1	2	1	2
CO2	2	1	2	2	1	2	1	3	1	1
CO3	1	2	3	1	2	1	2	3	2	1
CO4	1	1	2	3	2	1	2	1	1	2
CO5	2	1	2	1	1	1	2	3	2	1

M.Sc. ZOOLOGY, SEMESTER -II
TOOLS AND TECHNIQUES IN BIOLOGY
CODE No. Z 2.4 (a) 22
(w.e.f.2022-2023 admitted batch)

Course Type: Theory

Course Category: Elective foundation

Credits:4

Course Objectives/ Course outcomes :

CO:1 To provide information regarding different types of Microscopies, principles involved and working conditions of Microscopes up to SEM TEM and STEM.

CO:2 To make understand about different types of spectroscopies, and the related principles involved and working conditions and applications of these spectroscopies and the advantages in

scientific investigations.

CO:3 To learn about the importance of different types of chromatographic techniques and electrophoretic techniques the principle involved, applications as analytical tools and their uses in the biological sample analysis.

CO:4 To impart knowledge on the nucleic acid blotting techniques, Sequences and nomenclature data information sources like NCBI, GDB, MGB, data retrieval tools in analyzing the biomolecules.

CO:5 To provide about the statistical analysis processes involved in the data collection, Sampling distribution, measures of central tendencies and probability distributions Standard deviation, standard error and confidence interval; Regression and Correlation. Different tests of significance and Usage of Statistical Package for Social Sciences (SPSS).

UNIT – I

Microscopies: Working principle and types of Optical Microscopy – dark-field, phase-contrast, interference, polarization and fluorescence microscopy; Working principle and types of Electron Microscopy – Transmission electron microscopy (TEM), Scanning electron microscopy (SEM) and Scanning-Transmission electron microscopy (STEM); Different fixation and staining techniques for electron microscopy.

Learning outcome:

Students will be familiar with

- ☐ Different types of Microscopies, their working principles and uses

UNIT-II

Spectroscopies: Working principle of UV-Visible spectrophotometry, IR spectroscopy, Atomic Absorption Spectroscopy (AAS), Fluorescence and Phosphorescence spectroscopy, Electron Spin

Resonance (ESR) spectroscopy, mass spectrometry, X-ray crystallography and Nuclear Magnetic Resonance (NMR) spectroscopy.

Learning outcome:

Students will be familiar with

Different spectroscopic methods, working principles and applications
Recent advances in the existing instrumentation and their evolution

UNIT – III

1. Chromatography: Principles and applications of Gel filtration, Paper, Column, Ion-exchange, Affinity, Thin layer (TLC), Gas liquid (GLC) and High-Performance Liquid Chromatography (HPLC)

2. Electrophoresis: Agarose gel electrophoresis, Pulsed Field Gel Electrophoresis (PFGE), Polyacrylamide Gel Electrophoresis (PAGE), Sodium Dodecyl Sulphate Polyacrylamide Gel Electrophoresis (SDS-PAGE), Two-dimensional electrophoresis - Iso-electric focusing (IEF).

Learning outcome:

Students will be familiar with

1. Chromatographic techniques, their working principles, applications and uses
2. Different electrophoretic methods, working principles and applications
3. Recent advances in the existing instrumentation and their evolution

UNIT – IV

1. Nucleic acid blotting techniques: Southern blotting, Northern blotting and Western blotting; Polymerase Chain Reaction (PCR); DNA fingerprinting; Genomics and Proteomics.
2. Sequences and nomenclature: IUPAC symbols, nomenclature of DNA sequences, nomenclature of protein sequences, directionality of sequences, types of sequences used in bioinformatics.
3. Information sources: NCBI, GDB, MGB, data retrieval tools, database similarity searching, resources for gene level sequences, use of bioinformatics tools in analysis.

Learning outcome:

Students will be familiar with

1. Blotting techniques, their working principles, applications and uses in analysis of Nucleic acids
2. Nomenclature of DNA sequences, nomenclature of protein sequences types of sequences used in bioinformatics.
3. Data retrieval tools, database similarity searching, resources for gene level sequences, use of bioinformatics tools in analysis.

UNIT – V

1. Bio-statistics: Measures of central tendency and dispersal – mean, median and mode; Probability distributions - binomial, Poisson and normal; Sampling distribution.
2. Standard deviation, standard error and confidence interval; Regression and Correlation.
3. Tests of significance: Levels of significance, X² test, t-test and Analysis of Variance (ANOVA).
Usage of Statistical Package for Social Sciences (SPSS).

Learning outcome:

Students will be familiar with

1. Sampling distribution, measures of central tendencies and probability distributions
2. Standard deviation, standard error and confidence interval; Regression and Correlation.
3. Different tests of significance and Usage of Statistical Package for Social Sciences (SPSS).

REFERENCES BOOKS

1. Brewer JM, Pesce AJ & Ashworth RB. 1974. Experimental Techniques in Biochemistry. Prentice-Hall.
2. Diamond PS & Denman RF. 1966. Laboratory Techniques in Chemistry and Biochemistry. Butterworths
3. Dubey, R.C., 2006. A Text Book of Biotechnology. S. Chand & Company Ltd., New Delhi.
4. Eaton AD, Clesceri LS, Rice EW & Greenberg AE. 2005. Standard Methods for the Examination of Water and Wastewater. APHA/AWWA-WEF, Washington DC.
5. Fishbein L. 1973. Chromatography of Environmental Hazards: Metals, Gaseous and Industrial

Pollutants. Elsevier.

- 6 Jeffery GH, Basset J, Mendham J & Denney RC.(Eds.).1989. Vogel's Textbook of Quantitative Chemical Analysis. Longman.
7. Nelson DL and Cox MM. 2005. Lehninger Principles of Biochemistry. WH Freeman.
8. Murray RK, Granner DK, Mayes PA & Rodwell VW. 2000. Harper's Biochemistry. Appleton & Lange.
9. Narayanan, P. 2005. Essentials of Biophysics, New Age International (P) Ltd., New Delhi, India.
10. Satyanarayana, U. 2005. Biotechnology. Books and Allied (P) Ltd., Kolkata, India.
11. Sparks DL, Page AL, Helmke PA, Loeppert RH, Soltanpour PN, Tabatabai MA, Johnston CT & Sumner ME.(Eds.). 1996. Methods of Soil Analysis: Part 3. Chemical Methods. SSSA-ASA, Madison.
12. Welch PS. 2003. Limnological Methods. Narendra Publ. House.
13. Wilson K & Walker J. 2002. Practical Biochemistry: Principles and Techniques. Cambridge University Press, Oxford.
14. Anderson TW.1984. An Introduction to Multivariate Statistical Analysis. Wiley Series in Probability and Statistics, Singapore
15. Biradar RS. 2002. Course Manual on Fisheries Statistics. 2nd Ed. CIFE, Mumbai.
16. Ghosh S. 1999. Multivariate Analysis, Design of Experiments and Survey Sampling. Marcel Dekker.
17. Keller G. 2001. Applied Statistics with Microsoft Excel. Duxbury.
18. William RD & Matthew G. 1984. Multivariate Analysis, Methods and Applications. John Wiley & Sons.

CO-PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	2	1	3	1	2	1	2	1	1	2
CO2	1	2	1	2	1	2	1	3	2	1
CO3	2	1	2	1	1	2	1	1	3	2
CO4	1	2	2	3	2	1	2	2	1	1
CO5	1	2	1	3	2	1	1	2	1	3

M.Sc. ZOOLOGY, SEMESTER -II
FISH PHYSIOLOGY
CODE No. Z 2.4 (b) 22
(w.e.f.2022-2023 admitted batch)

Course Type: Theory

Course Category: Elective foundation

Credits:4

Course Objectives/ Course outcomes:

- CO1:** To introduce the basic concepts about Digestion, role of hormones in regulation of digestion and metabolism.
- CO2:** To study about the concepts of Respiration, Mechanism of gaseous exchange and Circulation.

CO3: To discuss about Sensory organs and Osmoregulation

CO4: To study the concepts of Excretion, Reproduction and Development in Fishes.

CO5: To study about the Endocrine Organs in fishes and Neuro-Endocrine system in Crustaceans.

UNIT – I

1. Digestion: Digestion of carbohydrates, lipids and proteins; Digestive enzymes and regulation of their secretions; Absorption and assimilation of nutrients; Role of hormones in the regulation of digestion; Factors affecting digestion and transport of nutrients.
2. Metabolism: Pathways of cellular metabolism.

Learning Outcome: Students are able to learn about the concepts of Digestion and Pathways of cellular metabolism

UNIT – II

1. Respiration: Definition of respiration; external respiration and internal respiration.
2. Mechanism of gaseous exchange, CO₂ transport, countercurrent principle, water flow across the gills, respiratory pumps.
3. Circulation: Role of blood in transport of gases; composition and function of blood.

Learning Outcome: Upon completion of the above unit students get awareness about Respiration, Mechanism of Gaseous Exchange and Circulation.

UNIT – III

1. Sensory organs: Structure and function of chemo-photo- and photoreceptor, lateral line sense organs.
2. Action potential, synapse, neurotransmitters, impulse transmission.
3. Osmoregulation: Mechanism of osmotic and ionic regulation; endocrine control of Osmoregulation

Learning Outcome: On completion of the unit students are able to identify the structure and function of Sensory Organs and the significance of Action potential and Osmoregulation.

UNIT – IV

1. Excretion: Mechanism of excretion of nitrogenous waste, water and ionic balance.
2. Reproduction and Development: Reproductive structure in fishes, Development of gonad: oogenesis, spermatogenesis, metabolic changes during oogenesis and spermatogenesis

Learning Outcome: Upon completion of the above unit students are able to understand the concepts of Excretion, Reproduction and Development.

UNIT –V

1. Endocrine system in fishes: Endocrine organs in fishes; Regulation of hormonal control on Reproduction in fishes.
2. Neuro-endocrine system in crustacean and its role in the regulation of reproduction.

Learning Outcome: To understand the Endocrine system in fishes and Neuro-endocrine system in crustaceans.

REFERENCE BOOKS:

1. Adiyodi KG & Adiyodi RG. 1971. Endocrine Control of Reproduction in Decapod Crustacea. Biology Reviews.

2. Agarwal NK. 2008. Fish Reproduction. APH Publ.
3. Brown ME. 1966. Physiology of fishes. Vol. I and II Academic Press. New York.
4. Halver JE. 1972. Fish nutrition. Academic Press, New York.
5. Hoar WS. 1984. General and Comparative physiology. Printice-Hall of India Pvt.Ltd. New Delhi.
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7. Lagler KF, Bardach, JE, Miller, RR, Passino DRM. 1977. Ichthyology, 2nd Ed. John Wiley & Sons, New York.
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CO-PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	2	1	3	1	1	2	2	1	2	2
CO2	2	2	1	1	2	2	1	3	1	2
CO3	1	2	1	2	1	2	1	2	3	1
CO4	3	2	1	2	2	1	2	1	2	1
CO5	3	1	2	1	2	1	2	2	1	2

M.Sc. ZOOLOGY, SEMESTER -II
AQUATIC MICROBIOLOGY
CODE No. Z 2.4 (c) 22
(w.e.f.2022-2023 admitted batch)

Course Type: Theory

Course Category: Elective foundation

Credits:4

Course Objectives/ Course outcomes:

Course Objectives:

CO1: To introduce the concept of cell structure.

CO2: To understand the concept of Microbial growth and Microbial Interaction in various Biogeochemical cycles.

CO3: To discuss about the Bioprocesses and Microbial Biomass Production.

CO4: To study the concepts of Nutritional requirements of Microorganisms and maintenance of cultures and population estimation techniques.

CO5: To study about the tests for identification of Bacteria and Basics of Mycological and Virological techniques.

UNIT – I

1. **Cell Structure:** Prokaryotic and eukaryotic cell structure; Cell membrane, cell wall, proteins, nucleic acids – structure, properties and interactions.

2. **Distribution and classification:** Microbial community in freshwater, estuary and marine environment - types and abundance.

Learning Outcome: Students are able to distinguish the cell structure, Microbial community in fresh water, estuary and marine environment.

UNIT – II

1. **Microbial Growth:** Factors influencing microbial growth - Physical, chemical and biological conditions of the environment.
2. **Microbial interaction:** Role of microbial population in biogeochemical cycles (C, N, P, S, Si and Fe), xenobiotic and inorganic pollutants.

Learning Outcome: Upon completion of the above unit they are able to understand the concepts of Microbial growth and Role of microbial population in Biogeochemical cycles.

UNIT – III

1. **Bioprocesses:** Principles and applications of bioprocesses - Bioremediation, biofertilization, biofilms, bio-leaching, bio-corrosion, bio-fouling.
2. Microbial biomass production – single cell protein; Bioprospecting.

Learning Outcome: On completion of the unit, they are able to differentiate Bioprocesses and Microbial Biomass Production.

UNIT – IV

1. Nutritional requirements of microorganisms – constituents of growth media. Sterilization and media preparation; Isolation, enumeration, preservation;
2. Maintenance of cultures – growth curve, different types of cultures, population estimation techniques.

Learning Outcome: To understand the Nutritional requirements of microorganisms and Maintenance of cultures.

UNIT – V

1. Routine tests for identification of bacteria – morphological, cultural, biochemical and serological.
2. Basics of mycological and virological techniques. Introduction to molecular techniques in microbiology.

Learning Outcome: They are able to apply routine tests for identification of bacteria and basics of mycological and virological techniques.

REFERENCE BOOKS

Dhevendaran K. 2008. *Aquatic Microbiology*, Daya Publ. House.

1. Frobisher M, Hinsdill RD, Crabtree KT & Goodheart CR. 1974. *Fundamentals of Microbiology*. WB Saunders.
2. Geesey G, Lewandowski Z & Flemming HC. (Eds.). 1994. *Biofouling and Biocorrosion in Industrial Water Systems*. CRC Press.
3. Prasad AB & Vaishampayan A. 1994. *Nitrogen Fixing Organisms – Problems and Prospects*. Scientific Publ.
4. Rao AS. 1997. *Introduction to Microbiology*. Printice-Hall, New Delhi.

CO-PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	1	2	1	2	1	2	2	1	2
CO2	2	2	1	2	1	1	2	1	3	1
CO3	1	3	2	1	2	1	2	1	1	2
CO4	1	2	1	3	2	1	1	2	1	1
CO5	2	1	2	3	1	2	1	2	1	2

M.Sc. ZOOLOGY, SEMESTER -III
ANIMAL BIOTECHNOLOGY AND MICROBIOLOGY
(CODE No. Z 3.1) 22
(w.e.f.2022-2023 admitted batch)

Course Type: Theory

Course Category: Mandatory core

Credits:4

Course Objectives/ Course outcomes :

CO1: To introduce the basic concepts about genetic engineering and cloning vectors.

CO2: To study about applications of biotechnology in veterinary science and medicine and gene therapy.

CO3: To discuss about the concept of microbiology, microbial, viral diseases and their control measures.

CO4: To understand microbiology of fermented food and industrial microbiology.

CO5: To analyze the recombinants-colony hybridization techniques, immunological tests in-situ hybridization and protozoan diseases.

UNIT-I:

1. Biotechnology 1. Genetic Engineering: Recombinant DNA technology, tools of genetic engineering – Restriction endonucleases, DNA ligases, topoisomerases, methylases, nucleases, polymerases, reverse transcriptase and their properties and functions.

2. Cloning vectors: Bacterial plasmid vector – pBR322 and its derivatives; bacteriophage

vectors – SV40, phage λ , phage M13; Cosmides; viral vectors; shuttle vectors.

Learning Outcomes: Upon completion of the above unit, they are able to understand the concept of recombinant DNA technology and cloning vectors.

UNIT - II

1.Applications of biotechnology in veterinary science: Artificial insemination, multiple ovulations, embryo transfer, in-vitro fertilization (IVF), embryo cloning; transgenic animals. 2.Applications of biotechnology in medicine: Production of monoclonal antibodies (Hybridoma technology), production of vaccines and production of growth hormone.
3. Gene therapy: Adenosine Deaminase (ADA) deficiency, Duchenne Muscular Dystrophy (DMD), hemophilia, phenylketonuria and thalassemia.

Learning Outcomes: Students are able to apply the concepts of biotechnology in veterinary science, medicine and in gene therapy.

UNIT – III:

1.Microbiology 1. History and scope of microbiology: Microbial nutrition; growth and their control; normal microbial flora of human body - skin, nose, oral cavity, pharynx, respiratory tract, eye, ear, stomach, intestine and genitourinary tract.
2. Microbial diseases and their control: Bacterial diseases- tuberculosis, plague, anthrax, tetanus, cholera; Viral diseases- influenza, AIDS, rabies, hepatitis, poliomyelitis, Ebola; Fungal diseases- superficial mycosis, cutaneous mycosis, subcutaneous mycosis, systemic mycosis;

Learning Outcomes: Students are able to understand the history, scope and significance of microbiology in controlling various microbial, bacterial and viral diseases.

UNIT – IV:

1. Microbiology of fermented food: Dairy products, meat and fish.
2. Industrial microbiology: Types of fermentation process; alcoholic beverages.

Learning Outcomes: On completion of the above unit students will get awareness about microbiology of fermented food and industrial microbiology.

UNIT – V:

- 1.Cloning and selection and screening analysis of recombinants-colony hybridization techniques, immunological tests in-situ hybridization.
2. **Protozoan diseases-** Amoebiasis, Malaria, Typhoid.

Learning Outcomes: Upon completion of the above unit, they are able to understand the

techniques of Cloning, selection and screening analysis of colony hybridization techniques, immunological tests in in-situ hybridization and protozoan diseases.

REFERENCE BOOKS

1. Anath Narayan R and Jayaram Panikkar CK. 1990. Text Book of Microbiology. 4 th Ed. Orient Longmen, Hyderabad, India.
2. Balasubramanian D et al. 2005. Concepts in Biotechnology. Universities Press (India) Pvt. Ltd., Hyderabad.
3. Dubey RC. 2006. A Text Book of Biotechnology. S. Chand & Company Ltd. New Delhi.
4. Pelzer MJ Jr and Chan ECS. 1981. General Microbiology. International Students Edition, McGraw Hill International Book Co., New Delhi.
5. Range MM. 2000. Animal Biotechnology. Aerobioses, India.
6. Satyanarayana U. 2005. Biotechnology. Books and Allied (P) Ltd. Kolkata, India

CO-PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	1	2	1	2	1	2	1	2	1
CO2	2	1	2	1	2	2	1	2	1	2
CO3	2	2	1	2	1	2	1	2	3	1
CO4	2	1	2	1	2	1	2	3	1	2
CO5	1	2	1	3	1	2	1	2	2	1

M.Sc. ZOOLOGY, SEMESTER -III
ICHTHYOLOGY
(CODE No. Z 3.2) 22
(w.e.f.2022-2023 admitted batch)

Course Type: Theory

Course Category: Mandatory core

Credits:4

Course Objectives/ Course outcomes :

CO1: To demonstrate the basic knowledge on the classification of major groups of fishes and the structure and function of skin and scales having taxonomic importance in classifying the fishes.

CO2: To understand the natural food of different groups of fishes, their feeding habits and adaptations with application of this knowledge to aquaculture

CO3: To explain the major groups of fishes and their geographical distribution, the methods of studying age and growth in fishes with their importance in fisheries and aquaculture.

CO4: To provide knowledge on the structure and function of respiratory, circulatory, osmoregulatory and excretory systems in various groups of fishes.

CO5: To describe the structure and function of brain, endocrine glands, and several aspects of reproductive biology to be useful and applicable for fisheries and aquaculture.

UNIT – I

1. **Classification of fishes:** Major groups up to subclass and their important characters.
2. **Skin:** Structure and function of skin in fishes.
3. **Scales:** Structure of placoid, cycloid, ctenoid, cosmoid and ganoid scales.

Learning outcomes: Students will be familiar with the major groups of fishes and their characters, and the structure and function of skin and scales of fishes.

UNIT – II

1. **Feeding in fishes:** Natural food of fishes.
2. **Feeding habits:** Predators, grazers, strainers, suckers and parasites.
3. **Feeding adaptations** and stimuli for feeding in fishes.

Learning outcomes: Students have a good understanding on the natural food of various kinds of fishes, and feeding habits and concurrent feeding adaptations in different groups of fishes.

UNIT – III

1. **Zoogeography:** Major groups of freshwater fish and their distribution.
2. **Age:** Methods of determination of age.
3. **Growth:** Methods for studying growth. Length-Weight relationship and Condition factor

Learning outcomes: Students will understand the zoogeographical realms and the distribution of fish fauna, and various methods of determination of age and growth in fishes.

UNIT – IV

1. **Respiratory system:** Structure and functioning of gills and accessory respiratory organs.
2. **Circulatory system:** Structure and functioning of cardiovascular system.
3. **Osmoregulation:** Ionic regulation in freshwater, marine and diadromous fishes.
4. **Excretory system:** Structure and function of kidneys in fishes.

Learning outcomes: Students will have a knowledge on the structure and function of respiratory organs such as gills and accessory respiratory organs in various groups of fishes; structure of heart and vascular systems in fishes; mechanism of osmoregulation in fishes of different aquatic habitats, and structure and function of kidneys in fishes.

UNIT – V

1. **Nervous system:** Structure and function of brain in elasmobranchs and teleosts.
2. **Endocrine glands:** Structure and function of pituitary gland, thyroid gland, ultimobranchial glands, chromaffin tissue, adrenocortical tissue and corpuscles of stannius.
3. **Reproduction:** Reproductive structures in elasmobranchs and teleosts; maturity stages of gonads.
4. Oviparity, ovoviviparity and viviparity; parental care in fishes; fecundity; gonadosomatic index.

Learning outcomes: Students will understand the structure and function of brain in fishes; structure and function of endocrine glands and especially their significance in reproduction and growth of fishes, and various aspects of reproductive biology in fishes.

REFERENCE BOOKS

1. Bond E. Carl. 1979. *Biology of Fishes*, Saunders.
2. Halver JE. 1972. *Fish Nutrition*. Academic Press.
3. Hoar WS and Randall DJ. 1970. *Fish Physiology*, Vol. I-IX, Academic Press, New York.
4. Lagler KF, Bardach, JE, Miller, RR, Passino DRM. 1977. *Ichthyology*, 2nd Ed. John Wiley & Sons, New York.
5. Lovell J. 1989. *Nutrition and Feeding of Fish*. Van Nostrand Reinhold, New York.
6. Moyle PB and Joseph J. Cech Jr. 2004. *Fishes: An Introduction to Ichthyology*. 5th Ed. Prentice Hall.
7. Nikolsky GV. 1963. *Ecology of Fishes*, Academic Press.
8. Norman JR and Greenwood PH. 1975. *A History of Fishes*, Halsted Press.
9. Potts GW and Wootten RJ. 1984. *Fish Reproduction: Strategies and Tactics*, Academic Press.

CO-PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	2	1	2	1	2	2	1	2	1
CO2	3	2	1	1	2	1	2	1	1	2
CO3	2	1	2	1	1	2	1	3	2	1
CO4	2	1	2	1	2	1	2	1	2	3
CO5	1	2	1	2	1	2	1	2	3	2

M.Sc. ZOOLOGY, SEMESTER -III

LIMNOLOGY

CODE No. Z 3.3 (a)

(w.e.f.2022-2023 admitted batch)

Course Type: Theory

Course Category: Elective -I

Credits:4

Course Objectives/ Course outcomes :

CO-1: To introduce the concepts about limnology and different inland water bodies and anomalous properties of water.

CO-2: This course will make the suitable knowledgeable to undertake water quality management in a culture system.

CO-3: To understand the classification, distribution and significance of biological components in inland water bodies.

CO-4: Analyzing concept of productivity, turbidity of inland water bodies and bio-manipulation of zooplankton in the management of ponds and lakes.

CO-5: Creating awareness about physicochemical, bio-geochemical cycles and eutrophication.

UNIT– I

1. **Definition and facets** of Limnology; Limnology as an applied science.

2. **Inland water types:** Lentic and lotic habitats—their identities and distribution, ponds and lakes, streams and rivers; Major rivers and lakes of India.
3. Origin and classification of lakes.
4. **Anomalous properties of water**, their influence on biota in inland waters.

Learning outcome:

Students acquire knowledge about facets of limnology and classification of inland water bodies and its values.

UNIT– II

1. **Dissolved oxygen:** Sources, losses and distribution patterns.
2. Identification of oxygen depletion problems and control mechanisms in fish ponds.
3. **Carbon dioxide:** Sources, losses and distribution patterns; role of carbon dioxide in chemical buffering.

Learning outcome:

Students are able to understand the application and effect of dissolved oxygen and carbon dioxide in inland water bodies and fish ponds.

UNIT– III

1. **Plankton:** Composition, classification and distribution patterns in lakes and rivers.
2. **Benthos:** Composition, classification and distribution of benthos in lakes and rivers.
3. **Nekton** and its significance.
4. **Large Aquatic Plants:** Classification, distribution and limnological significance.

Learning outcome:

Students will be Aware with the, concept and significance of biological components of inland water bodies.

UNIT– IV

1. **Productivity:** Concept of productivity; methods for the estimation of primary, secondary and tertiary productivity; Classification of lakes based on productivity; indices of productivity in lakes
2. **Turbidity:** Causes, consequences and control.
3. **Bio-manipulation Concept:** Zooplankton as a tool in lake management.

Learning outcome:

Students are able to differentiate and recognize the lakes, through productivity. Acquire knowledge about bio manipulation and role of turbidity

UNIT- V

1. **Temperature and Light:** Thermal stratification and its overall impact, thermal classification of lakes; Factors affecting light penetration in natural waters.
2. **Bio-geochemical cycles:** General account of nutrients; Nitrogen and Phosphorus cycles.
3. **Eutrophication:** Causes, consequences and control mechanisms.

Learning outcome:

Students are able to understand the importance physicochemical factors, essential cycles and Causes, consequences of water bodies.

REFERENCEBOOKS

1. AllanJD.1995.*StreamEcology:Structure and Function of RunningWaters*.Chapman&Hall
2. ColeGA.1983.*Text book of Limnology*, C.VMosbyCompany,St.Louis,Missouri,USA.
3. GoldmanCR.andHorneAJ.1983.*Limnology*.McGraw-Hill International BookCompany.
4. Golterman,HL.1975.*Physiological Limnology*.ElsevierPublishingCo.,Amsterdam.
5. Hutchinson,GE. 1957. *A Treatise on Limnology: Vol I. Geography, physics and chemistry*.JohnWileyand Sons, Inc., New York.
6. HutchinsonGE.1967.*ATreatiseonLimnology*,VolII.*Introduction to lake Biology and the Limnoplankton*. JohnWileyandSons, Inc., NewYork.
7. ReidGR.1961.*Ecology and Inland waters and Estuaries*.ReinHoldCorp.,NewYork.
8. RuttnerF.1953.*Fundamentals of Limnology*,Uni.ofTorontopress,Toronto.
9. WelchPS.1952.*Limnology*,2ndEd.McGraw-HillBookCo.,NewYork.
10. WetzelRG.1975.*Limnology*,W.B.SandersCompany,Philadelphia.

CO-PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	2	1	2	1	1	2	2	1	2
CO2	2	1	2	1	1	2	1	1	2	3
CO3	2	2	1	2	1	1	2	1	3	2
CO4	1	2	1	3	2	1	2	1	2	1
CO5	3	2	1	2	1	2	1	2	1	2

M.Sc. ZOOLOGY, SEMESTER -III
WATER QUALITY MANAGEMENT
CODE No. Z 3.3 (b)
(w.e.f.2022-2023 admitted batch)

Course Type: Theory

Course Category: Elective -I

Credits:4

Course Objectives/ Course outcomes:

CO1: To introduce the basic concepts about Water quality, Fertilizers and manures and Liming.

CO2: To understand the Dynamics of dissolved Oxygen and Principles of Oxygen.

CO3: To discuss about the hatchery management, water discharge standards and effluent treatment in hatcheries.

CO4: To study about the concept of Aquatic weed management.

CO5: To analyze the methods of applying chemicals and pollution in relation to aquaculture practices.

UNIT – I

1. **Water quality:** Constituents of water, Water quality parameters – optimal levels and their management in freshwater fish and brackish water shrimp culture.
2. **Fertilizers and manures:** Different kinds of fertilizers and manures, fertilizer grade, source, rate and frequency of application; Ecological changes taking place after fertilizing; Biofertilizers; Role of inorganic, organic and biofertilizers in aquaculture practices; Utilization of bioactive compounds by microorganisms.

3. **Liming:** Properties of liming materials, lime requirements and application of liming materials to ponds, effects of liming on pond ecosystem.

Learning Outcome: To understand the basic concepts of Water quality parameters, Fertilizers and manures and Liming

UNIT – II

1. **Dynamics of dissolved oxygen:** Daily changes in dissolved oxygen concentration, oxygen budget of culture ponds; algal die-off, overturns, identification of oxygen problems.
2. **Aeration:** Principles of aeration, emergency aeration, destratification and practical considerations.

Learning Outcome: Upon completion of the unit, they are able to learn about the dynamics of dissolved oxygen and Principles of aeration.

UNIT – III

Hatchery management: Fish / Shrimp hatchery

1. Hatchery protocols, seed rearing technology, Packaging and transport of seed.
2. Larval rearing-culture and use of different live feed; different chemicals and drugs used; water quality and feed management.
3. Water discharge standards; Effluent treatment in hatcheries.

Learning Outcome: They are able to identify the significance of Hatchery management, Water discharge standards and effluent treatment in hatcheries.

UNIT – IV

Aquatic weed management:

1. Common weeds and problems in culture ponds
2. Chemical, biological and mechanical control methods and Algal bloom control

Learning Outcome: Upon completion of the unit, they are able to understand the concept of Aquatic weed management.

UNIT – V

1. **Chemical treatments:** Potassium permanganate, hydrogen peroxide, calcium hydroxide; reduction of pH, control of turbidity, salinity, hardness, chlorides, water exchange, chlorine removal; rotenone, formalin and malachite green; methods of applying chemicals.
2. Pollution in relation to aquaculture practices.

Learning Outcome: Upon completion of the unit, they analyze the chemical treatment and Pollution in relation to aquaculture practices.

REFERENCE BOOKS

1. Adhikari S & Chatterjee DK. 2008. *Management of Tropical Freshwater Ponds*. Daya Publ.
2. Boyd CE and Tucker CS. 1992. *Water Quality and Pond Soil Analyses for Aquaculture*. Alabama Agricultural Experimental Station, Auburn University.
3. Boyd CE. 1979. *Water Quality in Warm Water Fish Ponds*. Auburn University
4. Boyd, CE. 1982. *Water Quality Management for Pond Fish Culture*. Elsevier Sci. Publ. Co.

5. Hepher B & Pruginin Y. 1981. *Commercial Fish Farming*. John-Wiley & Sons Inc.
6. Jhingran VG. 1982. *Fish and Fisheries of India*. Hindustan Publishing Corporation, India.
7. Midlen & Redding TA. 1998. *Environmental Management for Aquaculture*. Kluwer.
8. Pillay TVR & Dill WMA. 1979. *Advances in Aquaculture*. Fishing News Books, Ltd. England.
9. Rajagopalsamy CBT & Ramadhas V. 2002. *Nutrient Dynamics in Freshwater Fish Culture System*. Daya Publ.
10. Sharma LL, Sharma SK, Saini VP & Sharma BK. 2008. *Management of Freshwater Ecosystems*. Agrotech Publ. Academy.
11. Stickney RR. 1979. *Principles of Warm water Aquaculture*. John-Wiley & sons Inc

CO-PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	2	1	1	2	1	2	2	1	2
CO2	2	1	2	1	2	2	1	3	1	2
CO3	2	1	2	2	1	1	3	1	2	1
CO4	1	2	1	2	1	1	3	2	1	1
CO5	2	1	2	3	2	2	2	1	2	2

M.Sc. ZOOLOGY, SEMESTER -III
ENVIRONMENTAL BIOLOGY
CODE No. Z 3.3 (c)
(w.e.f.2022-2023 admitted batch)

Course Type: Theory

Course Category: Elective -I

Credits:4

Course Objectives/ Course outcomes:

- CO1:** To introduce the basic concepts about Classification and Characteristics of Fresh water and marine water and terrestrial region.
- CO2:** To understand the concept of Ecological Energetics and productivity of ecosystems and Impact of environmental factors on Energy flow.
- CO3:** To discuss about Air pollution, water pollution and environmental health hazards.
- CO4:** To study about the concept of Biomonitoring, Environmental Impact Assessment and natural calamities and disaster management.
- CO5:** To discuss about the concept of Bioaccumulation, Biomagnification, Bioremediation and Environmental laws in India.

UNIT-1:

- 1.1 A general account on Biomes and their environments.
- 1.2 Fresh Water: Classification and Characteristics, eutrophication, seasonal changes.
- 1.3 Marine: Classification and Characteristics.
- 1.4 Terrestrial: Forests – Grass lands – Tundra – Desert.

Learning Outcome: On completion of the above unit students will come to know about the concept of Biomes, classification and characteristics of fresh water and marine water and terrestrial

region.

UNIT-2:

2.1 Trophic dynamic view of ecosystem and energy flow.

2.2 Ecological Energetics and productivity of ecosystems.

2.3 Impact of environmental factors on Energy flow.

Learning Outcome: Understanding the trophic dynamic view of ecosystem, ecological energetic and productivity of ecosystem and Impact of environmental factors on energy flow.

UNIT-3:

3.1 Air Pollution: Criteria and standards in India, health hazards and Toxicology – Green house gases and Green House Effect.

3.2 Water Pollution: Criteria and standards in India, health hazards and toxicology.

3.3 Role of environmental epidemiological studies and health indices in evaluation of environmental health hazards: environmental epidemiological episodes in India and Abroad.

Learning Outcome: Students are able to understand the concept of Air pollution, Water pollution and Environmental health hazards in India and Abroad.

UNIT-4:

4.1 Biomonitoring.

4.2 Bio indicators and environmental monitoring, Environmental impact assessment.

4.3 Natural calamities and disaster management.

Learning Outcome: Upon completion of the above unit students are able to understand Biomonitoring, Environmental Impact Assessment, Natural calamities and disaster management.

UNIT-5:

5.1 Bioaccumulation and Biological magnification.

5.2 Bioremediation: Need and scope of bioremediation, Environmental applications of bioremediation. Future outlook of Bioremediation: Phytoremediation, Biotechnological cleaning up of the environment by plants.

5.3 Environmental Laws; Environmental Laws in India – legislation and Execution.

Learning Outcome: Students are able to understand the concept of Bioaccumulation, Biomagnification, Bioremediation and Environmental laws in India.

SUGGESTED READING MATERIAL:

1. Animal Physiology - Adaptation & Environment. 4th Edition Knut Schmidt - Nielsen - Cambridge University Press.
 2. Biochemical ecology and water pollution - PR Dugan, plenum press, London, 1972.
 3. Biodegradation & Bioremediation - 2nd edition, Martein Alexander - Academic Press, 1999 USA.
 4. Chemical and biological methods for water pollution studies R.K. Trivedy and P.K. Goel, 1984.
 5. Current pollution researches in India - RK. Trivedy and P.K. Goel. Karad.
 6. Ecology & Environment - P.D. Sharma, 1991.
 7. Ecotechnology for pollution control and environmental management, enviromedia, Karad, RK. Trivedi.
 8. Encyclopedia of environmental pollution and control, enviromedia, Karad, Vol. 1 & 2, R.K. Trivedi.
 9. Environmental Biology and Toxicology - P.D. Sharma, Rastogi Publications, Meerut (India), 1998.
 10. Environmental Physiology of desert organism. Ed. by N.F. Hadley - Dowden Hutchinson and Ross, Inc. Penn. USA.
 11. Environmental Science Research Volumes: Vol.1. Indicators of environmental quality - W.A. Thomas, 1972. Vol.3. Environmental pollution by pesticides - C.A. Edwards, 1974.
 12. Field Biology & Ecology - Allen H Benton & E. Werner, JR, 1980.
 13. Health hazards and human environment, World Health Organization (WHO) 1972.
 14. Industrial Pollution - VP. Kudesia, 1990.
 15. Methods in Environmental Analysis - Water soil and air by P.K. Gupta - Agrobios (India), Jodhpur, 2001
 16. Pesticides in the environment - R White Stevenns, Marcel Dekker Inc. New York, 1971.
 17. Practical methods in Ecology & Environmental Science, RK. Trivedy, Goel, Trisal, 1997.
 18. The Ecology of waste water treatment - H.A. Hawkes pergoman press, 1963.
 - a. Vol.5 Environmental dynamics of pesticides - R. Hague and V.H. Preed, 1975.
- Water Treatment and purification technology - W.J. Ryan, Agrobios (India), Jodhpur, 2002.

CO-PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	2	1	2	1	2	1	1	1	2
CO2	1	2	1	2	1	1	2	3	2	1
CO3	2	1	2	1	2	1	2	3	1	2
CO4	2	2	1	2	1	2	1	2	1	3
CO5	1	2	1	2	1	2	1	3	2	1

M.Sc. ZOOLOGY, SEMESTER -III
AQUATIC TOXICOLOGY
CODE No. Z 3.4 (a)
(w.e.f.2022-2023 admitted batch)

Course Type: Theory
 Course Category: Elective -II
 Credits:4

Course Objectives/ Course outcomes :

CO:1 To make understand about different sources of water pollution in general and sewage pollution in particular.

CO: 2 To analyze the different industrial effluents and their impact on the aquatic organisms.

CO:3 To provide information regarding different classes of pesticides , their entry in to the aquatic ecosystems and their accumulation in the aquatic bodies in general and food chain in particular.

CO4: To explain about sources of thermal pollution and radiation pollution in to the aquatic environment and the consequences of these pollutions to the aquatic organisms.

CO5: For creation of awareness regarding Environmental Impact Assessment policies and analysis processes can also be made. The regulations and acts enacted to prevent pollution.

CO-PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	2	1	3	2	1	2	2	1	1	2
CO2	1	2	1	3	2	1	2	1	2	1
CO3	2	1	2	1	2	1	2	3	2	1
CO4	3	2	1	2	1	2	1	2	1	2
CO5	2	2	1	1	2	2	1	3	2	1

UNIT – I

1. Water pollution and analysis: Sources of water pollution, physical and chemical characterization of water, minor components of water, important trace elements in water; biological investigation of water – DO, BOD; microbiological examination of water, water pollution and diseases.

2. Sewage treatment and analysis: Treatment of domestic sewage, primary treatment of sewage, chemical treatment of sewage, biological treatment, tertiary treatment of sewage, disposal of sewage, characterization and analysis of sewage – DO, COD, BOD.

Learning Outcome:

The students will understand the

- 1.The major sources of pollution
- 2.Water characterization and minor elements of water
- 3.Microbial contamination and the resultant diseases
- 4.Sewage pollution treatment and disposal

UNIT – II

1. Industrial pollution: Effluent from chemical industries, apparel industries, energy industry and service industries; waste water from food processing and material industry; analysis of metal pollutants, non-metal pollutants and gases, waste water treatment.

Learning Outcome:

The students will understand the

- 1.The major sources of industrial pollution from different industries
- 2.Analytical methods of metallic and non-metallic pollutants, gases.

UNIT-III

1. Pesticide pollution: Classification of pesticides, bio-concentration, bioaccumulation,

sources of contamination, bio-magnification, effects on non-target organisms, metabolites – uptake and depuration of toxic chemicals, control of pesticide pollution.

Learning Outcome:

1. History of pesticide usage
2. Different classes of pesticides and their impacts on non-target organisms
3. Pesticide pollution sources, bioaccumulation and bio-concentration

UNIT – IV

1. Thermal pollution: Source of thermal pollution, effects of discharge of heat, control of thermal pollution – artificial lakes or cooling ponds, cooling towers and improved electric generating plants.
2. Radiation pollution: Sources of radiation, effects of ionizing radiation on life, nuclear energy, the most dangerous radioactive pollutants, harmful effects of radiation and monitoring of radiation.

Learning Outcome:

The students will understand the

- ☐ The major sources of Thermal pollution from different industries and their control methods
- ☐ Sources of radiation pollution harmful effects of radiation pollution
- ☐ Monitoring of radiation pollution

UNIT – V

1. Environmental Impact Assessment (EIA) – Analysis: Introduction, EIA under National Environmental Policy Act (NEPA), EIA in action, implementation of EIA, Case studies –water quality impact analysis and nuclear power plant impact.
2. Pollution control Acts and Laws of India; The Environment (Protection) Act, 1986.

Learning Outcome:

The students will understand the

1. EIA in action, Case studies
2. Water quality impact analysis and nuclear power plant impact Monitoring of radiation pollution
3. Pollution control Acts and Laws of India

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1. Andrews HL. 1974. Radiation Bio-physics. Prentice Hall, Inc., New York, USA.
2. Chanlett ET. 1973. Environmental Protection. McGraw Hill, Inc., Japan.
3. Edwards CA. 1973. Environmental Pollution by Pesticides. Plenum Press, London/NY.
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CO-PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	2	1	2	1	2	1	1	1	2
CO2	1	2	1	2	1	1	2	3	2	1
CO3	2	1	2	1	2	1	2	3	1	2
CO4	2	2	1	2	1	2	1	2	1	3

CO5	1	2	1	2	1	2	1	3	2	1
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M.Sc. ZOOLOGY, SEMESTER -III
AQUACULTURE ENGINEERING
CODE No. Z 3.4 (b)
(w.e.f.2022-2023 admitted batch)

Course Type: Theory
Course Category: Elective -II
Credits:4

Course Objectives/ Course outcomes:

- CO1:** To introduce the basic concepts about Planning and Aquaculture Development
CO2: To discuss about the farm standards and bio-security measures.
CO3: To introduce about the concepts of design and construction of fish and shrimp farms.
CO4: To study about significance of design and constructing fish and shrimp hatcheries.
CO5: To learn about the design and construction of cages, rafts, pens, enclosures and raceways.

UNIT – I

- 1. Planning and Aquaculture Development:** Priorities, resources, technology, human resources, legal and environmental factors and organization of aquaculture.
- 2. Selection of Sites for Aquaculture:** Criteria for site selection of fresh water and brackish water farms - land based and open water farms; quantity and quality of water, sources of pollution and conflicts.

Learning Outcome: On completion of the above unit they are able to understand the planning and aquaculture development and criteria for selection of sites for aquaculture.

UNIT – II

Farm/Hatchery standards and Bio-security measures

1. Sanitary and Phyto-Sanitary (SPS) measures
2. Better Management Practices (BMP's)

Learning Outcome: Students will get awareness about Sanitary and Phyto-sanitary measures and better management Practices.

UNIT – III

Design and construction: Fish and shrimp farm

1. **Freshwater Fish Farm** - Design and construction
2. **Brackish water Shrimp Farm** - Design and construction

Learning Outcome: Students will gain knowledge and skills to design and plan a freshwater fish farm and brackish water shrimp farm and including site selection, pond design, water supply, and stocking.

UNIT – IV

Design and construction: Hatchery

1. **Fish Hatchery** - Design, construction: Criteria for site selection of hatchery and nursery; Design and construction of Jar hatchery and Chinese hatchery system.
2. **Shrimp Hatchery** - Design and construction: Site selection and facilities required – maturation tanks, spawning tanks, larval rearing tanks, live food culture tanks, water storage and filtration tank, aeration, seawater supply and piping system; Lay-out and construction.

Learning Outcome:

1. Students will gain knowledge and skills to design and plan a fish hatchery, including criteria for site selection, hatchery and nursery design, jar hatchery, and Chinese hatchery system.
2. Students will gain knowledge and skills to design and plan a shrimp hatchery, including site selection, facilities required such as maturation tanks, spawning tanks, larval rearing tanks, live food culture tanks, water storage and filtration tank, aeration, seawater supply, and piping system.

UNIT-V**Design and construction**

1. **Cages and Rafts:** Design and construction
2. **Pens and Enclosures:** Design and construction
3. **Raceway Farms:** Design and construction.

Learning Outcome:

Students will gain knowledge and skills to design and plan cage, raft systems, pen and enclosure for aquaculture, including site selection, materials selection, and engineering considerations.

REFERENCE BOOKS

1. Bose AN. *et al.*, 1991. *Coastal Aquaculture Engineering*. Oxford & IBH Publishing Company, Pvt. Ltd.
2. Chakraborty C & Sadhu AK. 2000. *Biology Hatchery and Culture Technology of Tiger Prawn and Giant Freshwater Prawn*. Daya Publ. House
3. CIFE. 1993. *Training Manual on Culture of Live Food Organisms for Aqua Hatcheries*. CIFE, Versova, Mumbai
4. FAO. 2007. *Manual for Operating a Small Scale Recirculation Freshwater Prawn Hatchery*
5. Hephher B & Pruginin Y. 1981. *Commercial Fish Farming*. John-Wiley & Sons Inc.
6. ICAR. 2006. *Handbook of Fisheries and Aquaculture*. ICAR.
7. Ivar LO. 2007. *Aquaculture Engineering*. Daya Publ. House.
8. Jhingran VG & Pullin RSV. 1985. *Hatchery Manual for the Common, Chinese and Indian Major Carps*. ICLARM, Philippines.
9. Misra R and Dora KC. 2015. *A text Book on Aquaculture Engineering*, Narendra Publishing House, New Delhi.
10. MPEDA. 1993. *Handbook on Aqua Farming - Live Feed. Micro Algal Culture*. MPEDA Publication
11. Pilley, TVR & Dill, WMA. 1979. *Advances in Aquaculture*. Fishing News Books, Ltd. England.
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CO-PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	2	1	2	1	2	1	2	1	2
CO2	2	2	3	1	2	1	1	1	2	1
CO3	1	3	2	2	1	2	2	1	2	2
CO4	2	3	2	1	1	2	1	2	1	2
CO5	2	1	2	1	3	1	2	2	1	2

M.Sc. ZOOLOGY, SEMESTER -III
TAXONOMY OF AND FUNCTIONAL ANATOMY OF SHELL FISH
CODE No. Z 3.4 (c)
(w.e.f.2022-2023 admitted batch)

Course Type: Theory
Course Category: Elective -II
Credits:4

Course Objectives/ Course outcomes:

- CO1:** To discuss about the classification of crustacea and Mollusca.
CO2: To understand the concepts of Feeding in Crustacea and Mollusca.
CO3: To study about the respiratory and digestive systems in Crustacea and Mollusca.
CO4: To discuss about the Endocrine system in Crustacea and Reproductive system in Crustacea and Mollusca.
CO5: To understand the concepts of Nervous and Excretory systems in Crustacea and Mollusca.

UNIT – I

1. **Classification of Crustacea:** Major groups up to orders and their important characters.
2. **Classification of Mollusca:** Major groups up to orders and their important characters.

Learning Outcome: Students will be able to identify the major groups of Crustacea and Mollusca and their distinguishing features.

UNIT – II

1. **Feeding in Crustacea:** Food and feeding habits of cultured crustaceans – Branchiopoda and Malacostraca.
2. **Feeding in Mollusca:** Food and feeding habits of cultured molluscs – Gastropoda and Bivalvia.

Learning Outcome: Students are able to understand the concepts of food and feeding habits of cultured crustaceans and molluscs.

UNIT – III

1. **Respiratory System in Crustacea:** Structure and function of respiratory organs.
2. **Respiratory System in Mollusca:** Structure and function of respiratory organs.
3. **Digestive System in Crustacea:** Structure and function of digestive organs.
4. **Digestive System in Mollusca:** Structure and functions of digestive organs.

Learning Outcome: Students will get awareness about respiratory and digestive systems in Crustacea and Mollusca.

UNIT – IV

1. **Endocrine System in Crustacea:** Structure and function of endocrine organs and their role in reproduction.
2. **Reproductive System in Crustacea:** Reproductive patterns, reproductive organs, gonad maturity, spawning and fertilization.
3. **Reproductive System in Mollusca:** Reproductive patterns, reproductive organs, gonad maturity, spawning and fertilization.

Learning Outcome:

1. Students will understand how hormones produced by the endocrine organs regulate the growth, development, and reproduction of Crustacea.
2. Students will understand the reproductive organs in Crustacea and Mollusca, including the gonads, genital openings, and copulatory organs.

UNIT -V

1. **Nervous system in Crustacea:** Structure and functions of brain and nerves.
2. **Nervous system in Mollusca:** Structure and functions brain and nerves.
3. **Excretory System in Crustacea:** Structure and function of excretory organs.
4. **Excretory System in Mollusca:** Structure and function of excretory organs

Learning Outcome: Upon completion of the above unit they are able to understand Nervous and excretory systems in Crustacea and Mollusca.

CO-PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	2	1	2	1	2	1	2	2	1
CO2	2	1	2	1	1	2	1	3	1	1
CO3	3	2	1	2	2	1	2	1	2	2
CO4	2	1	2	1	2	2	1	2	3	1
CO5	2	1	2	2	1	2	2	3	2	2

REFERENCE BOOKS

1. Barrington EJW. *Invertebrate Structure and Function*. 1976. Thomas Nelson and Sons Ltd. London s
2. Hyman LH. *The Invertebrates*, 1955. Vol.1 to 8, McGraw Hill Co., New York.
3. Borrardile & RA Potts. 1962. *The Invertebrates*. Asia Publishing House.
4. Kaestner A. 1967. *Invertebrate Zoology*. Vol. I - III. John Willey & Sons.
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M.Sc. ZOOLOGY, SEMESTER -IV FISH PATHOLOGY (CODE No. Z 4.1) 22 (w.e.f.2022-2023 admitted batch)

Course Type: Theory

Course Category: Mandatory core

Credits:4

Course Objectives/ Course outcomes :

CO1: To get awareness about the concept of viral diseases in fish and shrimp.

CO2: To understand the basic knowledge about bacterial and fungal diseases in fish and shrimp.

- CO3:** To discuss about Protozoan, Helminthic and Crustacean diseases in fish and Shrimp.
- CO4:** To understand the concepts of Gas bubble disease in fish and blue shell syndrome in Shrimps
- CO5:** To discuss Epizootic Ulcerative syndrome in fish and Muscle Necrosis, Gas bubble disease, Black Death disease and chronic soft-shell syndrome in Shrimps.

UNIT – I

Fish Diseases:

1. History, species affected, Clinical symptoms, pathology and control measures of Viral Hemorrhagic Septicemia (VHS) and Infectious Hematopoietic Necrosis (IHN).

Shrimp Diseases:

2. History, species affected, **Pathology**, clinical symptoms, prevention and treatment of Monodon Baculoviral disease (MBV), Infectious Hypodermal and Hematopoietic Necrosis (IHHN), Hepatol Pancreatic Parvovirus disease (HPPV), Yellow-head virus disease, Taura syndrome and White spot syndrome.

Learning Outcomes: Upon completion of the above unit, they are able to learn about viral diseases in fish and shrimp.

UNIT – II:

Fish Diseases:

1. History, species affected, Clinical symptoms, pathology, prevention and control measures of Bacterial
2. Hemorrhagic Septicemia (BHS), Bacacterial gill disease and Tail and fin rot.
3. Pathology, clinical symptoms, prevention and control measures of
4. Saprolegnia is and
5. Brachymeiosis.

Shrimp Diseases:

3. History, species affected, Clinical symptoms, pathology, prevention and control measures of Black gill disease, Filamentous bacterial gill disease.
4. History, species affected, Clinical symptoms, pathology, prevention and control measures of *Lagenidium* disease (Larval Mycosis) and Brown gill disease.

Learning Outcomes: Students are able to understand the concept of Bacterial diseases in fish and shrimp.

UNIT – III:

Fish Diseases:

1. History, species affected, **Clinical** symptoms, pathology and control measures of Ichthyophthiriasis, Enterococcidiasis, Whirling disease and Nodular disease.
2. History, species affected, Clinical symptoms, pathology and control measures of Gyrodactylosis and Dactylogyrosis.
3. History, species affected, Clinical symptoms, pathology and control measures of Argulosis and Lernaesis.

Shrimp Diseases:

History, species affected, History, Etiology, morphology and control measures of *Zoothamnium* and *Acineta*.

Learning Outcomes: Upon completion of the above unit they are able to get awareness about Protozoan, Helmenthic and Crustacean diseases in fish and shrimp.

UNIT – IV:

Fish Diseases:

1. History, species affected, clinical symptoms, pathology and control measures of gas bubble disease and lack of oxygen.
2. **Shrimp Diseases:** History, species affected, Clinical symptoms, pathology and control measures of Cramped tails, and Blue shell syndrome.

Learning Outcomes: Students acquire knowledge about gas bubble disease in fish and cramped tails, blue shell syndrome in shrimp.

UNIT – V:

Fish Diseases:

1. History, species affected, clinical symptoms, pathology, prevention and control measures of Epizootic Ulcerative syndrome.

Shrimp Diseases:

2. History, species affected, Clinical symptoms, pathology and control measures of Muscle Necrosis, Gas bubble disease, Black Death disease and chronic soft-shell syndrome.

Learning Outcomes: On completion of the unit, they are able to understand the Epizootic Ulcerative syndrome in fish and Muscle Necrosis, Gas bubble disease, Black Death disease and chronic soft-shell syndrome in shrimp.

REFERENCE BOOKS

1. Cheng TC. 1964. *The Biology of Animal Parasites*. W.B. Saunders Company, Philadelphia, Pennsylvania, USA.
2. Conroy CA and Herman RL. 1968. *Text book of Fish Diseases*.TFH (Great Britain) Ltd, England.
3. Lightner DV. 1996. *A Handbook of Shrimp Pathology and Diagnostic Procedures for Diseases of Cultured Penaeid Shrimp*. World Aquaculture Society, Louisiana, USA.
4. Reichenbach KH. 1965. *Fish Pathology*. TFH (Gt. Britain) Ltd, England.
5. Ribelin WE and Migaki G. 1975. *The Pathology of Fishes*. The Univ. of Wisconsin Press Ltd, Great Russel Street, London, UK.
6. Shuzo Egusa.1978. *Infectious Diseases of Fish*. Oxonian Press Pvt. Ltd. New Delhi.
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6. Shuzo Egusa.1978. *Infectious Diseases of Fish*. Oxonian Press Pvt. Ltd. New Delhi.
7. Van Duijn, C. 1973. *Diseases of Fishes*. Cox and Wyman Ltd. London.

CO-PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	1	2	1	2	1	2	1	2	1
CO2	3	2	1	2	1	1	2	1	1	2
CO3	2	1	2	1	2	2	1	3	2	1
CO4	2	1	2	1	2	1	1	2	1	2
CO5	1	2	1	1	2	1	2	2	1	2

M.Sc. ZOOLOGY, SEMESTER -IV
IMMUNOLOGY
(CODE No. Z 4.2) 22
(w.e.f.2022-2023 admitted batch)

Course Type: Theory

Course Category: Mandatory core

Credits:4

Course Objectives/ Course outcomes:

CO1: Understand the basic principles of the immune system, including the different types of immune responses, immune cells, and molecules involved in immunity.

CO2: Analyze the molecular mechanisms of antigen recognition, processing, presentation and how they lead to the activation of the immune system.

CO3: Understand the principles of immunological memory, including how it develops and how it can be exploited in vaccination.

CO4: Analyze the role of the immune system in the pathogenesis of infectious and autoimmune diseases, and how this knowledge can be used in the development of therapies.

CO5: Evaluate current research in immunology, including primary research articles and scientific reviews, and apply this knowledge to address scientific questions and solve problems.

UNIT – I

Antigens: Chemical nature of Antigens, Haptens, Epitopes, Paratopes; Binding forces of antigen-antibody interactions – Affinity, Avidity and Cross reactivity; Antigenicity and Immunogenicity.

Lymphoid Organs: Primary lymphoid organs – Thymus, Bone marrow and Bursa of Fabricius; Secondary lymphoid organs – Spleen, Lymph nodes, MALT and GALT.

Cells of the immune system: Origin of the cells - Stem cells; Lymphoid lineage – T-lymphocytes, B-lymphocytes, Null cells; Myeloid lineage – Monocytes, Polymorphonuclear (PMN) leukocytes; Accessory cells.

Learning Outcome: Students are able to Understand the basic principles of the immune system, including the different types of immune responses, immune cells, and molecules involved in immunity.

UNIT-II

Antibody molecules/Immunoglobulins: Basic structure of the immunoglobulin molecule; Structure and function of IgG, IgA, IgM, IgE and IgD molecules.

Major Histocompatibility Complex (MHC): Structure of MHC molecules, Antigen processing and presentation by MHC molecules.

Complement System: Classical and Alternative Pathways; Biological functions of complement.

Learning Outcome: Students are able to analyze the molecular mechanisms of antigen recognition, processing, presentation and how they lead to the activation of the immune system.

UNIT-III

Cytokines: Interleukins (ILs), Interferons (INFs), Tumor Necrosis Factors (TNFs), Colony Stimulating Factors (CSFs) and Chemokines.

Innate Immunity: Phagocytosis- intracellular killing, Humoral and Cellular components

Acquired Immunity: Humoral immunity, Cell-mediated immunity; Primary and Secondary immune response, Memory function; Active and Passive immunity, Types of Vaccines.

Learning Outcome: Students are able to understand the principles of immunological memory, including how it develops and how it can be exploited in vaccination.

UNIT – IV

1. **Hypersensitivity:** Types of Hypersensitivity reactions and Regulatory mechanisms.
2. **Tolerance:** Immune and Self Tolerance; Autoimmunity and Autoimmune disorders.
3. **Tumor Immunology:** Immunity to tumours, tumour-specific antigens; Immunosurveillance

Learning Outcome: Students are able to Analyze the role of the immune system in the pathogenesis of infectious and autoimmune diseases, and how this knowledge can be used in the development of therapies.

UNIT - V

1. **Immunodiffusion:** Simple diffusion, Radial immunodiffusion and Double immunodiffusion.
2. **Immunoelectrophoresis:** Counter and Rocket immunoelectrophoresis.
3. **Radioimmunoassay (RIA):** Competitive R.I.A, and Excess Reagent R.I.A.
4. Enzyme Linked Immune Sorbent Assay (ELISA).
5. **Hybridoma Technology** – Production of monoclonal antibodies.

Learning Outcome: Students are able to Evaluate current research in immunology, including primary research articles and scientific reviews, and apply this knowledge to address scientific questions and solve problems.

REFERENCE BOOKS

1. Goldsby AR, Kindt TJ and Osborne BA. 2000. *KUBY Immunology*. W.H. Freeman and Company, NY.
2. Ivon M. Roitt. 2001. *Essential Immunology*. Blackwell Science Ltd, Mishawaka, IN, USA.
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4. Nandini Shetty. 2008. *Immunology Introductory Text*. Wiley Eastern Limited, New Age International Publishers, New Delhi.
5. Rajasekara Pandian M and Senthil Kumar B. 2007. *Immunology and Immunotechnology*. Pamina Publishing Corporation, New Delhi, India.

CO-PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	2	1	1	2	2	1	2	2	2
CO2	2	1	2	3	1	2	1	1	2	2
CO3	2	2	1	2	1	3	2	1	1	1
CO4	1	2	1	1	2	2	1	3	1	2
CO5	2	2	1	2	3	1	2	1	2	1