**COURSE OUTCOMES**

**BSC Mathematics**

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| **S No** | **Class & Semester** | **Course & Course Code** | **COs** | **Course Outcomes** |
| 01 | B.Sc & I-Sem | Calculus and Optimization Techniques& MAT5101T | CO1 | Recall the definitions and formulae for Taylor's and Maclaurin's theorems, curvature, and arc length. |
| CO2 | Explain the concepts of power series expansion and its application to functions such as sin⁡x,cos⁡x,ex\sin x, \cos x, e^xsinx,cosx,ex, etc. |
| CO3 | Solve problems involving maxima and minima of functions using Lagrange’s method of multipliers. Apply Beta and Gamma functions in evaluating integrals and solve problems related to volume and surface areas of solids of revolution. |
| CO4 | Analyze curves for tracing and identify asymptotes using given conditions and techniques. |
| CO5 | Assess the feasibility of solutions in linear programming problems and derive dual solutions using simplex algorithms. |
| 02 | B.Sc & II-Sem | Discrete Mathematics & Vector Calculus & MAT5201T | CO1 | Recall and define basic concepts of relations, equivalence classes, and partial order relations. |
| CO2 | Solve linear recurrence relations using the method of generating functions. |
| CO3 | Apply operations like union, join, and products to graphs. |
| CO4 | Analyze vector operations like gradient, divergence, and curl in physical contexts. |
| CO5 | Apply theorems of Gauss, Green, and Stokes to solve problems related to vector calculus. |
| 03 | B.Sc & III-Sem | Real Analysis &  MAT5003T | CO1 | Recall the definitions of finite, infinite, countable, and uncountable sets, and provide examples. Explain the completeness property and the Archimedean property of R\mathbb{R}R, and identify cluster points within a set. |
| CO2 | Analyze bounded and monotone sequences to verify convergence using the monotone convergence theorem. |
| CO3 | Compare different convergence tests such as the geometric series test, root test, and ratio test to identify series convergence. |
| CO4 | Analyze the radius of convergence for power series and determine convergence intervals. |
| CO5 | State the definitions of pointwise and uniform convergence, and recall the Mn-test and M-test criteria. |
| 04 | B.Sc & IV-Sem | Algebra &  MAT5004T | CO1 | Define and identify groups, abelian and non-abelian groups, using examples from number systems. |
| CO2 | Examine the structure and symmetries of geometric shapes (e.g., triangles, rectangles, and squares) as symmetry groups. |
| CO3 | Analyze the structure of quotient groups and their connection to normal subgroups. |
| CO4 | Explain the distinction between commutative and non-commutative rings, and give examples such as polynomial rings and rings of continuous functions. |
| CO5 | Analyze the properties of integral domains and fields, using examples such as Zp, Q, R, and C. |
| 05 | B.Sc & V-Sem | Matrices &  BSC/DSE/506A | CO1 | Define vector spaces and explain the standard basis for R2, R3. Analyze the concept of linear independence and identify subspaces within R2, R3. |
| CO2 | Explain the effects of geometric transformations such as translation, dilation, rotation, and reflection in matrix form. |
| CO3 | Solve systems of linear equations (both homogeneous and non-homogeneous) with up to four variables. |
| CO4 | Explain the distinction between commutative and non-commutative rings, and give examples such as polynomial rings and rings of continuous functions. |
| CO5 | Analyze and solve practical problems involving matrices in geometry, physics, and statistics. |
| 06 | B.Sc & VI-Sem | Numerical Methods & BSC/DSE/606A | CO1 | Define key terms related to numerical methods such as Bisection, False Position, and LU Decomposition. |
| CO2 | Solve systems of linear equations using Gauss-Jacobi and Gauss-Seidel methods, demonstrating proficiency in iterative techniques. |
| CO3 | Implement linear and higher-order interpolation techniques to estimate values for a given dataset. |
| CO4 | Analyze the accuracy of numerical differentiation techniques based on the given problem's context. |
| CO5 | Analyze the error and efficiency of different numerical integration methods and select the most appropriate method based on problem requirements. |

**BSC Physics**

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| **S No** | **Class & Semester** | **Course & Course Code** | **COs** | **Course Outcomes** |
| 01 | B. Sc. & I-Sem | Mechanics and Oscillation & PHY5101T | CO 1 | Apply the principles of inertial and non-inertial frames to solve problems involving motion and forces. |
| CO2 | Explain the concept of work done by conservative and non-conservative forces. |
| CO3 | Define the center of mass and recall how to calculate it. |
| CO4 | Apply the equations of motion to solve problems related to the rotational motion of rigid bodies, using angular momentum and rotational inertia. |
| CO5 | Explain the concept of coupled oscillators and how normal modes arise in coupled systems. |
| 02 | B. Sc. & II-Sem | Electromagnetism & PHY5201T | CO 1 | To explores the fundamental principles and applications of electromagnetic phenomena. Be able to use electromagnetic theory and principles in a wide range of applications. |
| CO2 | To develop a strong mathematical and analytical skills and problem-solving abilities in the context of electricity and magnetism. |
| CO3 | To learn about the knowledge of Gauss and Maxwell’s law which are very useful in electromagnetic theory. |
| CO4 | To learn about the basic concept of magnetic, electric, scalar and vector fields in matter. |
| CO5 | To gain an appropriate knowledge for the practical applications of electromagnetic principles in various scientific and engineering disciplines. |
| 03 | B. Sc. & III-Sem | Thermal Physics and Statistical Mechanics  & (PHY5003T) | CO 1 | Recall and state the fundamental laws of thermodynamics and the concept of temperature. |
| CO2 | Explain the significance of entropy and its behavior in reversible and irreversible processes. |
| CO3 | Apply the first law of thermodynamics to calculate work done and heat exchange in isothermal and adiabatic processes. |
| CO4 | Describe the laws governing kinetic theory, radiation, and thermodynamic potentials, including their physical and mathematical interpretations. |
| CO5 | Use statistical mechanics to classify and interpret the behavior of different quantum particles using Fermi-Dirac, Bose-Einstein, and Maxwell-Boltzmann statistics. |
| 04 | B. Sc. & IV-Sem | Wave and Optics & PHY5004T | CO 1 | Students will understand the harmonic oscillations and distinguish between transverse and longitudinal waves. They will be able to analyze wave propagation and their characteristics in various physical systems. |
| CO2 | Students will apply the principles of surface tension and viscosity to solve practical problems, describe their dependence on temperature and explain their significance in real-world applications such as fluid mechanics and lubrication. |
| CO3 | Students will understand complex waveforms like sawtooth and square waves using Fourier's theorem and interpret their harmonic components to understand practical applications in signal processing and acoustics. |
| CO4 | Students will analyze the concepts of sound intensity, loudness and the decibel scale and relate these to musical notes, scales and the auditory experience. |
| CO5 | Students will analyze wave phenomena such as interference, diffraction and polarization and apply these principles in acoustics and optics for real-world problem-solving and innovation. |
| 05 | B. Sc. & V-Sem | Solid State Physics & BSC/DSE/505D | CO 1 | Understand the types of bonding in solids (ionic, covalent, metallic and van der Waals) and their impact on material properties. |
| CO2 | Understand the free electron theory, band theory and their applications to metals, semiconductors and insulators. |
| CO3 | Explain lattice vibrations, phonons and their role in thermal properties like heat capacity and thermal conductivity. |
| CO4 | Develop knowledge about different types of magnetism (paramagnetism, ferromagnetism, antiferromagnetism) and understand magnetic materials' applications. |
| CO5 | Gain an understanding of the phenomenon of superconductivity, its theories and potential applications. |
| 6 | B. Sc. & VI-Sem | Nuclear and Particle Physics & BSC/DSC/605B | CO 1 | Explain the constituents of the nucleus and their intrinsic properties, including size, mass, charge density, and binding energy. |
| CO2 | Utilize the Liquid Drop Model and the semi-empirical mass formula to evaluate nuclear stability, interpret the significance of various terms, and calculate two-nucleon separation energies. |
| CO3 | Comprehend the basics of α-decay processes, the theory of α-emission, and the Gamow factor. |
| CO4 | Classify types of nuclear reactions and analyze their kinematics, including Q-value, reaction rate, and reaction cross-section. |
| CO5 | Understand the basic features of particle interactions, types of particles, and their families. |

**B. Sc. Chemistry**

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| **S No** | **Class & Semester** | **Course & Course Code** | **COs** | **Course Outcomes** |
| **01** | **B.Sc. & I-Sem** | **B. Sc. Physical Science/Bioscience**  **(CHE5101T)** | CO 1 | Define fundamental principles such as Bohr’s theory, dual nature of matter. Schrödinger equation, quantum numbers, VSEPR theory, and bonding concepts. |
| CO2 | Illustrate the limitations of Bohr’s theory, interpret the shapes of atomic orbitals, describe resonance structures, and explain bonding theories such as ionic, covalent, and metallic bonds. |
| CO3 | Differentiate between bonding types, evaluate the stability of molecules using concepts like exchange energy and polarizability, and analyze molecular geometries using VSEPR and hybridization theories. |
| CO4 | Solve problems involving electronic configurations, hybridization, Born-Haber cycles, lattice energies, and dipole moments to predict chemical and physical properties of compounds. |
| CO5 | Examine weak chemical interactions, assess their effects on physical properties like melting and boiling points, and analyze gas behavior using kinetic theory and van der Waals equations. |
| **02** | **B. Sc. (Physical Science/Bioscience) IInd Semester** | **Chemistry-II**    **(CHE5201T)** | CO1 | Describe the general characteristics, diagonal relationships, and anomalous behavior of s- and p-block elements. List the properties and reactions of their hydrides, oxides, and other compounds. |
| CO2 | Interpret the preparation, properties, and chemical reactions of alkanes, alkenes, cycloalkanes, and alkynes. Illustrate mechanisms such as free radical substitution, electrophilic addition, and nucleophilic addition in hydrocarbons. |
| CO3 | Solve problems involving the calculation of bond energies, enthalpy changes, and entropy changes using thermochemical data and laws of thermodynamics. Use Kirchhoff’s equation to study temperature dependence of reaction enthalpy. |
| CO4 | Evaluate the factors affecting chemical equilibria and ionic equilibria, including Le Chatelier’s principle, pH, hydrolysis, and buffer solutions. Analyze the relationships between equilibrium constants for gas-phase reactions. |
| CO5 | Examine the structure, bonding, and reactions of dienes, silicones, and borazine. Analyze the industrial applications of hydrocarbons and interpret the role of reaction energetics and equilibria in real-world chemical processes. |

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| **S No** | **Class & Semester** | **Course & Course Code** | **COs** | **Course Outcomes** |
| **01** | **B.Sc. & IIIrd-Sem** | **Solutions, phase equilibrium, conductance, electrochemistry & functional group organic chemistry-II (BSC/CC/307)** | CO 1 | Understand the thermodynamic principles of ideal and non-ideal solutions, including Raoult’s law, vapor pressure curves, and azeotropes. |
| CO2 | Learn the fundamentals of conductance, transference number, and applications in titrations, along with the principles of electrochemistry, including Nernst equation and EMF calculations. |
| CO3 | Gain knowledge on the preparation, reactions, and interconversion of carboxylic acids, their derivatives, and amines, including important reactions like Hell-Vohlard-Zelinsky and Hofmann elimination. |
| CO4 | Explore the structure and synthesis of amino acids, peptides, and proteins, including techniques like Edman degradation and Merrifield solid-phase synthesis. |
| CO5 | Understand the classification, properties, and structures of carbohydrates, including glucose, fructose, disaccharides, and polysaccharides, and methods of determining configurations. |
| **2** | **B. Sc. (Physical Science/Bioscience) IVth Semester** | **Cc-transition metal & coordination chemistry, states of matter & chemical kinetics**  **(BSC/CC/407)** | CO1 | Understand the terms, ligand, denticity of ligands, chelate, coordination number and use standard rules to name coordination compounds. |
| CO2 | Discuss the various types of isomerism possible in such compounds and understand the types of isomerism possible in a metal complex. |
| CO3 | Use Valence Bond Theory to predict the structure and magnetic behaviour of metal complexes and understand the terms inner and outer orbital complexes. |
| CO4 | Explain the meaning of the terms Δo.S, Δt, pairing energy, CFSE, high spin and low spin and how CFSE affects thermodynamic properties like lattice enthalpy and hydration enthalpy. |
| CO5 | Write rate law and derive rate equations for simple and complex reactions and understanding of theories of reaction rates. |

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| **S No** | **Class & Semester** | **Course & Course Code** | **COs** | **Course Outcomes** |
| **01** | **B.Sc. Vth Sem** | **Green Chemistry**  **(BSC/DSC/501A/507A)** | CO 1 | Explain the fundamental concepts of green chemistry, its definition, need, and goals, emphasizing its role in promoting sustainable and eco-friendly chemical processes. |
| CO2 | Apply the Twelve Principles of Green Chemistry to design environmentally benign chemical syntheses, focusing on waste prevention, atom economy, and minimizing hazardous substances. |
| CO3 | Analyze the use of green solvents, alternative energy sources (microwave, ultrasonic energy), and catalytic reagents in chemical reactions to enhance sustainability and reduce environmental impact. |
| CO4 | Evaluate strategies for preventing chemical accidents and designing inherently safer processes, using real-world case studies like the Bhopal Gas Tragedy and safer alternatives to industrial accidents. |
| CO5 | Illustrate the application of green chemistry through examples like the green synthesis of adipic acid, environmentally safe antifoulants, recyclable carpets, and healthier fats and oils, while considering future trends in sustainable development. |
| **02** | **B.Sc. Vth Sem** | **Pharmaceutical Chemistry**  **(BSC/SEC/501C/507C)** | CO 1 | Recall fundamental concepts related to drug discovery, design, and development, along with the retrosynthetic approach and classification of drugs based on their therapeutic effects. |
| CO2 | Explain the synthesis pathways of representative drugs, including analgesics (Aspirin, Paracetamol, Ibuprofen), antipyretics, anti-inflammatory agents, and antibiotics (Chloramphenicol). |
| CO3 | Demonstrate the application of retrosynthetic methods to design the synthesis of antibacterial (e.g., Sulphonamides) and antiviral agents (e.g., Acyclovir), as well as CNS and cardiovascular drugs (e.g., Phenobarbital, Diazepam, Glyceryl Trinitrate). |
| CO4 | Analyze the production processes involved in aerobic and anaerobic fermentation for the development of products like ethyl alcohol, citric acid, antibiotics (Penicillin, Cephalosporin), and vitamins (Vitamin B2, B12, and C). |
| CO5 | Evaluate the effectiveness and biochemical synthesis strategies of drugs for specific therapeutic applications such as anti-leprosy (Dapsone), HIV/AIDS-related drugs (AZT-Zidovudine), and other pharmaceutical products derived through fermentation. |
| **03** | **B. Sc. (Physical Science/ Bioscience VIth Semester** | **Quantum Chemistry, Spectroscopy & photochemistry**  **(BSC/DSC/607A)** | CO1 | Define and explain the postulates of quantum mechanics, quantum operators, and the Schrödinger equation. |
| CO2 | Illustrate and interpret solutions to quantum systems like the particle-in-a-box, simple harmonic oscillator, and rigid rotator. |
| CO3 | Apply VB and MO theories to model and predict molecular bonding, including homonuclear and heteronuclear diatomic molecules. |
| CO4 | Examine and solve problems in rotational, vibrational, and electronic spectroscopy, including selection rules and spectral line intensities. |
| CO5 | Analyze and interpret spectral data from NMR, ESR, and Raman spectroscopy to deduce molecular structures. |
| **04** | **B. Sc. (Physical Science/ Bioscience) VIth Semester** | **Bioinorganic and Environmental chemistry (BSC/DSC/601A)** | CO1 | Explain the significance of metal ions such as Na⁺, K⁺, Mg²⁺, and Ca²⁺ in biological processes. |
| CO2 | Define and describe the major segments of the environment, including atmosphere, hydrosphere, and biosphere. |
| CO3 | Recognize the major air pollutants (e.g., SO₂, CO₂, CO, NOₓ, H₂S) and their sources. |
| CO4 | Explain the hydrological cycle, sources of water pollution, and their impacts on ecosystems. |
| CO5 | Analyze pollution sources from industries such as electroplating, textile, tannery, dairy, petroleum, and fertilizers. |

**BSC Bioscience**

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| **Sr. No** | **Class & Semester** | **Course & Course Code** | **COs** | **Course Outcomes** |
| 01 | B.Sc & 1st -Semester | Structure & Function of Non-Chordate (ZOO51M1T) | CO1 | Understanding the basic principles and criteria behind the classification of all organisms. |
| CO2 | Categorizing animals based on shared characteristics and evolutionary relationships. |
| CO3 | Exploring foundational morphological and developmental criteria for classification. |
| CO4 | Learning the structural and life cycle aspects of protozoans, sponges, and cnidarians. |
| CO5 | Delving into the structure and reproductive cycles of more complex invertebrates. |
| 02 | B.Sc & 1st-Semester | Biology of Non-Chordates  (ZOO5101T) | CO1 | Understand the constraints on organism survival based on resource availability and environmental conditions. |
| CO2 | Learn how species coexist and compete, influencing biodiversity and ecosystem function. |
| CO3 | Recognize the transitional zones between ecosystems, and their role in species richness. |
| CO4 | Comprehend the transfer of energy through ecosystems, and the interdependencies among organisms. |
| CO5 | Visualize the structure of ecosystems in terms of energy, biomass, and numbers. |
| 03 | B.Sc & 1st -Semester | Diversity of plant- kingdom  (BOT5101T) | CO1 | Able to apply various classification systems to identify and categorize different species within these groups. |
| CO2 | Able to demonstrate the reproductive processes in algae and fungi by explaining the stages involved in their life cycles. |
| CO3 | Able to identify & explain the economic & ecological applications of diverse life forms in industry, medicine, and environmental sustainability. |
| CO4 | Will learn to analyze and compare the morphological structures of various life forms, identifying key features and adaptations. |
| CO5 | Able to apply their knowledge to identify different species of diverse life forms in practical settings and their uses & importance in daily life. |
| 04 | B.Sc & 1st -Semester | Introduction & scope of Microbiology (MMB5101T) | CO1 | Acquainted with the historical developments and contributions of eminent scientists which led to the development of microbiology as a scientific discipline. |
| CO2 | Learn the different systems of classification & acquired knowledge on the characteristics and diversity prevalent among acellular and cellular microorganisms. |
| CO3 | Able to list important human diseases and their causative agents & also acquire knowledge about the immune system. |
| CO4 | Conversant with microbial interactions; the impact of microorganisms on agriculture and environment will also be dealt with. |
| CO5 | **Gained an insight into the types of fermentation processes, fermenters and the application of microorganisms in metabolites/biomass production.** |
| 05 | B.Sc & 2nd -Semester | Comparative Anatomy and Development Biology of Vertebrates (ZOO5201T) | CO1 | Understand the basic classification and salient features of the phylum Chordata up to the order level, including subclasses in mammals. |
| CO2 | Describe the salient features of Herdmania, Branchiostoma, and Petromyzon (Sea Lamprey). |
| CO3 | Identify the structure and function of the swim bladder and accessory respiratory organs in fishes. |
| CO4 | Differentiate between venomous and non-venomous snakes and understand the adaptations for flight in birds. |
| CO5 | Analyze the concept of adaptive radiation in mammals and its evolutionary significance. |
| 06 | B.Sc & 2nd -Semester | Structure and function of Chordates  (ZOO52M1T) | CO1 | Understand the general characters and classification of Chordata, including lower Chordates and Agnatha. |
| CO2 | Classify fishes up to the class level, and describe their scales, fins, migration, and parental care. |
| CO3 | Study the general characters of amphibians, focusing on Rana tigrina, parental care, neoteny, and paedogenesis. |
| CO4 | Identify poisonous and non-poisonous snakes, and understand their biting mechanism. |
| CO5 | Learn the characteristics and adaptations of birds like Columba (Pigeon) and study mammalian classification with a focus on the economic importance of mammals such as rabbits. |
| 07 | B.Sc & 2nd -Semester | Cell Biology, Genetics and Plant Breeding  (BOT5201T) | CO1 | **Understanding Cell Structure and Function**: Students will be able to describe and differentiate between eukaryotic and prokaryotic cells. |
| CO2 | Gain knowledge about the structure of chromosomes; understand the differences between euchromatin and heterochromatin. |
| CO3 | **A**ble to explain the processes of mitosis and meiosis, including their stages and significance in the life cycle of cells. |
| CO4 | Gain knowledge to apply Mendelian principles of inheritance and understand deviations such as incomplete dominance, codominance, lethality, and epistasis. |
| CO5 | Understand structural and numerical chromosomal aberrations, the types and molecular basis of mutations, and the role of chemical and physical mutagens. |
| 08 | B.Sc & 2nd -Semester | Bacteriology and Virology  (MMB5201T) | CO1 | Explain the fundamental differences between bacteria, viruses, and other microorganisms. |
| CO2 | Describe the morphology, structure, genetics, and physiology of bacteria and viruses. |
| CO3 | Understand microbial pathogenesis, including how bacteria and viruses cause diseases in humans, animals, and plants. |
| CO4 | Explain the mechanisms of bacterial and viral replication and how they interact with host cells. |
| CO5 | Understand the principles of microbial classification, taxonomy, and identification techniques. |
| 09 | B.Sc & 3rd -Semester | Physiology & Biochemistry  (ZOO5003T) | CO1 | Describe the structure and function of neurons, skeletal muscles, the nephron, the heart, and the alimentary canal. |
| CO2 | Explain the mechanisms of action potentials in neurons, muscle contraction, digestion, pulmonary ventilation, and urine formation. |
| CO3 | Analyze the coordination of respiratory gases transport, cardiac cycles, and hormonal control of reproduction. |
| CO4 | Illustrate the pathways and regulatory mechanisms involved in carbohydrate, lipid, and protein metabolism. |
| CO5 | Evaluate the role of enzymes in biochemical reactions, including their kinetics, inhibition, and regulatory mechanisms. |
| 10 | B.Sc & 3rd -Semester | Human Physiology  (ZOO50M3T) | CO1 | Understand the process of digestion, absorption and respiration along with the control mechanism. |
| CO2 | Understand the process of blood and lymph circulation along with the process of coagulation. |
| CO3 | Understand the structure of heart and cardiac cycle along with its control mechanism. |
| CO4 | Understand the process of impulse generation and conduction as well as the role of endocrine system in physiology. |
| CO5 | Understand the structure and function of muscles. |
| 11 | B.Sc & 3rd -Semester | Plant Anatomy and Embryology  (BOT5003T) | CO1 | Learn about various plants parts, embryonic development, breeding activity and conservation techniques. |
| CO2 | Develop an understanding of concepts and fundamentals of plant anatomy. |
| CO3 | Examine the internal anatomy of plant systems and organs. |
| CO4 | Develop critical understanding on the evolution of concept of organization of shoot and root apex. |
| CO5 | Analyze the composition of different parts of plants and their relationships. |
| 12 | B.Sc & 3rd -Semester | Microbial Metabolism (MMB5003T) | CO1 | Acquainted with the diverse physiological groups of bacteria/ archea and transport systems commonly employed by microbes. |
| CO2 | Get sufficient knowledge of bacterial bacterial growth curve, calculation of generation time and effect of environmental factors on the growth. |
| CO3 | Understand catabolic pathways of energy generation and conservation as well as familiar with the concepts of aerobic respiration and fermentation in microbes. |
| CO4 | Conversant with the groups of microbes having ability to extract energy from inorganic compounds and assimilate carbon from CO2 (chemolithotrophs) |
| CO5 | Knowledge on the families of phototrophic microorganisms. Students would also be aware of differences between anoxygenic and oxygenic photosynthesis. |
| 13 | B.Sc & 4th - Semester | Genetics and Evolutionary Biology  (ZOO5004T) | CO1 | Explain Mendel’s laws, extensions of inheritance, and chromosomal mechanisms of heredity. |
| CO2 | Describe linkage, crossing over, and techniques for chromosomal mapping. |
| CO3 | Classify mutations and explain mechanisms of sex determination and dosage compensation. |
| CO4 | Summarize evolutionary theories and analyze direct evidence such as fossils and phylogenetic trends. |
| CO5 | Apply population genetics principles to explain species evolution, macro-evolution, and the impact of extinction. |
| 14 | B.Sc & 4th - Semester | Economic Zoology  (ZOO50M4T) | CO 1 | Understands silkworms rearing and their products. |
| CO2 | Gain knowledge in Bee keeping equipment and apiary management. |
| CO3 | Acquaint knowledge about the culture techniques of poultry. |
| CO4 | Acquaint the knowledge about basic procedure and methodology of Vermiculture. |
| CO5 | Learn various concepts of pearl culture. |
| 15 | B.Sc & 4th - Semester | Structure & function of non-chordate (ZOO50M1T) | CO 1 | Understand the constraints on organism survival based on resource availability and environmental conditions. |
| CO2 | Learn how species coexist and compete, influencing biodiversity and ecosystem function. |
| CO3 | Recognize the transitional zones between ecosystems, and their role in species richness. |
| CO4 | Comprehend the transfer of energy through ecosystems, and the interdependencies among organisms. |
| CO5 | Visualize the structure of ecosystems in terms of energy, biomass, and numbers. |
| 16 | B.Sc & 4th - Semester | Plant Physiology and Metabolism (BOT5004T) | CO 1 | Understand Water relation of plants with respect to various physiological processes. |
| CO2 | Explain chemical properties and deficiency symptoms in plants |
| CO3 | Classify aerobic and anaerobic respiration |
| CO4 | Explain the significance of Photosynthesis and respiration |
| CO5 | Assess dormancy and germination of seeds |
| 17 | B.Sc & 4th - Semester | Microbial genetics and Molecular biology  (MMB5004T) | CO1 | Understanding Microbial Genetics & the structure, organization, and function of microbial genomes. |
| CO2 | Describe genetic variations in microbes, including mutations, recombination, and horizontal gene transfer, gene expression regulation in bacteria and viruses. |
| CO3 | Understand DNA replication, transcription, and translation in prokaryotes, operon models and gene regulatory mechanisms. |
| CO4 | Describe plasmids, transposons, and bacteriophages and their role in genetic variation. |
| CO5 | Apply molecular biology techniques such as PCR, cloning, and gene editing. |
| 18 | B.Sc & 5th - Semester | Applied Zoology  (BSC/ DSE /503) | CO1 | Understand the fundamental concepts and terminologies of host-parasite relationships, focusing on various parasites and their impact on hosts. |
| CO2 | Learn the transmission, prevention, and control methods of diseases like tuberculosis and typhoid. |
| CO3 | Gain knowledge about the life cycles, pathogenicity, and management of important parasites, including spirochaetes, rickettsiae, protozoa, and helminths. |
| CO4 | Study the biology of key agricultural and medical pests and apply control measures to mitigate their impact. |
| CO5 | Explore artificial reproductive techniques, dairy technology, poultry breeding, and aquaculture innovations, focusing on practical applications in animal husbandry and fish technology. |
| 19 | B.Sc & 5th - Semester | Genetic Engineering & Biotechnology  (BSC/ DSE /502 A) | CO1 | Acquainted with historical developments in the field of biotechnology as well as hands-on training about of methods of DNA, RNA and protein analyses. |
| CO2 | In-depth understanding of the exploitation of restriction and DNA-modifying enzymes in recombinant DNA technology, along with the use of linkers and adapters. |
| CO3 | Acquired detailed knowledge of the use of different cloning vectors and different types of expression vectors used to express heterologous proteins in bacteria, yeast, insect cells and mammalian cells. |
| CO4 | Learnt of amplification and quantification of DNA and RNA, construction of genomic and cDNA libraries, and whole genome sequencing. |
| CO5 | Acquainted with understanding of gene delivery methods in different organisms thus acquired knowledge of genetic engineering for development of products of human therapeutic interest. |
| 20 | B.Sc & 5th - Semester | Reproductive Biology  (BSC/ DSE /603(B) | CO1 | Understand the functioning of male and female reproductive systems particularly in humans. |
| CO2 | Understanding the hormonal regulation of the reproductive systems (e.g., menstrual cycle, spermatogenesis). |
| CO3 | Detailed understanding of gametogenesis (sperm and egg production) & mechanisms of fertilization at the cellular and molecular levels. |
| CO4 | Understanding early embryonic development (from zygote to blastocyst) and implantation. |
| CO5 | Get knowledge about assisted reproductive technologies to face the challenges of growing incidence of infertility. |
|  | B.Sc & 6th - Semester | Industrial & Food Microbiology  (BSC/ DSE /602 A) | CO1 | Acquired knowledge about different types of fermentation processes & acquainted with types of fermenters and the components of a typical fermenter. |
| CO2 | Learnt the various techniques involved in the isolation, screening, preservation, and maintenance of industrial strains. They will also be familiar with the ingredients used in a fermentation medium. |
| CO3 | Gained in-depth knowledge about the microbial production of various products and enzymes in the industry along with their downstream processing. |
| CO4 | Understanding of important parameters affecting microbial growth in foods. Spoilage of some common foods by microorganisms & acquire knowledge of commonly occurring food borne diseases. |
| CO5 | Acquainted with different physical methods and chemicals used in food preservation. The student will also be aware of the concept of quality control of food. |

**BSC Bioscience**

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| **Sr. No** | **Class & Semester** | **Course & Course Code** | **COs** | **Course Outcomes** |
| 01 | B.Sc & 1st -Semester | Structure & Function of Non-Chordate (ZOO51M1T) | CO1 | Understanding the basic principles and criteria behind the classification of all organisms. |
| CO2 | Categorizing animals based on shared characteristics and evolutionary relationships. |
| CO3 | Exploring foundational morphological and developmental criteria for classification. |
| CO4 | Learning the structural and life cycle aspects of protozoans, sponges, and cnidarians. |
| CO5 | Delving into the structure and reproductive cycles of more complex invertebrates. |
| 02 | B.Sc & 1st-Semester | Biology of Non-Chordates  (ZOO5101T) | CO1 | Understand the constraints on organism survival based on resource availability and environmental conditions. |
| CO2 | Learn how species coexist and compete, influencing biodiversity and ecosystem function. |
| CO3 | Recognize the transitional zones between ecosystems, and their role in species richness. |
| CO4 | Comprehend the transfer of energy through ecosystems, and the interdependencies among organisms. |
| CO5 | Visualize the structure of ecosystems in terms of energy, biomass, and numbers. |
| 03 | B.Sc & 1st -Semester | Diversity of plant- kingdom  (BOT5101T) | CO1 | Able to apply various classification systems to identify and categorize different species within these groups. |
| CO2 | Able to demonstrate the reproductive processes in algae and fungi by explaining the stages involved in their life cycles. |
| CO3 | Able to identify & explain the economic & ecological applications of diverse life forms in industry, medicine, and environmental sustainability. |
| CO4 | Will learn to analyze and compare the morphological structures of various life forms, identifying key features and adaptations. |
| CO5 | Able to apply their knowledge to identify different species of diverse life forms in practical settings and their uses & importance in daily life. |
| 04 | B.Sc & 1st -Semester | Introduction & scope of Microbiology (MMB5101T) | CO1 | Acquainted with the historical developments and contributions of eminent scientists which led to the development of microbiology as a scientific discipline. |
| CO2 | Learn the different systems of classification & acquired knowledge on the characteristics and diversity prevalent among acellular and cellular microorganisms. |
| CO3 | Able to list important human diseases and their causative agents & also acquire knowledge about the immune system. |
| CO4 | Conversant with microbial interactions; the impact of microorganisms on agriculture and environment will also be dealt with. |
| CO5 | **Gained an insight into the types of fermentation processes, fermenters and the application of microorganisms in metabolites/biomass production.** |
| 05 | B.Sc & 2nd -Semester | Comparative Anatomy and Development Biology of Vertebrates (ZOO5201T) | CO1 | Understand the basic classification and salient features of the phylum Chordata up to the order level, including subclasses in mammals. |
| CO2 | Describe the salient features of Herdmania, Branchiostoma, and Petromyzon (Sea Lamprey). |
| CO3 | Identify the structure and function of the swim bladder and accessory respiratory organs in fishes. |
| CO4 | Differentiate between venomous and non-venomous snakes and understand the adaptations for flight in birds. |
| CO5 | Analyze the concept of adaptive radiation in mammals and its evolutionary significance. |
| 06 | B.Sc & 2nd -Semester | Structure and function of Chordates  (ZOO52M1T) | CO1 | Understand the general characters and classification of Chordata, including lower Chordates and Agnatha. |
| CO2 | Classify fishes up to the class level, and describe their scales, fins, migration, and parental care. |
| CO3 | Study the general characters of amphibians, focusing on Rana tigrina, parental care, neoteny, and paedogenesis. |
| CO4 | Identify poisonous and non-poisonous snakes, and understand their biting mechanism. |
| CO5 | Learn the characteristics and adaptations of birds like Columba (Pigeon) and study mammalian classification with a focus on the economic importance of mammals such as rabbits. |
| 07 | B.Sc & 2nd -Semester | Cell Biology, Genetics and Plant Breeding  (BOT5201T) | CO1 | **Understanding Cell Structure and Function**: Students will be able to describe and differentiate between eukaryotic and prokaryotic cells. |
| CO2 | Gain knowledge about the structure of chromosomes; understand the differences between euchromatin and heterochromatin. |
| CO3 | **A**ble to explain the processes of mitosis and meiosis, including their stages and significance in the life cycle of cells. |
| CO4 | Gain knowledge to apply Mendelian principles of inheritance and understand deviations such as incomplete dominance, codominance, lethality, and epistasis. |
| CO5 | Understand structural and numerical chromosomal aberrations, the types and molecular basis of mutations, and the role of chemical and physical mutagens. |
| 08 | B.Sc & 2nd -Semester | Bacteriology and Virology  (MMB5201T) | CO1 | Explain the fundamental differences between bacteria, viruses, and other microorganisms. |
| CO2 | Describe the morphology, structure, genetics, and physiology of bacteria and viruses. |
| CO3 | Understand microbial pathogenesis, including how bacteria and viruses cause diseases in humans, animals, and plants. |
| CO4 | Explain the mechanisms of bacterial and viral replication and how they interact with host cells. |
| CO5 | Understand the principles of microbial classification, taxonomy, and identification techniques. |
| 09 | B.Sc & 3rd -Semester | Physiology & Biochemistry  (ZOO5003T) | CO1 | Describe the structure and function of neurons, skeletal muscles, the nephron, the heart, and the alimentary canal. |
| CO2 | Explain the mechanisms of action potentials in neurons, muscle contraction, digestion, pulmonary ventilation, and urine formation. |
| CO3 | Analyze the coordination of respiratory gases transport, cardiac cycles, and hormonal control of reproduction. |
| CO4 | Illustrate the pathways and regulatory mechanisms involved in carbohydrate, lipid, and protein metabolism. |
| CO5 | Evaluate the role of enzymes in biochemical reactions, including their kinetics, inhibition, and regulatory mechanisms. |
| 10 | B.Sc & 3rd -Semester | Human Physiology  (ZOO50M3T) | CO1 | Understand the process of digestion, absorption and respiration along with the control mechanism. |
| CO2 | Understand the process of blood and lymph circulation along with the process of coagulation. |
| CO3 | Understand the structure of heart and cardiac cycle along with its control mechanism. |
| CO4 | Understand the process of impulse generation and conduction as well as the role of endocrine system in physiology. |
| CO5 | Understand the structure and function of muscles. |
| 11 | B.Sc & 3rd -Semester | Plant Anatomy and Embryology  (BOT5003T) | CO1 | Learn about various plants parts, embryonic development, breeding activity and conservation techniques. |
| CO2 | Develop an understanding of concepts and fundamentals of plant anatomy. |
| CO3 | Examine the internal anatomy of plant systems and organs. |
| CO4 | Develop critical understanding on the evolution of concept of organization of shoot and root apex. |
| CO5 | Analyze the composition of different parts of plants and their relationships. |
| 12 | B.Sc & 3rd -Semester | Microbial Metabolism (MMB5003T) | CO1 | Acquainted with the diverse physiological groups of bacteria/ archea and transport systems commonly employed by microbes. |
| CO2 | Get sufficient knowledge of bacterial bacterial growth curve, calculation of generation time and effect of environmental factors on the growth. |
| CO3 | Understand catabolic pathways of energy generation and conservation as well as familiar with the concepts of aerobic respiration and fermentation in microbes. |
| CO4 | Conversant with the groups of microbes having ability to extract energy from inorganic compounds and assimilate carbon from CO2 (chemolithotrophs) |
| CO5 | Knowledge on the families of phototrophic microorganisms. Students would also be aware of differences between anoxygenic and oxygenic photosynthesis. |
| 13 | B.Sc & 4th - Semester | Genetics and Evolutionary Biology  (ZOO5004T) | CO1 | Explain Mendel’s laws, extensions of inheritance, and chromosomal mechanisms of heredity. |
| CO2 | Describe linkage, crossing over, and techniques for chromosomal mapping. |
| CO3 | Classify mutations and explain mechanisms of sex determination and dosage compensation. |
| CO4 | Summarize evolutionary theories and analyze direct evidence such as fossils and phylogenetic trends. |
| CO5 | Apply population genetics principles to explain species evolution, macro-evolution, and the impact of extinction. |
| 14 | B.Sc & 4th - Semester | Economic Zoology  (ZOO50M4T) | CO 1 | Understands silkworms rearing and their products. |
| CO2 | Gain knowledge in Bee keeping equipment and apiary management. |
| CO3 | Acquaint knowledge about the culture techniques of poultry. |
| CO4 | Acquaint the knowledge about basic procedure and methodology of Vermiculture. |
| CO5 | Learn various concepts of pearl culture. |
| 15 | B.Sc & 4th - Semester | Structure & function of non-chordate (ZOO50M1T) | CO 1 | Understand the constraints on organism survival based on resource availability and environmental conditions. |
| CO2 | Learn how species coexist and compete, influencing biodiversity and ecosystem function. |
| CO3 | Recognize the transitional zones between ecosystems, and their role in species richness. |
| CO4 | Comprehend the transfer of energy through ecosystems, and the interdependencies among organisms. |
| CO5 | Visualize the structure of ecosystems in terms of energy, biomass, and numbers. |
| 16 | B.Sc & 4th - Semester | Plant Physiology and Metabolism (BOT5004T) | CO 1 | Understand Water relation of plants with respect to various physiological processes. |
| CO2 | Explain chemical properties and deficiency symptoms in plants |
| CO3 | Classify aerobic and anaerobic respiration |
| CO4 | Explain the significance of Photosynthesis and respiration |
| CO5 | Assess dormancy and germination of seeds |
| 17 | B.Sc & 4th - Semester | Microbial genetics and Molecular biology  (MMB5004T) | CO1 | Understanding Microbial Genetics & the structure, organization, and function of microbial genomes. |
| CO2 | Describe genetic variations in microbes, including mutations, recombination, and horizontal gene transfer, gene expression regulation in bacteria and viruses. |
| CO3 | Understand DNA replication, transcription, and translation in prokaryotes, operon models and gene regulatory mechanisms. |
| CO4 | Describe plasmids, transposons, and bacteriophages and their role in genetic variation. |
| CO5 | Apply molecular biology techniques such as PCR, cloning, and gene editing. |
| 18 | B.Sc & 5th - Semester | Applied Zoology  (BSC/ DSE /503) | CO1 | Understand the fundamental concepts and terminologies of host-parasite relationships, focusing on various parasites and their impact on hosts. |
| CO2 | Learn the transmission, prevention, and control methods of diseases like tuberculosis and typhoid. |
| CO3 | Gain knowledge about the life cycles, pathogenicity, and management of important parasites, including spirochaetes, rickettsiae, protozoa, and helminths. |
| CO4 | Study the biology of key agricultural and medical pests and apply control measures to mitigate their impact. |
| CO5 | Explore artificial reproductive techniques, dairy technology, poultry breeding, and aquaculture innovations, focusing on practical applications in animal husbandry and fish technology. |
| 19 | B.Sc & 5th - Semester | Genetic Engineering & Biotechnology  (BSC/ DSE /502 A) | CO1 | Acquainted with historical developments in the field of biotechnology as well as hands-on training about of methods of DNA, RNA and protein analyses. |
| CO2 | In-depth understanding of the exploitation of restriction and DNA-modifying enzymes in recombinant DNA technology, along with the use of linkers and adapters. |
| CO3 | Acquired detailed knowledge of the use of different cloning vectors and different types of expression vectors used to express heterologous proteins in bacteria, yeast, insect cells and mammalian cells. |
| CO4 | Learnt of amplification and quantification of DNA and RNA, construction of genomic and cDNA libraries, and whole genome sequencing. |
| CO5 | Acquainted with understanding of gene delivery methods in different organisms thus acquired knowledge of genetic engineering for development of products of human therapeutic interest. |
| 20 | B.Sc & 5th - Semester | Reproductive Biology  (BSC/ DSE /603(B) | CO1 | Understand the functioning of male and female reproductive systems particularly in humans. |
| CO2 | Understanding the hormonal regulation of the reproductive systems (e.g., menstrual cycle, spermatogenesis). |
| CO3 | Detailed understanding of gametogenesis (sperm and egg production) & mechanisms of fertilization at the cellular and molecular levels. |
| CO4 | Understanding early embryonic development (from zygote to blastocyst) and implantation. |
| CO5 | Get knowledge about assisted reproductive technologies to face the challenges of growing incidence of infertility. |
|  | B.Sc & 6th - Semester | Industrial & Food Microbiology  (BSC/ DSE /602 A) | CO1 | Acquired knowledge about different types of fermentation processes & acquainted with types of fermenters and the components of a typical fermenter. |
| CO2 | Learnt the various techniques involved in the isolation, screening, preservation, and maintenance of industrial strains. They will also be familiar with the ingredients used in a fermentation medium. |
| CO3 | Gained in-depth knowledge about the microbial production of various products and enzymes in the industry along with their downstream processing. |
| CO4 | Understanding of important parameters affecting microbial growth in foods. Spoilage of some common foods by microorganisms & acquire knowledge of commonly occurring food borne diseases. |
| CO5 | Acquainted with different physical methods and chemicals used in food preservation. The student will also be aware of the concept of quality control of food. |