VIDYABHARTI SANSTHA, WARDHA.
DR. R. G. BHOYAR ARTS, COMMERCE & SCIENCE COLLEGE
MOHANAPUR, TH-SELOO DIST-WARDHA 442104
(FORMERLY VIDYABHARTI COLLEGE)
Affiliated To Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur.
NAAC Accredited with B+ Grade
College Index : (Sr.-699) (Jr.07.08.006)

## PROGRAM OUTCOME FOR B. SC. MATHEMATICS

| | |
|---|---|
| **Program Outcomes** | **PO1:** To develop creative and critical thinking.<br>**PO2:** To develop effective communication.<br>**PO3:** To build strong leadership qualities and develop team spirit.<br>**PO4:** To learn to become better and effective citizens of the country.<br>**PO5:** To develop moral maturity and ethical behavior.<br>**PO6:** To learn about the environment and sustainability process.<br>**PO7:** To self-direct a life-long learning system.<br>**PO8:** To learn knowledge application.<br>**PO9:** To learn analytical, scientific reasoning and problem solving.<br>**PO10:** To gain Information / Digital Literacy. |

## PROGRAM SPECIFIC OUTCOMES FOR B. SC. MATHEMATICS

| | |
|---|---|
| **Program Specific Outcomes** | **PSO1:** Construct mathematical arguments, proofs and develop mathematical as well as analytical thinking<br>**PSO2:** Critically interpret numerical data, graphical data and develop models<br>**PSO3:** Apply mathematical knowledge to a career and research related to mathematical sciences<br>**PSO4:** Apply critical thinking skills to solve problems which canbe modelled mathematically. |

## Course Outcomes B. Sc . Mathematics

| | |
|---|---|
| **Sem. I & II Paper-I: Algebra & trigonometry, Differential and difference equations** | **CO1:** Understand the applications of De Moiver's theorem, properties of groups and subgroups<br>**CO2:** Learn basic properties of first order, higher order differential equations and solve them with different methods.<br>**CO3:** Understand to find unknown solution by using known solution, the formation of difference equation, solution of homogeneous and non-homogeneous linear equation.<br>**CO4:** Understand the concepts of rank, Eigen values of matrices, solution of homogeneous and non-homogeneous system of equations. |
| **Sem I & II Paper-II:Calculus, Vector calculus & improperintegrals** | **CO1:** Understand basic properties of limit, continuity and derivability of functions, expansion of functions in terms of infinite series by using different methods.<br>**CO2:** Find indeterminate forms and partial differentiation of functions with two or more variables.<br>**CO3:** Understand basics of directional derivatives, gradient, divergence and curl.<br>**CO4:** Evaluation of double and triple integral, improper integral and their convergence. |
| **Sem III & IV Paper-I: Advanced calculus, Partial Differential equations & calculus of variations** | **CO1:** Understand concept of limit and continuity of functions of two variables, application of Mean value theorems<br>**CO2:** Study of convergence, divergence of sequences and series using various tests.<br>**CO3:** Understand ordinary differential equation in more than two variables and methods of finding solution<br>**CO4:** Study Lagrange's method, Charpit's method, Jacobi's method to solve PDE, homogeneous and non-homogeneous PDE with constant coefficients |
| **Sem III & IV Paper-II: Differential equations & group homomorphism, Mechanics** | **CO1:** Understand basic properties of Laplace transforms,inverse Laplace transforms and solution of ordinary differential equation using Laplace transform.<br>**CO2:** Study of group homomorphism, isomorphism in details.<br>**CO3:** Understand kinematics in two dimensions, mathematical exposition and geometrical representation of simple harmonic motion.<br>**CO4:** Study mechanics of system of particles and Lagrange's equations. |

| | |
|---|---|
| **Sem V & VI Paper-I:Analysis, Abstract algebra** | **CO1:** Study Fourier series and it's convergence, existence of Riemann-Stieltjes integral, construction of analytic function, harmonic function etc.<br>**CO2:** Understand conformal mapping, bilinear transformation.<br>**CO3**: Study Group automorphism, inner automorphism, vector spaces and it's properties, subspaces, basis, dimensions etc<br>**CO4:** Understand algebra of linear transformation and its inverse, matrix associated with linear map and vice versa, properties of inner product space. |
| **Sem V & VI Paper-II: Metric space, complexintegration & Algebra,Special theory of relativity** | **CO1:** Understand concepts of countable, uncountable sets, completeness, compactness, connectedness of metric space.<br>**CO2:** Calculation of zeros and different types of singularities of analytic function, application of Cauchy's residue theoremto evaluate integral.<br>**CO3:** Study geometrical interpretation, group properties of Lorentz transformations and basics of tensors, metrictensors etc.<br>**CO4:** Understand equivalence of mass and energy, transformation formulae for mass, momentum and energy, relativistic equations of motion, Maxwell's equations etc. |

## PROGRAM OUTCOME FOR B. SC. PHYSICS

| | |
|---|---|
| **Program Outcomes** | **PO1:** Gain a thorough understanding of the subject.<br>**PO2:** Lay the groundwork for future learning.<br>**PO3:** Learn the fundamentals of research.<br>**PO4:** Instill good moral and ethical ideals in yourself.<br>**PO5:** Recognize your societal and environmental responsibility.<br>**PO6:** Develop communication and professional skills.<br>**PO7:** Acquire the ability to accept a wide range of ideas and points of view.<br>**PO8:** Empower yourself to meet the demands of a changing universe. |

## PROGRAM SPECIFIC OUTCOMES FOR B. SC. PHYSICS

| | |
|---|---|
| **Program Specific Outcomes** | **PSO1:** Understand the principles of physics, matter characteristics, and electrodynamics, as well as the basic notions of scientific process.<br>**PSO2:** Understanding the theoretical foundations of quantum mechanics, relativistic physics, nuclear physics, optics, spectroscopy, solid state physics, astrophysics, statistical physics, photonics, and thermodynamics.<br>**PSO3:** Understand and apply electrical ideas in the design of various analogue and digital circuits.<br>**PSO4:** Understand the fundamentals of computer programming and numerical analysis with PSO4.<br>**PSO5:** Use laboratory experiments to test and apply theoretical principles. |

## Course Outcomes B. Sc. Physics

### B. Sc. Semester-I

| | |
|---|---|
| **Paper – I: Properties ofMatter and Mechanics: Learning Outcomes:** | **CO1:** The curriculum covers general characteristics of matter, which include solid and liquid. Elasticity is a solid property that offers a notion of material strength in three forms, as well as liquid viscosity and its relevance. Surfacetension in a liquid's geometrical form.<br>**CO2:** Mechanics covers the fundamentals. Newton's laws of motion and how they're used. Students' imagination is improved by geometrical descriptions of rules, and thestudy of restrictions leads to the area of physics known as classical mechanics. The relationship between M.I. and body movements is given by rotational motion. |
| **Paper-II: Electrostatics, Time varying fields & Electric Currents:** | Students will be able to:<br>**CO1:** State and express Coulomb's law in vector form and apply it to solve for E due to stationary charges, Electric potential due to point charge, owing to dipole, and fielddue to dipole at any place after finishing this course.<br>**CO2:** Able to establish that potential is force per unit charge and to describe V and its link to energy conceptually.<br>**CO3:** Able to explain the similarities and differences between a conductor and a dielectric, the action of an electric field, dielectric polarisation, polar and non-polar molecules, and the Classius-Mossoti equation.<br>**CO4:** When given epsilon and the free charge on the dielectrics, be able to determine the E field inside the dielectric.<br>**CO5:** Able to grasp the fundamental concepts of parallel plate capacitors, including capacity derivation with or without the use of a calculator. When given epsilon and the free charge on the dielectrics, it is possible to determine the E field inside the dielectric.<br>**CO6:** Able to grasp the fundamental concepts of parallel plate capacitors, including capacity derivation with and without dielectrics, as well as solve numerical issues.<br>**CO7:** Able to articulate and explain Faraday's laws of electromagnetic induction, self and mutual induction, transformers and their operation, transformer losses and applications, and Kirchhoff's laws.<br>**CO8:** Able to study series resonance, frequency derivation, power in an ac circuit, and solve mathematical problems. |

**B. Sc. Semester-II**

| | |
|---|---|
| **Paper-I: Oscillations, Kinetic theory of gasesand Thermodynamics:** | **CO1:** Students will be able to grasp linear and angular S.H.M., as well as the S.H.M. differential equation and its solution. Also capable of developing damped oscillation differential equations and energy dissipation via damped oscillations.<br>**CO2:** The basics and applications of forced vibrations, resonance, and its energy and quality factor will be understood by the students. Also included are gas laws and their applications.<br>**CO3:** Students will learn about gas transportation phenomena and the thermodynamics that underpin it. Also, the role of thermodynamic laws in engine efficiency. |
| **Paper-II: Gravitation, Astrophysics, Magnetism and Magneto statics:** | **CO1:** The students get an understanding of the fundamental rules of classical mechanics, which improves their understanding of planetary motion and interactions.<br>**CO2:** An introductory course in astrophysics piques students' curiosity in space science.<br>**CO3:** Studying atomic magnets at a microscopic level improves students' intellectual abilities in material research and provides insight into the relationship between electric and magnetic fields as a future key to power consumption. |

**B. Sc. Semester-III**

| | |
|---|---|
| **Paper-I: Sound waves,Applied acoustic, Ultrasonic and Power supply Learning** | **CO1:** Students learn about the many types of waves and their properties. They also learn about harmonics, sound quality, and the human ear's reaction and audibility to sound. Students may learn about sound intensity measurement and the influence of temperature on sound.<br>**CO2:** Students are familiar with various sound measurement instruments such as transducers, sound recording, and sound reproduction.<br>**CO3:** Students learn about ultrasonic waves, their characteristics, ultrasonic wave generating methods, and research applications.<br>**CO4:** Students learn about the necessity of voltage, current, and load management, as well as power supply and conversion from alternating current to direct current |
| **PHYSICS - Paper-II: Physical optics and Electromagnetic waves:** | **CO1:** Students are able to explain how light behaves as a wave.<br>**CO2:** Examine how light intensity varies owing to interference and diffraction. • Understand Michelson and Fabry-Parot Interferometer Applications<br>**CO3:** Examine the concept of polarisation and how it is used.<br>**CO4:** Understand electromagnetic waves, Maxwell's field equations, and their transverse nature.<br>**CO5:** Explain Poynting's theorem and its significance. |

**B. Sc. Semester-IV**

| | |
|---|---|
| **PHYSICS - Paper-I: Solid state physics, X-ray and Laser:** | **CO1:** Students will have a fundamental understanding of crystal systems and spatial symmetry, Miller indices, and how different diffraction methods are used to study crystalline materials.<br>**CO2:** Be familiar with the notion of a reciprocal space lattice and the meaning of Brillouin zones.<br>**CO3:** Students will be able to identify the different types, characteristics, and uses of X-rays.<br>**CO4:** Students explain the fundamentals of lasers, how they are made, and how they are used. |
| **PHYSICS - Paper-II: Solid state electronics, and Molecular physics:** | **CO1:** Students will learn the fundamentals, manufacturing, and applications of LED, Solar Cell, and BJT in everyday life, as well as the concepts, applications, and special characteristics of FET, JFET, and MOSFET.<br>**CO2:** Students will be able to explain and quantify vibrational and rotational energy, kinds of molecules, diatomic molecules as harmonic and anharmonic oscillators, rotational-vibrational spectra, and the Born Oppenheimer approximation.<br>**CO3:** Students who understand the relevance and applicability of Raman spectroscopy in molecular physics are also familiar with the Frank-Condon principle, the fundamentals of NMR and ESR, and their spectroscopic applications. |

**B. Sc. Semester-V**

| | |
|---|---|
| **Paper-I: Atomic physics, free electrontheory and Statisticalphysics:** | **CO1:** Students comprehend the many theories of the atomic model, as well as the various quantum numbers. The student also investigates how the momentums and magnetic moments associated with various electron motions are orientated, as well as their interactions.<br>**CO2:** Students learn about electron conduction, both electrical and thermal. Fermi temperature band, Fermi energy. Free electron theory: different theorems, models, and experiments Material classification is also important.<br>**CO3:** The student gains an understanding of - space, Gamma space, probability distribution, and thermodynamic probability, Principle of a priori probability, Boltzmann's entropy relation, different states, Maxwell Boltzmann distribution law, and its application; Boltzmann's entropy relation; Boltzmann's entropy relation; Boltzmann'sentropy relation; Boltzmann's entropy relation; Boltzmann' Students will also study Bose-Einstein statistics, as well as the Fermi Dirac distribution and how to use it. |

| | |
|---|---|
| **Paper-II: Quantum mechanics, Nanomaterials and Nanotechnology:** | Students will be able to:<br>**CO1:** Understand the major components of quantum mechanics' historical evolution, as well as wave characteristics of matter, after finishing this course.<br>**CO2:** Capable of relating classical mechanics to quantum mechanics.<br>**CO3:** Able to solve Schrodinger equations in one to three dimensions and understand them physically.<br>**CO4:** Familiarity with the fundamentals of nanoscience and nanotechnology, as well as their relevance in everyday life. |

**B. Sc. Semester-VI**

| | |
|---|---|
| **Paper-I: Relativity, Nuclear physics and Bio Physics** | **CO1:** Students comprehend frame of reference, special theory of relativity postulates, and relativistic variation in length, time, mass, velocity addition, and mass energy equivalence.<br>**CO2:** They can design radiation detectors, charge accelerators, and nuclear reactions, as well as the many types of nuclear processes and their significance in modern technology.<br>**CO3:** Students are able to describe and grasp the essential ideas of decay particles.<br>**CO4:** Students will be able to understand bio physics and its significance in the medical profession. |
| **Paper-II: Electronics,Fiber optics, Communication and Digital electronics** | **CO1:** Students will understand the construction and operation of amplifiers and oscillators, as well as their applications.<br>**CO2:** Students will be able to understand the fundamental principles and operations of fiber optics, as well as the importance of optical fibre, light wave propagation in optical fiber, and its role in communication.<br>**CO3:** They will also be familiar with communication kindssuch as AM and FM, as well as their core theory and how television is broadcast using these methods.<br>**CO4:** The students will be able to understand how large amounts of data are kept in current times utilizing technologies such as Number Systems, as well as the theory behind it. |

# PROGRAM OUTCOME FOR B. SC. CHEMISTRY

| | |
|---|---|
| **Program Outcomes** | **PO1:** The Programme enables the students to understand basic facts and concepts in Chemistry.<br>**PO2:** To develop the ability to apply the principles of Chemistry, to develop problem solving skills, to become familiar with the emerging areas of Chemistry and their applications in various spheres of Chemical sciences and to apprise the students of its relevance in future studies.<br>**PO3:** Students know about importance of Qualitative and Quantitative analysis used for different samples like soil samples, alloys estimation, water analysis. New technological world using nanomaterials, properties of nano materials magnetic properties of materials.<br>**PO4:** Thermodynamic and Thermochemistry useful in our daily life and related with our surrounding atmosphere.<br>**PO5:** Nuclear Magnetic resonance spectroscopy allows the molecular structure of a material to be analyzed by observing the measuring the interaction of nuclear spins when placed in a powerful magnetic field and extensively used in medicine in the form of magnetic resonance imaging and for analysis of chemicals.<br>**PO6:** Bioinorganic chemistry provides knowledge about significant role of metal ions in biological system which is required for the maintenance of life.<br>**PO7:** Student can describe the process It also develops skills in the proper handling of apparatus and chemicals and also gets exposure to the different processes used in industries and their applications.<br>**PO8:** Use modern techniques used in analysis of materials and handling of the new equipment during the practical.<br>**PO9:** To inculcates the scientific temperament in the studentsduring the experiments and how to corelate with outside the scientific community. |

# PROGRAM SPECIFIC OUTCOMES FOR B. SC. CHEMISTRY

| | |
|---|---|
| **Program Specific Outcomes** | **PSO1:** The B.Sc. programme enabled the students to enhance their critical thinking, during the three years period of study and the curriculum motivates the mental thoughts and suppositions of the students. This helps the students to take up practical work and compare the results with their assumptions, there by leading to accuracy and validity of the practical knowledge. This Analysis leads to take decisions at intellectual, directorial and personal from different perspectives of life.<br>**PSO2:** Understand the basic principles and concepts underlying the inorganic, organic and physical chemistry.<br>**PSO3:** Comprehend the applications of chemistry in various walks of life.<br>**PSO4:** Students gained functional knowledges of the fundamental theoretical concepts and experimental methods of Chemistry.<br>**PSO5:** The students will be benefited to equip themselves to job requirements in the quality control, analytical laboratory or production wing of any Chemical or Pharmaceutical industry.<br>**PSO6:** Able to use instrumental methods of chemical analyses. Students acquire fundamental Botanical knowledge through theory and practical. |

## Course Outcomes B. Sc. Chemistry

### B. Sc. Semester-I

| | |
|---|---|
| **PAPER-I: INORGANIC CHEMISTRY** | **CO1:** Basic knowledge of atomic structure, inorganic fundamental of a periodic property.<br>**CO2:** Conceptualization of Valence bond theory (VBT) and Molecular Orbital theory (MOT), and VSPER theory.<br>**CO3:** Differentiation in ionic and metallic bond, and S-block elements.<br>**CO4:** A study of P-block elements, oxyacids of Sulphur, hydride of Phosphorus, and noble gases.<br>**CO5:** Food adulteration process and detection, test fordetection physical adulteration and chemical adulteration and how to identify the food adulterant which are used various food products |
| **PAPER-II: PHYSICAL CHEMISTRY** | **CO1:** Basic knowledge of thermodynamics and calculations of problems related to Thermo-chemistry.<br>**CO2:** Difference between Ideal gas and Real gas and their related equation.<br>**CO3:** Understanding of Liquid State with emphasis onproperties of liquid.<br>**CO4:** Concept of adsorption isotherm and principles of catalysis.<br>**CO5:** Types of colloidal, electrophoresis and electro-osmosis, emulsion and gels |

### B. Sc. Semester-II

| | |
|---|---|
| **PAPER-I: ORGANIC CHEMISTRY** | **CO1:** Understand the concept structure, bonding in organic compounds and different types of reaction mechanisms.<br>**CO2:** Understand the concept of stereochemistry in detail.<br>**CO3:** Understand the nomenclature, synthesis, chemical and physical properties of alkanes, cycloalkanes and alkenes<br>**CO4:** Understand the nomenclature, synthesis, chemical and physical properties of dienes, alkynes and also the concept of aromaticity of organic compounds.<br>**CO5:** Fuels and its calorific values properties and uses application of lubricants in industries |

| | |
|---|---|
| **PAPER-II: PHYSICAL CHEMISTRY** | **CO1:** CO1: Second law of thermodynamics and free energy work functions.<br>**CO2:** CO2: Understanding of Phase rule and liquid-liquid mixture.<br>**CO3:** Insight into Nuclear Chemistry and Molecular Structure.<br>**CO4:** laws of Chemical kinetics.<br>**CO5:** Types of pollutions and its control measures, types of pollutants, adsorption techniques. |

**B. Sc. Semester-III**

| | |
|---|---|
| **PAPER-I: INORGANIC CHEMISTRY** | **CO1:** Diagrammatic representation of molecules according to MOT, and properties of interhalogen compounds<br>**CO2:** Chemistry of first transition elements and non-aqueous solvents<br>**CO3:** Comparative study of the second and third transition series and error in chemical analysis<br>**CO4:** Chemistry of lanthanides and actinides, and lanthanide contraction |
| **PAPER-II: ORGANIC CHEMISTRY** | **CO1:** Understand nomenclature, synthesis, chemical propertiesof alkanes in aryl, alkyl halides.<br>**CO2:** Understand nomenclature, synthesis, chemical propertiesof dihydric, trihydric alcohols and phenols in detail<br>**CO3:** Understand nomenclature, synthesis, chemical propertiesof aldehydes and ketones and mechanisms of nucleophilic addition<br>**CO4:** Understand nomenclature, synthesis, chemical properties of carboxylic acids and their derivatives along with reactive mechanisms. |

**B. Sc. Semester-IV**

| | |
|---|---|
| **PAPER-I: INORGANIC CHEMISTRY** | **CO1:** A detail study of coordination compounds and its applications.<br>**CO2:** Isomerism and redox process in inorganic compounds.<br>**CO3:** The concept organometallic and metal carbonyl compounds.<br>**CO4:** Applications of inorganic macromolecules in thebiological concept, and acid-bases principles. |

| | |
|---|---|
| **PAPER-II: PHYSICAL CHEMISTRY** | **CO1:** Insight into laws of crystallography and Bravais lattices<br>**CO2:** Debye-Huckel theory and concepts related to electrochemistry<br>**CO3:** Introduction to Rotational and Vibration Spectroscopy.<br>**CO4:** Basics of Quantum Chemistry, Operators andSchrodinger wave function |

**B. Sc. Semester-V**

| | |
|---|---|
| **PAPER-I: ORGANIC CHEMISTRY** | **CO1:** The students will understand some fundamental aspects of organic chemistry. They will learn mechanism of some organic reactions, classification of polymers, structure and uses of some commercial and natural polymers.<br>**CO2:** To know stereochemistry and various possible conformations of organic compounds and how it affects the reaction outcome.<br>**CO3:** To be familiarize with the important photochemical reactions in Organic Chemistry.<br>**CO4:** To understand the functions and applications of bioorganic compounds. |
| **PAPER-II: PHYSICAL CHEMISTRY** | **CO1:** To study the basic postulates of quantum mechanics.<br>**CO2:** To enable the students to solve the simple quantum mechanical models such as simple harmonic oscillator, particle in a 1D- box, rigid rotor, H atom etc.<br>**CO2:** To understand the quantum mechanical aspect of angular momentum and spin.<br>**CO3:** Enable the students to predict the point group of important molecules and to know how they are classified<br>**CO4:** To understand the idea of space groups and to learn the theory of molecular symmetry.<br>**CO5:** To gain skill to apply group theory to vibrational and electronic spectroscopy. |

**B. Sc. Semester-VI**

| | |
|---|---|
| **PAPER-I: INORGANIC CHEMISTRY** | **CO1:** To know the structure and bonding of important coordination compounds.<br>**CO2:** To understand the magnetic properties of complexes and to know how magnetic moments can be employed for the interpretation of their structure<br>**CO3:** To get an overview about the stereochemistry of coordination compounds<br>**CO4:** To get an idea about the basic coordination chemistry of Lanthanides and Actinides.<br>**CO5:** Ability to prepare inorganic complexes. Ability to prepare inorganic complexes.<br>**CO6:** To know about VBT, CFT and MOT of co-ordination complexes |

| | |
|---|---|
| **PAPER-II: ORGANIC CHEMISTRY** | **CO1:** To impart the students a thorough knowledge about the mechanisms of reactions of some selected functional groups in organic compounds<br>**CO2:** To give an outline of applied organic chemistry and the applications of organic chemistry in various spheres of chemical sciences.<br>**CO3:** To give an elementary idea of chemotherapy, organic spectroscopy and photochemistry.<br>**CO4:** To analyze organic compound using UV, IR and NMR spectroscopic techniques, which provides platform for students to work in industries. |

# PROGRAM OUTCOME FOR B. SC. BOTANY

| | |
|---|---|
| **Program Outcomes** | **PO1:** Students know about different types of lower & higherplants their evolution in from algae to angiosperm &also their economic and ecological importance.<br>**PO2:** Cell biology gives knowledge about cell organelles & their functions.<br>**PO3:** Molecular biology gives knowledge about chemical properties of nucleic acid and their role in living systems.<br>**PO4:** Genetics provides knowledge about laws of inheritance, various genetic interactions, chromosomal abrasions & multiple alleles.<br>**PO5:** Structural changes in chromosomes.<br>**PO6:** Student can describe morphological & reproductive characters of plant and also identified different plant families and classification.<br>**PO7:** They know economic importance of various plant products & artificial methods of plant propagation.<br>**PO8:** Various concepts in ecology and phytogeography.<br>**PO9:** Use modern Botanical techniques and decent equipment.<br>**PO10:** To inculcates the scientific temperament in the students and outside the scientific community. |

## PROGRAM SPECIFIC OUTCOMES FOR B. SC. BOTANY

| | |
|---|---|
| **Program Specific Outcomes** | **PSO1:** Students acquire fundamental Botanical knowledge through theory and practical.<br>**PSO2:** To explain basis plant of life, anatomy, reproduction and their survival in nature.<br>**PSO3:** Help to understand role of living and fossil plants in our life.<br>**PSO4:** Understand good laboratory practices and safety.<br>**PSO5:** To create awareness about cultivation, conservation and sustainable utilization of biodiversity.<br>**PSO6:** To know advance techniques in plant sciences like tissue culture, plant disease management, artificial gene transfer etc.<br>**PSO7:** Students understand about the phytogeography of India, ethnobotanically important plants and their use. |

## Course Outcomes B. Sc. Botany

### B. Sc. Semester-I

| | |
|---|---|
| PAPER-I: **VIRUSES, PROKARYOTES, ALGAE & BIOFERTILIZERS** | **CO1:** Study of Microbes and algae to understand theirDiversity.<br>**CO2:** Know the systematics, morphology and structure ofViruses, bacteria, Mycoplasma and algae.<br>**CO3:** To know life cycle pattern of microbes and theireconomic importance.<br>**CO4:** To know evolution of microbes and algae.<br>**CO5:** To learn skill of preparation and use of biofertilizersfor sustainable development. |
| PAPER-II: **FUNGI, LICHEN, PLANT PATHOLOGY, BRYOPHYTA & MUSHROOM CULTIVATION** | **CO1:** Study of Fungi, Lichens, plant pathology and Bryophyta.<br>**CO2:** To know the systematics, morphology and structure offungi, Lichens, plant pathogens, hosts and Bryophytes<br>**CO3:** To know life cycle pattern of fungi, lichens, plantpathogens and bryophytes.<br>**CO4:** To know economic importance of fungi, lichens and Bryophytes.<br>**CO5:** To know evolution of fungi, lichens and Bryophytes.<br>**CO6:** To learn skill of cultivation and importance of mushrooms for human consumption. |
| **Lab Work:** | • To get acquainted with ultrastructure of viruses and bacteria, to study staining method of bacteria<br>• To study structure and reproduction of *Nostoc*<br>• To study the structure and reproduction in Algae, like *Chara*, *Vaucheria*, *Ectocarpus* and *Batrachospermum*<br>• To learn the method of identification and characterization of bacteria useful in biofertilizers<br>• To learn staining method of fungi and bryophytes.<br>• To get acquainted with different plant pathogens and lichens<br>• To learn the technique of mushroom cultivation |

**B. Sc. Semester-II**

| | |
|---|---|
| PAPER-I:<br>**PALAEOBOTANY, PTERIDOPHYTA, GYMNOSPERMS &SOIL ANALYSIS** | **CO1:** Study of Palaeobotany, geological time scale and morphology of angiosperms.<br>**CO2:** To know life cycle pattern of Pteridophyta and Gymnosperms.<br>**CO3:** To know the systematics, morphology and structure of Pteridophyta and Gymnosperms.<br>**CO4:** To know economic importance of Pteridophyta and Gymnosperms.<br>**CO5:** To know evolution of Pteridophyta and Gymnosperms.<br>**CO6:** To learn the skill of soil analysis for cultivation of variety of plants. |
| PAPER-II:<br>**MORPHOLOGY OF ANGIOSPERMS & FLORICULTURE**<br><br>**Lab Work:** | **CO1:** To study the morphology of angiosperms with respectto evolution of plants.<br>**CO2:** To the evolution of different floral organ for sexual reproduction in angiosperms.<br>**CO3:** To know the variation among the reproductive organsof the angiosperms.<br>**CO4:** To know the systematics, morphology and structure of angiosperms.<br>**CO5:** To know the adaptive pollination and reproductivebiology of angiosperms.<br>**CO6:** To learn the skill of floriculture and its tools and techniques.<br><br>• Observation and study of types of fossils<br>• Study of structure and reproduction pteridophytes like, Selaginella & Equisetum and gymnosperms like, Cycas& Pinus<br>• To get acquainted with types, physical and chemical properties of soil<br>• Study of morphology of angiosperms,<br>• Study of identification and commercial aspects of cut flowers |

**B. Sc. Semester-III**

| | |
|---|---|
| PAPER-I:<br>**ANGIOSPERM SYSTEMATICS, EMBROLOGY & INDOOR GARDENING** | **CO1:** To Study vegetative and floral characters of angiosperms.<br>**CO2:** To know the preparation of floral formulae and floral diagrams of angiosperms.<br>**CO3:** To know economic importance of angiospermsfamilies.<br>**CO4:** To know the pattern of embryogenesis in various angiosperms plants.<br>**CO5:** To learn the skill for development of indoor gardeningand its importance. |

| | |
|---|---|
| PAPER-II: **ANGIOSPERM ANATOMY & HORTICULTURE** | **CO1:** To gain knowledge of different plant tissue and tissue systems.<br>**CO2:** To understand structure and type of cells and tissues in plants, type of vascular bundles and stellar systems.<br>**CO3:** To know the simple and complex tissues and itsfunctions.<br>**CO4:** To know the process of secondary growth and its rolein formation of wood and periderm<br>**CO5:** To learn the skill for horticultural practices used. |
| **Lab Work:** | • To Study fossil angiosperms<br>• To learn the anatomy of dicot and monocot<br>• To study embryology of angiosperms<br>• To get acquainted with the techniques used in landscaping and indoor gardening<br>• To study various horticultural crops |

**B. Sc. Semester-IV**

| | |
|---|---|
| PAPPER-I: **CELL BIOLOGY, PLANT BREEDING, EVOLUTION & SEED TECHNOLOGY** | **CO1:** Gain knowledge about cell and its function.<br>**CO2:** Learn the scope and importance of Cell and Molecular biology.<br>**CO3:** To understand ultrastructure of cell wall, plasma membrane and cell organelles<br>**CO4:** To understand the morphology and structure of chromosomes.<br>**CO5:** To understand the different techniques used in plant breeding.<br>**CO6:** To know the process of evolution of plants in universe<br>**CO7:** To learn the skill used in seed technology |
| **Lab Work:** | • To study ultrastructure of cell organelles<br>• To study cell division, mitosis and meiosis with use nuclear stain<br>• To learn the different biostatistics methods<br>• To study seed dormancy, viability and percentage of germination<br>• To prove Mendel's laws of inheritance with the help of coloured beads<br>• Study of interaction of genes through different genetics problems<br>• To study sterilization for plant nursery and methods of propagation |

**B. Sc. Semester-V**

| | |
|---|---|
| PAPER-I: **PLANT PHYSIOLOGY, MINERAL NUTRITION& HYDROPONICS** | **CO1:** To know the scope and importance of plant physiology.<br>**CO2:** To understand plant & water relation and mineralnutrition.<br>**CO3:** Understand process of photosynthesis, $C_3$, C4, CAM pathways.<br>**CO4:** Understand the process of respiration, nitrogen metabolism and plant movement<br>**CO5:** To learn the technique of development of hydroponics. |
| PAPER-II: **PLANT ECOLOGY & ORGANIC FARMING**<br><br>**Lab Work:** | **CO1:** To study concept of ecology and ecosystems.<br>**CO2:** To understand climatic and edaphic factors.<br>**CO3:** To know physiographic factors and interrelationsamong the living organisms.<br>**CO4:** To understand the components of ecosystems,autecology, synecology and plant succession.<br>**CO5:** To know the adaptations of plants.<br>**CO6:** To learn the skill and importance of organic farmingfor healthy life.<br><br>• To study the plant physiology experiments, like photosynthesis, respiration, permeability, RQ, photoperiodism, plant movements, etc.<br>• To get acquainted with mineral nutrition andhydroponics<br>• Study of different qualitative and quantitative methods used in plant ecology<br>• To learn the techniques used in organic farming |

**B. Sc. Semester-VI**

| | |
|---|---|
| PAPER-I: **BIOCHEMISTRY BIOTECHNOLOGY& HERBAL TECHNOLOGY** | **CO1:** To study carbohydrates, lipids, amino acids and enzymology.<br>**CO2:** To know the plant tissue culture techniques and applications.<br>**CO3:** To understand tools and techniques used in genetic engineering.<br>**CO4:** To know the artificial gene transfer techniques.<br>**CO5:** To learn the skill used in formation of dye andcosmetics from plants.<br>**CO6:** To know the basic concept of herbal technology. |

| | |
|---|---|
| PAPER-II:<br>**PHYTOGEOGRAPHY, UTILIZATION OF PLANTS, TECHNIQUES & PHARMACOGNOSY** | **CO1:** To know the phytogeography of India and world<br>**CO2:** To know the natural resources and various types of pollutions and its impact on living organism.<br>**CO3:** To study the natural resources and its conservation strategies.<br>**CO4:** To know the economic importance of plants and ethnobotany.<br>**CO5:** To study microscopy, electrophoresis, centrifugation and chromatography.<br>**CO6:** To learn the basics of pharmacognosy and skill forused of plants in pharmacognosy. |
| **Lab Work:** | • To study the biochemical experiments<br>• To study the different instruments and equipment usedin biotechnology<br>• To study the different techniques used in herbal technology<br>• To learn types of pollution parameters.<br>• To get acquainted with ethnobotany and economic botany with suitable examples<br>• To study the techniques used in pharmacognosy |

# PROGRAM OUTCOME FOR B. SC. ZOOLOGY

| | |
|---|---|
| **Program Outcomes** | **PO1:** Classification and Identification of organisms accordingto their characteristic features.<br>**PO2:** Correlates the Morphology, physiology and biology of invertebrate and vertebrates**.**<br>**PO3:** Gain the knowledge of Micro-technique for preserving tissue and specimens.<br>**PO4:** Analyse interactions among the various organisms of different phylas, their distribution and relationship with the environment.<br>**PO5:** Gain knowledge about economic importance and application of knowledge agro based small industries like sericulture, apiculture, aquaculture, fish breeding, pear-culture.<br>**PO6:** Understand concept of genetics and its importance in human health**.**<br>**PO7:** Understand the use of biotechnology, biostatistics and bioinformatics. |

## PROGRAM SPECIFIC OUTCOMES FOR B. SC. ZOOLOGY

| | |
|---|---|
| **Program Specific Outcomes** | **PSO1:** Students are able to understand the basic concept of cell biology, environmental biology, genetics, physiology, taxonomy and applied zoology.<br>**PSO2:** Understand the application of biological sciences in aquaculture, sericulture, vermin-culture, pearl-culture and apiculture.<br>**PSO3:** Perform procedures as per laboratory standards in the area of physiology, cell biology, environmental biology,genetics, entomology, Biotechnology fisheries.<br>**PSO4:** Gain knowledge about research methodology i. e.skills of micro technique which consists of preservation of tissue and specimens, their staining techniques. |

## Course Outcomes B. Sc. Zoology

### B. Sc. Semester-I

| | |
|---|---|
| **Paper-I: Life and Diversity of Animals –Non-chordates (Protozoa to Annelida)** | **CO1:** Students get knowledge about unity and diversity of life on the earth.<br>**CO2:** Students will be able to identify and classify non-chordates on the basis of their peculiar characteristics.<br>**CO3:** students will be able to understand phylum wise structural features, morphology, anatomy, physiology, habit and Habitat.<br>**CO4:** Students will be able to explain how organisms' function at different level of grade of Organization like cellular, tissue, organ and organ system.<br>**CO5:** They will be able to give examples of the physiological adaptation, development, behavior of different forms of life.<br>**CO6:** Students understand economic importance of non-chordates as well as life cycle of pathogenic organisms. |
| **Paper – II: Environmental Biology** | **CO1:** Students get knowledge and understand about different strata of atmosphere.<br>**CO2:** Students able to understand /recognize biological, chemical, physical components of earths system.<br>**CO3:** Students will also understand how natural system human designed system work together and conflict witheach other.<br>**CO4:** Students understood about environmental issues like water pollution, Air pollution, soil pollution and noise pollution.<br>**CO5:** Students able to understand and gain knowledge about renewable and non-renewable energy sources. |
| **Lab. Work:** | • Study of museum specimen (classification and structural features.<br>• Learn about estimation of Dissolved oxygen and carbon dioxide PH and hardness of water<br>• Study of pond ecosystem<br>• Learn about dissection and perform mounting of biological material |

**B. Sc. Semester-II**

| | |
|---|---|
| **Paper – III: Life and Diversity of Animals –Non-chordates (Arthropoda to Hemichordata)** | **CO1:** Students understood role of insect vectors in spreading diseases, mode of infection and symptoms.<br>**CO2:** Students also understood economic importance of molluscans.<br>**CO3:** Students understood affinities of hemichordates with different phyla.<br>**CO4:** Students get knowledge about indirect development through various larval stages. |
| **Paper – IV: Cell Biology**<br><br>**Lab Work:** | **CO1:** Students will be able to understand structure and functions of cell and cell organelles.<br>**CO2:** Students will understand the structures and purposes of basic components of prokaryotic and eukaryotic cells and cell organelles<br>**CO3:** Students will understand how these cellularcomponents are used to generate and utilize energy in cells<br>**CO4:** Students will understand types of cell division that is mitosis and meiosis<br>**CO5:** Students will apply their knowledge of cell biology to study environmental or physiological responses of cell.<br><br>• Study of Museum specimen (classification and structural features)<br>• Study of permanent slides of larva of different animals and sections through different organs and<br>Perform cell biology experiments, mounting and study dissection. |

**B. Sc. Semester-III**

| | |
|---|---|
| **Paper-V: Life and diversity of Animals –Chordates (Protochordata to Amphibia** | **CO1:** Students are able to understand diversity of earlier chordate from protochordata to amphibian.<br>**CO2:** Students are also studied about growth and development, evolution of different system of chordates.<br>**CO3:** Students also get knowledge about adaptations, parental care and sexual dimorphism in chordates |

| | |
|---|---|
| **Paper – VI: Genetics** | **CO1:** Students are able to understand Mendel's laws of inheritance, basic concepts of gene, transmission of hereditary characters.<br>**CO2:** Students also understand about interaction of genes.<br>**CO3:** Students also understand concept of lethal genes, chromosomal disorder and syndrome caused due to abnormal chromosomal no.<br>**CO4:** Students also understand about population genetics and application of genetics. |
| **Lab Work:** | • Study of museum specimen of chordates (classification and structural features)<br>• Observe and studied permanent slides of developmental biology and sections through different organs<br>• Perform genetic experiments and studied karyotype of genetic traits. |

**B. Sc. Semester-IV**

| | |
|---|---|
| **Paper - VII: Life and Diversity of Animals – Chordates (Reptilia, Aves and Mammals)** | **CO1:** Students understand about classification of reptiles, Aves and mammals based on structural variation.<br>**CO2:** Get knowledge about Biting mechanism in snakes, adaptations in Aves and mammals.<br>**CO3:** Get information about modern evolution theories, genetic basis of evolution<br>**CO4:** Understand comparative study of development of heart and aortic arches in birds, Aves and mammals.<br>**CO5:** Study different aspects of chick development |
| **Paper - VIII: Molecular Biology and Immunology**<br><br>**Lab Work:** | **CO1:** Understand detail structure of DNA and RNA as a genetic material, structure of gene.<br>**CO2:** Students are able to understand different processes like replication, transcription, protein synthesis.<br>**CO3:** Able to understand concept of immunity, types ofantigen antibody and their interaction.<br>**CO4:** Get information about types of immune response and about immune deficiencies.<br><br>• To study classification and identification of chordates<br>• To study skeleton of rabbit and fowl<br>• To study permanent slides of chick embryology and permanent slides.<br>• Perform staining and immunology and molecular biology experiments. |

**B. Sc. Semester-V**

| | |
|---|---|
| **Paper-IX: General Mammalian Physiology I** | **CO1:** It gives knowledge about structural features and functions of different systems like digestive, respiratory and circulatory.<br>**CO2:** General properties of enzymes, enzyme activity<br>**CO3:** Digestive glands, respiratory pigments, respiration mechanism and in detail circulatory system. |
| **Paper-X: Aquaculture and Economic entomology**<br><br>**Lab Work:** | **CO1:** This paper gives knowledge about-application of zoology and economic importance of zoology like fresh water aquaculture, prawn culture, pearl culture, apiculture, sericulture, and lac culture.<br>**CO2:** Gives information about economic entomology and methods of pest control.<br><br>• Perform physiology experiments i.e. estimation of carbohydrates, proteins, fats and vitamins.<br>• Perform counting of red blood cells and white blood cells.<br>• To study histological slides<br>• Perform mounting,<br>• Collection and identification of local fishes.<br>• To study different insect pests. |

**B. Sc. Semester-VI**

| | |
|---|---|
| **Paper-XI: General Mammalian Physiology II** | **CO1:** Get knowledge about nerve and muscle physiology,<br>**CO2:** Studied in detail structure and function of different endocrine glands.<br>**CO3:** Understood reproductive system, causes of infertilityin male and female. |

| | |
|---|---|
| **Paper-XII: Applied Zoology II (Bio-techniques, micro techniques, Biotechnology, Bioinformatics and Biostatistics** | **CO1:** Students are able to understand methods of separation of biomolecules, micro techniques (different staining methods).<br>**CO2:** Understand importance and role of bioinformatics.<br>**CO3:** Understand application of statistics in biology and biotechnology. |
| **Lab Work:** | • Detection of urea albumin sugar and creatinine in urine<br>• Perform biotechnology experiments and micro-technique methods<br>• Perform and study application of bioinformatics and biostatistics.<br>• Observe histological slides. |

# PROGRAM OUTCOME FOR B. SC. MICROBIOLOGY

| | |
|---|---|
| **Program Outcomes** | **PO1:** Demonstrate laboratory skills applicable toMicrobiological and Clinical methods including laboratorysafety.<br>**PO2:** Acquire skills for accurately reporting observations and findings through oral, written and digital formats.<br>**PO3:** Apply the knowledge of microbiology from multiple fields to critically analyse and evaluate microbiological, environmental and health related issues and to create awareness and impact of microbiology outside the science community.<br>**PO4:** Practice flexible professional skills needed for careers in microbiology & related professional and scientific fields like- Health sector, medical laboratory technology (MLT), Water testing labs, Dairy and food Industry as quality assurance and quality control professional etc, can opt for either post graduate study program, research, or for variouscompetitive exams and professional courses.<br>Exposure provided to the students during the add-on bioinformatics certificate course would help students gain awareness of career options in the software industry too.<br>**PO5:** Students will be able to expand their learning horizons through use of multidimensional learning resources to keep themselves at par with the pace of scientific and research development worldwide. |

## PROGRAM SPECIFIC OUTCOMES FOR B. SC. MICROBIOLOGY

| | |
|---|---|
| **Program Specific Outcomes** | **PSO1:** The subject helps to gain knowledge about all types of microbial world, living as well as non-living, its harmful & useful interactions with human, animals, plants, bacteria and the environment<br>**PSO2:** Students will be able to recognize structural & functional relationship of all living beings at molecular & cellular level.<br>**PSO3:** They will get acquainted with importance of microorganisms as model systems in Genetics & Molecular Biology.<br>**PSO4:** Students will be able to demonstrate basic microbiological techniques & acquire experimental and quantitative skills encompassing preparation of laboratory reagents, media, conducting experiments, handling different instruments, analysing samples& interpreting results. |

## Course Outcomes B. Sc. Microbiology

### B. Sc. Semester-I

| | |
|---|---|
| **Paper-I: FUNDAMENTALS OF MICROBIOLOGY** | **CO1:** Get knowledge about basic branches of microbiology, they will understand the contribution of eminent scientists in the development of microbiology.<br>**CO2:** Acquainted with the ultrastructure of bacterial cell, concepts of prokaryotic and eukaryotic cell's, their differences with examples.<br>**CO3:** They will acquire the knowledge about nutritional requirements, classification of bacteria on the basis of nutritional habits.<br>**CO4:** Learn about the growth of microbes, cell cycle and reproduction processes, various environmental parameters affecting their growth & different techniques used for their detection & quantification. |
| **Paper-II: BASIC TECHNIQUES IN MICROBIOLOGY** | **CO1:** Understand the basic principles and applications of various types of microscopic techniques.<br>**CO2:** The students learn different techniques of Cultivation and preservation of bacteria, yeast and fungi. They are acquainted with various culture collection centres in India and abroad.<br>**CO3:** Understand different staining techniques, role of reagent and dyes principles involved in these staining techniques.<br>**CO4:** Get acquainted with various disinfectants, antiseptic and antimicrobial agents used in microbial control. They come to know about its mode of action and mechanism involved in microbial control. |
| **Lab Work:** | • Trained for handling various basic as well as advanced instruments used in microbiology laboratory.<br>• Know about preparations of different types of media and methods to cultivate the microbes.<br>• Able to demonstrate different staining procedures, stains & reagents used and microscopic observations of various types of bacteria.<br>• Able to isolate different types of bacteria from samplesof milk, water, soil etc.<br>Able to demonstrate sensitivity of bacteria to antibiotics, and UV radiation effect. |

**B. Sc. Semester-II**

| | |
|---|---|
| **Paper-I: MICROBIAL DIVERSITY** | **CO1:** Know about the Prokaryotic microbial diversity with examples, general characters & their life cycle.<br>**CO2:** Get acquainted with Eukaryotic microbial diversity with examples, general characters & their life cycle.<br>**CO3:** Understand the general characters, morphology and classification of viruses, mode of replication and methods of cultivation.<br>**CO4:** Conceptualize various kind of positive and negative microbial interactions |
| **Paper-II: FOOD MICROBIOLOGY & MILK MICROBIOLOGY**<br><br>**Lab Work:** | **CO1:** Get acquainted with various food and milk products, their production techniques, various diseases caused, prevention of spoilage and its preservation.<br>**CO2:** Gain knowledge about food safety and food standards.<br><br>• Demonstrate Slide culture techniques for the cultivation and study of mould.<br>• Get Acquainted with SPC method to determine quality of food.<br>• Learn to visualize under Microscope different characteristics of Fungi (*Aspergillus, Penicillium* and *Mucor*) Protozoa *(Plasmodium vivax, Trypanosoma* and *Amoeba*) & Algae (*Spirullina, Anabena* and *Euglena*), *Mycoplasma, Rickettsia* and *Chlamydia*.<br>• Know the method of Coliform detection in food as per BIS.<br>• Enumeration of total aerobic viable count from raw and pasteurized milk by serial dilution method.<br>• Can demonstrate MBRT and Phosphatase test.<br>• Know the technique to study the Effect of salt and sugaron microbial growth.<br>• Demonstrate to find out MIC of preservative compound. |

**B. Sc. Semester-III**

| | |
|---|---|
| **Paper-I**: **CHEMISTRY OF ORGANIC CONSTITUENTS AND ENZYMOLOGY** | **CO1:** Acquire knowledge about classification of organic compounds like Carbohydrates and lipids and get acquainted with their structures and various bonds involved in them.<br>**CO2:** Understand classification & structures of amino acids& proteins.<br>**CO3:** Concept building about classification, structures and functions of enzymes, their mode of action and reaction mechanism. Understand steady state kinetics.<br>**CO4:** Gain knowledge about nucleic acids, structures and their differences. Can describe importance ofvitamins to human body and their deficiency syndrome. |
| **Paper-II**: **INDUSTRIAL MICROBIOLOGY** | **CO1:** Know the scope of industrial microbiology and screening methods used for isolation of industrially important microbes.<br>**CO2:** Gain knowledge about different Fermenter configurations& designs.<br>**CO3:** Scale up and DSP.<br>**CO4:** Concept building about industrial production of SCP, Baker's yeast, ethanol, penicillin and semisynthetic penicillin, citric acid, Vit B12, beer and wine. |
| **Lab Work**: | • Demonstrate and Identify carbohydrates and lipidsfrom unknown samples.<br>• Demonstrate enzyme activity by bacteria (amylase, catalase, gelatinase, lipase)<br>• Estimate proteins, DNA and RNA by spectrophotometric method<br>• Get knowledge and hands on training on- productionof ethanol and methods of estimation.<br>• Get acquainted with the isolation procedure of amylase producer from soil.<br>Demonstrate Leavening capacity of yeast andImmobilization of yeast for invertase activity. |

**B. Sc. Semester-IV**

| | |
|---|---|
| **Paper-I: METABOLISM** | **CO1:** Understand the general strategy of metabolism and conceptualize various metabolic processes operating in living cells.<br>**CO2:** Gain knowledge about methods of DNA replication, models of replication, enzymes involved and Prokaryotic transcription process and mechanism.<br>**CO3:** Acquainted with deamination processes, Urea cycle, glucogenic and ketogenic amino acids Genetic code and Prokaryotic translation<br>**CO4:** Understand the mechanism by which energy is generated. |
| **Paper-II: APPLIED MICROBIOLOGY**<br><br>**Lab Work:** | **CO1:** Get acquainted with multiple tube dilution technique, IMViC classification and understand the significance of bacteriological analysis of drinking water.<br>**CO2:** Gain knowledge about various methods applied for treatment of water and waste water & understand the importance of disposal of industrial wastes and techniques used in its disposal.<br>**CO3:** Understand the techniques of air analysis, varioussamplers used & methods involved. Know the role of soil microbes and methods involved in biofertilizer & biopesticide productions. Conceptualize PSB, mycorrhiza & microbial leaching process.<br>**CO4:** Gain knowledge about Food spoilage, pathogens involved and methods of preservations. Food bornediseases and food intoxications.<br><br>• Demonstrate the techniques to isolate microbes from water and waste water.<br>• Know the techniques to find out MPN, DO, COD,BOD, alkalinity of water and IMViC tests.<br>• Understand the methods of chlorination of water and Chlorine demand.<br>• Hands on knowledge about MBRT and Phosphatase test. |

**B. Sc. Semester-V**

| | |
|---|---|
| **Paper-I: MEDICAL MICROBIOLOGY** | **CO1:** Concept building about various epidemiological concepts and definitions. Various modes by which infections spread in community, portal of entry& exit and their control.<br>**CO2:** Microbial mechanism of Pathogenicity and virulence, exaltation and attenuation methods, MID, MLD, ID50, LD50.<br>**CO3:** Acquire knowledge about methods used in isolation and identification of various pathogenic organisms, based on |

| | |
|---|---|
| | their morphology, cultural characteristics, biochemical characteristics, serology and labdiagnosis.<br>**CO4:** Understand the Basic principles of drug designing, the role of these drugs and antimetabolites in disease control. |
| **Paper-II**: **MOLECULAR BIOLOGY AND BIO-INSTRUMENTATION**<br><br>**Lab Work**: | **CO1:** Acquainted with various concepts – related to gene, different types of mutation and its regulation.<br>**CO2:** Concept building about various processes by which gene transfer occurs amongst microbes<br>**CO3:** Understand the principles, methodology and application of various bio instruments like spectrophotometer, electrophoresis, chromatography, centrifuge etc<br>**CO4:** Get acquainted with Isotopic tracer technique and its applications.<br><br>• Demonstrate bacterial and plasmid DNA isolation techniques.<br>• Gain knowledge and hands on training on restriction digestion technique.<br>• Demonstrate spectrophotometrically creatinine estimation.<br>• Demonstrate gel filtration, paper chromatography and TLC<br>• .Knowledge and hands on training on isolation and identification of pathogenic bacteria (*E coli, S aureus, Salmonella, Proteus*). |

**B. Sc. Semester-VI**

| | |
|---|---|
| **Paper-I**: **IMMUNOLOGY** | **CO1:** Concept building about defensive mechanism of host against diseases, various terminologies used and definitions of epidemic, endemic, pandemic, nosocomial infection, zoonotic infection, vector, types and role of vectors, portal of entry portal of exit of pathogens.<br>**CO2:** Knowledge about Haematopoiesis, Cells of immune system, general characters of B and T cells, cellular and humoral immunity.<br>**CO3:** Understand the structures, properties, types and importance of Antigens and Immunoglobulins, Ag-Ab reactions in Diagnostic immunology.<br>**CO4:** Gain knowledge about ELISA test, its application and various Hypersensitivity reactions and their types. |

| | |
|---|---|
| **Paper-II**: **BIOTECHNOLOGY** | **CO1:** Know the tools and techniques of genetic engineering<br>**CO2:** Knowledge about DNA, fingerprinting and its application in forensic science<br>**CO3:** Acquainted with the methods of production of insulin, interferon. Vaccines, monoclonal antibody. Understand the applications of biotechnology in agriculture<br>**CO4:** Acquire knowledge about the advantages/disadvantages of genetic engineering for humans & comprehend the production and importance of genetically modified foods and animals, know about the ethics to be followed. |
| **Lab Work**: | • Demonstrate VDRL test, Widal test, immunodiffusion technique And Western blot technique.<br>• Perform PCR<br>• Development of spheroplast<br>• Get the knowledge of lab production of biofertilizer andsoya sauce |

# PROGRAM OUTCOME FOR B. SC. BIOCHEMISTRY

| | |
|---|---|
| **Program Outcomes** | **PO1:** Apply domain specific knowledge and expertise to effectively address complex challenges in professional, social and personal context.<br>**PO2:** Cultivate a multidisciplinary mindset and contribute to the global knowledge base with a specific focus on advancing the knowledge and development of the country.<br>**PO3:** Develop strong communication and presentation skills to enhance employability and excel in the job market.<br>**PO4:** Foster social awareness and actively engage as responsible and proactive citizens addressing societal issues.<br>**PO5:** Evaluate and articulate the impact of the subject on advancements in science and technology, benefitting the general population and contributing to societal development. |

# PROGRAM SPECIFIC OUTCOMES FOR B. SC. BIOCHEMISTRY

| | |
|---|---|
| **Program Specific Outcomes** | **PSO 1**: To have advanced knowledge of the biochemistry domain.<br>**PSO 2:** To Connect with another branch life life science.<br>**PSO 3:** To Provide the option for higher education, disciplinary & multi-disciplinary research.<br>**PSO 4:** To be able to work in the following sectors<br>• Public Health Entities.<br>• Drug Manufacturing Companies.<br>• Blood Bank & Services.<br>• Cancer Research Institutes.<br>• Educational Institutes.<br>• Industrial Laboratories.<br>• Research Department.<br>• Agriculture and Fisheries. |

## Course Outcomes B. Sc. Biochemistry

### B. Sc. Semester-I

| | |
|---|---|
| **Paper-I: BIOMOLECULES & HUMAN PHYSIOLOGY** | **CO1:** To Understand the basic structure of carbohydrates with their diverse functions in cellular processes.<br>**CO2:** To Understand the Structure of lipids and the functional activities of lipids.<br>**CO3:** Students understand the functioning of muscle and digestive systems.<br>**CO4:** Explain the Structure of Plasma membrane and their transport |
| **Paper-II: MICROBIOLOGY & VIROLOGY** | **CO1:** To Understand the historical discoveries in the field of microbiology and components of microscope for observation of microorganisms.<br>**CO2:** Students understand the principles of various bacterial staining methods and identify key features of viruses.<br>**CO3:** Explain the difference between prokaryotes and eukaryotes and bacterial classification.<br>**CO4:** To Understand the growth requirement of bacteria. |

### B. Sc. Semester-II

| | |
|---|---|
| **Paper-I: HUMAN PHYSIOLOGY** | **CO1:** To Understand the structural and functional aspects of human excretory and reproductive systems.<br>**CO2:** Describe blood composition and functional attributes of each blood component.<br>**CO3:** Students understand the neuronal function and communication.<br>**CO4:** Explain the hormonal regulatory circuitry involved in regulating cellular functions. |
| **Paper-II: MICROBIOLOGY & IMMUNOLOGY** | **CO1:** To Understand the nutritional requirements of microorganisms for growth.<br>**CO2:** Students are able to understand the Compare and contrast mechanism of action of different microbial control agents.<br>**CO3:** To Study the immune system and structural features of immunoglobulin.<br>**CO4:** Give an overview of the classification and maturation of the immune system. |

**B. Sc. Semester-III**

| | |
|---|---|
| **Paper-I**: **MACROMOLECULES** | **CO1:** To Understand the chemistry of amino acids found in proteins with features responsible for the synthesis of proteins.<br>**CO2:** Describe the structure-function relationship of proteins with parameters involved in protein folding.<br>**CO3:** Examine factors involved in the structural dynamics of nucleic acids.<br>**CO4:** Identify ways to examine the structural features of different forms of nucleic acids. |
| **Paper-II**: **BIOPHYSICAL TECHNIQUES I** | **CO1:** To Understand the concepts, principles, working, detection system, and applications of spectrophotometers.<br>**CO2:** Students are able to understand the Compare various forms of spectrophotometers and develop know-how about the mechanism of action of buffers and their various types of equations.<br>**CO3:** To Develop knowledge about fundamental principles of chromatography and possible extensions in the same.<br>**CO4:** Get a complete overview of some common chromatographic methods and their applications. |

**B. Sc. Semester-IV**

| | |
|---|---|
| **Paper-I**: **ENZYMOLOGY** | **CO1:** Recognize various terminologies used in enzymology and will get familiarized with various models required to explain enzyme-substrate complex.<br>**CO2:** Describe the basic mechanisms of action of some specific enzymes with factors responsible for the same.<br>**CO3:** Derive different mathematical equations required to explain enzymes activity through graphs (Ex LB plots) and what kind of inhibitors govern them.<br>**CO4:** Acquire knowledge about enzyme assay principles used after their purification. |
| **Paper-II**: **BIOPHYSICAL & CHEMICAL TECHNIQUES** | **CO1:** Demonstrate an understanding of the principles and techniques of gel electrophoresis, including the different types of gels, solubilizers, and the procedure for running electrophoresis with its applications.<br>**CO2:** Identify the various specialized technical attributes of gel electrophoresis and immunological techniques.<br>**CO3:** Identify the advantages and applications of isotopes for studies associated with biomolecules. |

| | |
|---|---|
| | **CO4:** Derive and recognize the mathematical principles underlying the sedimentation process for applications in biomolecular characterization. |

**B. Sc. Semester-V**

| | |
|---|---|
| **Paper-I**: **METABOLISM I** | **CO1:** Recognize and appreciate the importance of bioenergetics principles governing the progress of biochemical reactions.<br>**CO2:** Demonstrate the knowledge of techniques used for performing metabolic studies.<br>**CO3:** Enlist and explain the steps involved in the metabolic progression of simple sugars.<br>**CO4:** Identify and describe the mechanisms involved metabolism of complex carbohydrates along with metabolic energy output. |
| **Paper-II**: **MOLECULAR BIOLOGY** | **CO1:** Recognize and appreciate the basic features of replication, semi-conservative replication with experimental evidence and different models of replication.<br>**CO2:** Demonstrate the knowledge of regulatory aspects of replication along with DNA damage and repair mechanisms.<br>**CO3:** Descriptive explanation of the mechanism of RNA synthesis and factors involved in it.<br>**CO4:** Identify regulation of gene expression in prokaryotes, mechanisms of Lac Operon & Trp operon with viral reverse transcription as a mode of inheritance. |

**B. Sc. Semester-VI**

| | |
|---|---|
| **Paper-I**: **METABOLISM II** | **CO1:** Recognize and explain lipid metabolism as an alternative route of energy harnessing in the absence of carbohydrates through mechanisms such as Beta oxidation and HMP shunt.<br>**CO2:** Identify and describe lipid biosynthetic pathways as routes for the synthesis of storage and structural lipids.<br>**CO3:** Explain the principles of amino acid metabolism and detoxification strategies employed for the removal of ammonia generated therein.<br>**CO4:** Discuss the intricacies associated with nucleic acid metabolism and diseases associated with it. |
| **Paper-II**: **MOLECULAR BIOLOGY & r-DNA TECHNOLOGY** | **CO1:** Comprehend and recognize the features of the genetic code and wobble hypothesis.<br>**CO2:** Demonstrate the knowledge of aspects associated with the protein translation system and its regulation.<br>**CO3:** Recognize and discuss the requirements for the performance of basic rDNA technology.<br>**CO4:** Explain the methods utilized for the execution of complete rDNA synthesis and cloning pathway. |