ST. XAVIER'S COLLEGE JAIPUR

Department of Science

Programme Outcomes (POs) and Course Outcomes (COs)

Bachelor of Science

PO 1: **Comprehension of Physics**: Students will demonstrate proficiency in mathematical principles, cultivating a comprehensive understanding essential for grasping physics concepts.

PO 2: **Problem Analysis in Physics**: Students will exhibit a profound understanding of classical mechanics, electromagnetism, and modern physics, proficiently applying this knowledge to analyse diverse physical phenomena.

PO 3: **Logical Thinking Capacity**: Graduates are expected to cultivate logical thinking through advanced mathematical learning, enabling practical applications in real-life scenarios within their respective disciplines.

PO 4: **Conceptualization in Mathematics and Software**: Through practical applications, graduates will acquire the ability to conceptualize and implement mathematical functions and terminology in computer languages and software.

PO 5: **Proficient Explanation and Comprehension of Chemical Concepts**: Graduates will demonstrate proficiency in explaining and comprehending chemical concepts across various scientific disciplines.

PO 6: **Scientific Attitude in Chemistry**: Graduates will develop scientific acumen, enabling them to perform, observe, and analyse the outcomes of chemical reactions.

PO 7: **Multidisciplinary Approach in Plant Sciences**: Graduates will demonstrate an awareness of the multidisciplinary approach inherent in the field of plant sciences.

PO 8: **Environmental Sustainability in Botany**: Graduates will possess a thorough understanding of both theoretical principles and practical applications in Botany with a focus on environmental sustainability.

PO 9: **Respect Towards Humanity in Biology**: Graduates will comprehend fundamental concepts related to the biology of life with an emphasis on respect towards humanity.

PO 10: **Gender Perspectives in Zoology**: Facilitate hands-on experience for students in the practical aspects of zoology, enhancing their understanding of the subject with consideration for gender perspectives.

Program Specific Outcome - B. Sc. Pass Course

The Program Specific Outcomes (PSOs) are attained by students through learning acquired on completion of a program of study. The term 'program' refers to the entire scheme of study followed by learners leading to a qualification. It will include subject-specific skills and generic skills, including transferable skills and competencies, the achievement of which the students of a specific program of study should be able to demonstrate for the award of the degree qualification. They would also focus on knowledge and skills that prepare students for further study, employment, and citizenship. A program of study may be mono-disciplinary, multi-disciplinary, or interdisciplinary (LOCF Manual, UGC).

Course Outcome - B. Sc. Pass course

The course outcomes are attained by learners through the essential learnings acquired on completion of selected courses of study within a program. The term 'course' is used to mean the individual courses of study that make up the scheme of study for a program. Course outcomes are specific to the learning for a given course of study related to a disciplinary or interdisciplinary/multidisciplinary area. Course outcomes are specific to a course of study within a given program of study and will be aligned to program-specific outcomes. The achievement by students of course outcomes leads to the attainment of the program-specific outcomes (LOCF Manual, UGC).

The Program Specific Outcomes and course outcomes relating to the B.Sc. degree program in Physics, Mathematics, Chemistry, Botany and Zoology may include the following:

Program-specific Outcomes in Physics

The students at the end Bachelor of Science degree in Physics will be able to:

PSO 1 Develop an understanding of basic concepts and universal laws of motion, vibrations and origins of electromagnetic waves.

PSO 2 Learn about industrial applications based on various physics concepts such as the production of excessive cold temperature, various modelling techniques and basic electric circuit designing and analysis.

PSO 3 Acquire the knowledge about characteristics of atoms, nuclei and solid states. It will be helpful for students to determine the peculiar behaviour of semiconductors, phenomena of superconductivity and so on.

PSO 4 Practical will be carried out by students for demonstration of various physics laws. This will ensure the progress of the analysis ability and brainstorming capabilities of students as a scientific pupil.

Course outcomes in Physics

Year	Paper Code	Paper	Course Outcome
Part-I	***P-101***	***Mechanics & Oscillators***	**CO 1** Introduction of Basics Mechanics and Oscillations **CO 2** Concepts of measurement of motion **CO 3** Detailed study of mechanical behaviour of real objects. **CO 4** Analyzing the momentum and conservation and collision between two real-life objects. **CO 5** Understanding of various kinds of oscillations and how different waves travel in space using their different oscillation modes
	P-102	***Electromagnetism***	**CO 1** Introduction to the basics theory of electric fields and magnetic field of Electromagnetism. **CO 2** Knowledge about magnetism, Maxwell equation and electromagnetism. **CO 3** Learning about the different types of interferences and diffraction processes. **CO 4** Demonstration of various electricity and magnetism concepts and also a clear picture of how current is generated in various arrangements. **CO 5** Understanding of the Maxwell equations.
	P-103	***Optics***	**CO 1** Understanding of the exchange between heat and work through various interactions. **CO 2** Understanding of the optics **CO 3** Detailed concept of study about the holographical methods **CO 4** Learning of the Newton rings, Airwedge, and some interferometers of the lasers **CO 5** Explaining the Latest technology-based devices such as laser, holography and fibre optics.
	P-204	***Thermo dynamics***	**CO 1** Introduction of statistical and quantum mechanics. **CO 2** Detailed study of the three laws of thermodynamics. **CO 3** Learning the industrial level high temperatures are produced using different set-ups based on thermal laws. **CO 4** Analyzing the exchange between heat and work through various interactions. **CO 5** Understanding the collective behaviour of molecules and atoms in any medium via classical statistics and quantum statistics.

Part-II	***P-205***	***Mathematical Physics***	**CO 1** Knowledge of Mathematical physics from our general physics. **CO 2** Techniques of Lorentz transformations, four-vector formulations. **CO 3** Introduction of Differential Equations and equations of first order and second order differential equations. **CO 4** Knowledge of Homogeneous linear differential equations. **CO 5** Knowledge of the Boundary value problems, Laplace equations, and separation techniques.
	P-206	***Electronics & Solid State Devices***	**CO 1** Understand the charge distribution and charge transfer process in semiconductors **CO 2** Designing and basic analysis of electronic circuits. Calculating the parameters of the rectifiers, transistors, and De Morgan's laws **CO 3** Improvement of amplification Oscillator and amplifiers **CO 4** Understanding the band theory of solids and the carried concentration in solids. **CO 5** Calculate parameters associated with semiconducting devices and analyze devices based on their applications
Part-III	***P-307***	***Quantum Mechanics & Spectroscopy***	**CO 1** Understanding the basic concept of principles of quantum mechanics and its applications to simple systems like simple harmonic oscillations. **CO 2** Describing angular momentum and spin dynamics of quantum systems and solving the angular momentum using co-efficient. **CO 3** Will be able to find the energy and wave functions of quantum conservative systems. **CO 4** Can understand Schrodinger equations and how their solutions explain the internal phenomena of hydrogen atoms. **CO 5** Understanding about the molecular structure and various spectroscopic technique and their modern developments.
	P-308	***Nuclear and Particle Physics***	**CO 1** Describe basic properties of nuclei, nuclear interactions, nuclear structure and reactions **CO 2** Identify the strengths and limitations of various models. **CO 3** Apply the knowledge of basic laws of conservation and momentum in the determination of particle properties of process in the subatomic world.

			CO 4 Work on elementary particles in physics and relating theoretical predictions and measurement results. **CO 5** Demonstrate the quark models based on nuclei in the subatomic molecules.
	P-309	***Solid State Physics***	**CO 1** Different types of structure of solids and its characterization of X-Ray technique. **CO 2** Understanding of Thermal and Electrical properties of solids specifically heat and some models for calculations. **CO 3** Explaining the bonding crystal structure, crystallography, diffraction and band theory of solids. **CO 4** Characterize of solid based on fermi level position in the semiconductors **CO 5** Origin of magnetism, various types of magnitude materials and its use in modern technology

Program-Specific Outcome in Mathematics

The students at the end Bachelor of Science degree in Physics will be able to:

PSO 1 Acquire an in-depth knowledge of Algebra, Calculus, Geometry and Differential Equations. This leads to the study of related areas such as physical and life sciences building a foundation for higher studies in mathematics.

PSO 2 The skills and knowledge gained have intrinsic beauty, which leads to proficiency in analytical reasoning.

PSO 3 Utilize the concepts to solve theoretical and applied problems by critical understanding, analysis and synthesis.

PSO 4 ability to communicate mathematics effectively by written, computational and graphic means.

Course Outcomes in Mathematics

Year	Paper Code	Paper	Course Outcome

Part-I	***M-101***	***Discrete Mathematics***	**CO 1** Introduction to set theory and number theory. **CO 2** Boolean algebra and its significance to the theory of probability, geometry of sets, and information theory. **CO 3** The value of a proposition in argumentation is that it can be used to create new propositions. **CO 4** Introduction to Graph Theory and important terms of graph theory. **CO 5** Application of Graph Theory**.**
	M-102	***Calculus***	**CO 1** Knowledge about the Infinity Series. **CO 2** Introduction to Derivatives of Arcs. **CO 3** Understanding the Concept of maxima minima function of two variables. **CO 4** A detailed study of Beta and Gamma Function. **CO 5** Get knowledge of Area Rectification.
	M-103	***Analytic Geometry and Optimization Theory***	**CO 1** Understanding Polar Equations of Conic. **CO 2** Introduction to Sphere and cone theory. **CO 3** Understanding Cylinder and Coincides. **CO 4** Knowledge of generating lines. **CO 5** Introduction to Linear Programming Problem.
Part-II	***M-204***	***Real Analysis***	**CO 1** Introduction about real Analysis and its application. **CO 2** Introduction to Real Sequence and Convergence of sequence. **CO 3** Different properties of derivatives. **CO 4** Introduction to Riemann Integral. **CO 5** Knowledge about Sequence and Series of Functions.
	M-205	***Differential Equations***	**CO 1** Introduction of Differential Equations and Equations of first order and first degree. **CO 2** Understanding the concept of First order and of higher degree. **CO 3** Knowledge of Homogeneous linear differential equations. **CO 4** Introduction to the linear differential equation of second order.
	M-206	***Numerical Analysis***	**CO1** Acquire basic knowledge in solving interpolation with equal-interval problems by various numerical methods. Estimate the missing terms through interpolation methods. **CO2 Develop** skills in analysing the methods of interpolating a given data, properties of interpolation with unequal intervals and derive conclusions, approximate a function using an appropriate numerical method.

			CO3 Be able to derive and understand the Trapezoidal rule, Simpson's 1/3 – rule, Simpson's 3/8 rule, and Weddle's rules **CO4** Be able to find the solution of linear systems by using Direct methods, Matrix inversion method, Gaussian elimination methods, Gauss-Jordan Method, Method of factorization. **CO5** Be able to find the solution of ordinary differential equations of first order by the Euler method.
Part-III	***M-307***	***Abstract Algebra***	**CO 1** Introduction of Group Theory. **CO 2** Usage and application of Morphism of the group. **CO 3** Analysis of simple properties of Ring and Subring. **CO 4** Knowledge about the Ideals and Quotient Ring. **CO 5** Understanding of Linear Combinations and Vector Space.
	M-308	***Complex Analysis***	**CO 1** Understanding of Complex Plane. **CO 2** Demonstrate the Complex Integration. **CO 3** Knowledge about Taylor's Theorem. **CO 4** Understanding of Singularities of an Analytic Function. **CO 5** Analysis of Conformal Mapping
	M-309	***Mechanics***	**CO 1** Understanding the radial and transverse velocity and acceleration. **CO 2** understanding of Motion in resisting medium. **CO 3** Understanding about Central orbits. **CO 4** Knowledge about the Equilibrium of coplanar. **CO 5** Understanding of Virtual Work and Catenary.

Program-Specific Outcome in Chemistry

The students at the end Bachelor of Science degree in Chemistry will be able to:

PSO 1: Possess knowledge about the patterns and types of bonding, periodic properties, coordination behaviour, acid-base concepts, and radioactivity phenomena of inorganic compounds and elements.

PSO 2: Graduates will be capable of explaining the mechanisms of organic reactions involving different functional groups, heterocyclic compounds, and natural products. They will also have a foundational understanding of UV, IR, and NMR spectroscopy.

PSO 3: Graduates will acquire a deep understanding of physical parameters related to states of matter and chemical reactions, thermodynamic and electrochemical phenomena. Additionally, they will grasp the basics of spectroscopy in inorganic molecules, as well as concepts in quantum, magneto, and photochemistry.

PSO 4: Graduates will undergo practical training for the qualitative and quantitative identification of ions and functional groups. They will develop proficiency in handling various instruments and reagents, along with a thorough understanding of the necessary precautions associated with these techniques.

Course Outcome in Chemistry

Year	Paper Code	Paper	Course Outcome
Part-I	***CH-101***	***Inorganic Chemistry***	**CO 1** Develop a thorough understanding of band theories, ionic structure, and defects, including the properties associated with them. **CO 2** Engage in the study of theories of bonding, exploring the geometry of inorganic molecules, and understanding the ionic, dipolar, and electronegativity characteristics of bonds. **CO 3** Acquire knowledge about the periodic properties of the 's' and 'p' block elements within the periodic table. **CO 4** Delve into the study of the structure, formation, and properties of compounds involving 'p' block elements. **CO 5** Engage in the learning of laws, concepts, and kinetics related to radioactivity, particles, reactions, and the stability features of the nucleus.
	CH-102	***Organic Chemistry***	**CO 1** Gain knowledge about the general reaction mechanisms, intermediates, energy pathways, and methods used to determine reaction mechanisms. **CO 2** Develop a deep understanding of stereochemistry in organic molecules, encompassing optical, geometrical, and conformational isomerism, as well as different types of isomers and their representation. **CO 3** Undertake a detailed study of the nomenclature, preparation, and properties of alkanes, cycloalkanes, alkenes, cycloalkenes, alkadienes, and alkynes. **CO 4** Learn about aromaticity, synthesis, reactions, and the directive influence on benzene in organic compounds. **CO 5** Engage in a comparative study of the formation and chemical properties of alkyl, aryl, benzyl, and vinyl halides.
	CH-103	***Physical Chemistry***	**CO 1** Practice the application of mathematical formulas commonly used in chemistry, along with gaining a qualitative understanding of liquid crystals. **CO 2** Learn about the ideal and non-ideal behaviour of gases, including different types of isotherms, velocity, and physical parameters in gaseous molecules.

			CO 3 Acquire knowledge about crystal lattice, laws of crystallography, and diffraction patterns, enabling them to identify crystal structures. **CO 4** Engage in a broad study of the order of reactions, exploring physical and experimental methods for identifying them and understanding the terms and theories related to chemical kinetics.
Part-II	***CH-201***	***Inorganic Chemistry***	**CO 1** Learn about the characteristics of d-block elements, including the properties of compounds formed by these elements. **CO 2** Gain knowledge of nomenclature, isomerism, and concepts and theories related to coordination compounds **CO 3** Explore the general features, chemistry, occurrence, and separation methods of lanthanides and actinides. **CO 4** Delve into redox chemistry through the analysis of Frost, Latimer, and Pourbaix diagrams. **CO 5** Understand different concepts of acidic and basic behaviour, along with the classification and characteristics of some aqueous and non-aqueous solvents.
	CH-202	***Organic Chemistry***	**CO 1** Learn about the electromagnetic spectrum, laws of UV & IR spectroscopy, the idea about λ_{max} values and the reason for shifting, types of vibrations and regions of radiation lying in it. **CO 2** Engage in a detailed Study of nomenclature, synthesis, and physical and chemical properties of alcohol, phenols, ethers and epoxides. **CO 3** Gain Knowledge of preparation and mechanistic pathways of reactions shown by aldehydes and ketones. **CO 4** Study the synthesis, physical properties and reaction mechanism of carboxylic acids, acid halides, anhydrides, esters and amides. **CO 5** Understand the nitro and amine derivatives of alkanes and arenes.

	CH-203	***Physical Chemistry***	**CO 1** Learn terms, systems, and processes involved in thermodynamics, calculations related to the first law and thermochemistry. **CO 2** Acquire knowledge of theorems related to the second and third laws of thermodynamics, derivations of functions related to it, and concepts of chemical equilibrium. **CO 3** Engage in the study of phase rule and terms related to it, phase diagram of phase systems and mixtures. **CO 4** Undertake a detailed study of terms, theories, experiments and applications related to conductivity. **CO 5** Gain information about types of electrodes and cell, emf and pH measurements by using these.
Part-III	***CH-301***	***Inorganic Chemistry***	**CO 1** Understanding of acid-base behaviour based on hard and soft concepts and theories related to it. **CO 2** Explanation of splitting of 'd' orbital, theories and factors affecting it, reasons for magnetic behaviour in metal complexes CO 3 Study of reactions and stability of metal complexes, types, and discussion of electronic transitions. CO Learning of preparation, properties, bonding and applications of different organometallic compounds. CO 10 Knowledge of different elements in biological processes, structure and bonding in some inorganic polymers.
	CH-302	***Organic Chemistry***	**CO 1** Understanding NMR spectroscopy for organic molecules and structural elucidation from it. Role of active methylene group in organic synthesis and related name reactions. **CO 2** A detailed study of preparation, properties, and chemical reactions of some benzo fused, five and six-membered heterocycles. **CO 3** Learning of classification, structure, stereochemistry, bonding pattern, and physical & and chemical properties in carbohydrates. **CO 4** Overview of structure, stereochemistry, and properties of amino acids, constitution, and bonding in proteins and nucleic acids. **CO 5** Study of organosulphur compounds having different functional groups, classification, formation and bonding in organic polymers and dyes.

	CH-303	***Physical Chemistry***	**CO 1** Study of quantum mechanics laws and principles, Schrödinger and sinusoidal wave equations and concepts related to it. **CO 2** Basic ideas of formation and physical characteristics of bonding, antibonding, and hybrid molecular orbitals. **CO 3** Learning of principle, energy, and selection rules in vibrational, rotational, Raman, and electronic spectrum **CO 4** Understanding of laws of photochemistry and process involved in, dipole moment and optical activity of molecules. **CO 5** Knowledge about concentration measurements in solution, colligative properties, and calculation of molecular weight by these.

Program-Specific Outcome in Botany

The students at the end Bachelor of Science degree in Botany will be able to:

PSO 1: Understanding lower plant groups and their modes of evolution.
PSO 2: Students can gather knowledge on different Microbiological techniques, pathological problems identification in plants and their probable protection methods.
PSO 3: Can understand the diversity of angiospermic plants. They can gather knowledge on different conservation strategies and the status of plants around them.
PSO 4: Students can gather knowledge on different practical methods and instrumentation.

Course Outcome in Botany

Year	Paper Code	Paper	Course Outcome
	B -101	***Algae Lichens & Bryophytes***	**CO 1** General characters & classification of Algae **CO 2** Reproduction, Life Cycle & Economic Importance of Algae **CO 3** Lifecycle of *Oscillatoria*, *Nostoc*, *Volvox* & *Chara* **CO 4** Lifecycle of *Vaucheria*, *Ectocarpus*, *Polysiphonia* **CO 5** General characters, origin & evolution of bryophytes **CO 6** Lifecycle of *Riccia*, *Marchantia* & *Anthoceros* **CO 7** Lifecycle of *Funaria* & Lichens **CO 8** Laboratory Exercises related to the genera of Algae & Bryophytes including identification, slide preparation & section cuttings

Part -I			**CO 9** Laboratory exercises related to permanent specimens of Lichens.
	B -102	***Cell Biology & Genetics***	**CO 1** Introduction to cells, cell membranes. **CO 2** Study of cell organelles like Nucleus, Mitochondria, ER, Chloroplast, Plasma Membranes etc. **CO 3** Study of chromosomes, chromosomal aberrations, lampbrush, polytene & sex chromosomes **CO 4** Mendel's laws of inheritance **CO 5** Study of Monohybrid Cross, Dihybrid Cross, Test Cross & Back Cross **CO 6** Concept of gene, operon concept, one gene-one enzyme theory **CO 7** Introduction to plan breeding, techniques of plant breeding **CO 8** Study of applications of plant breeding. **CO 9** Laboratory exercises on Mitosis & Meiosis **CO 10** Permanent specimens of the special chromosome, the study of permanent slides & solving of problems of genetics
	B -103	***Microbiology, Mycology and Plant Pathology***	**CO 1** General introduction to Microbiology **CO 2** Describe the structure & reproduction of bacteria **CO 3** Classification & economic importance of bacteria **CO 4** To study the lifecycle of Mycoplasma & virus **CO 5** Detailed study of general characters of fungi, their classification & economic importance. **CO 6** To study the general account of plant pathology **CO 7** Describe the diseases caused in plants like white rust, green ear, black rust, smut & early blight **CO 8** Laboratory exercises on staining & preparation of slides of genera of Fungi **CO 9** Gram Staining of bacteria, study of micrographs & permanent specimens.
Part -II	***B -204***	***Pteridophyte, gymnosperm, & Paleobotany***	**CO 1** To study the general characters of gymnosperms ***CO 2*** To study the life cycle of *Cycas*, *Pinus* & *Ephedra* **CO 3** To study the classification & economic importance of gymnosperms. **CO 4** To study the classification & economic importance of Pteridophytes. **CO 5** Describe in detail about Paleobotany

			CO 6 Study the life cycle of Fossil plants **CO 7** Laboratory exercises on section cutting, slide preparation of vegetative & reproductive parts of pteridophytes & gymnosperms **CO 8** Laboratory exercises on the study of permanent specimens of fossil plants.
Part -II	***B -205***	***Molecular Biology & Biotechnology***	**CO 1** Describe the biological, physical & chemical nature of hereditary material DNA & RNA **CO 2** Explain the function of DNA replication & preliminary account of DNA damage & repair **CO 3** Give the central dogma of life **CO 4** Explain the genetic code, initiation, elongation & termination **CO 5** Study the regulation of gene expression in prokaryotes & eukaryotes **CO 6** Describe in detail the basic aspects of Biotechnology, the concept of culture techniques, plant tissue culture & their applications **CO 7** Describe in detail recombinant DNA technology **CO 8** Laboratory exercises on media preparation, culture techniques, identification & working of equipment.
	B -206	***Plant Physiology & Biochemistry***	**CO 1** To study the physiochemical properties of water, transpiration, guttation, & their factors **CO 2** Describe in detail about mineral nutrition in plants **CO 3** Describe in detail about transport of organic substances in plants. **CO 4** Explain the theoretical & practical aspects of photosynthesis **CO 5** Explain the theoretical & practical aspects of respiration **CO 6** Explain in detail carbohydrates, proteins & lipids **CO 7** Study about enzymes, growth, and plant hormones **CO 8** Laboratory exercises on demonstration & performance of processes like photosynthesis, respiration, growth, transpiration etc.
	B -307	***Plant Morphology & Anatomy***	**CO 1** Study the basic body plan of flowering plants **CO 2** Study the diversity of plant forms **CO 3** Describe the branching pattern & canopy architecture in plants **CO 4** Explain the tissue, tissue system, and shoot apical meristem in detail **CO 5** Explain the primary structure of the stem, leaf & root

Part -III			**CO 6** To study the secondary growth in plants **CO 7** To study the structure & ecological adaptation in seed **CO 8** Laboratory exercises on the study of the root, stem, leaf, flower, section cutting, staining, slide preparation
	B -308	***Taxonomy & Embryology***	**CO 1** To classify the plant families **CO 2** To study the general characteristics of different flowering plants **CO 3** To demonstrate the floral aspect of families in the curriculum **CO 4** Study in detail about ovules, types of ovules, endosperm, ovary etc. **CO 5** Field visits to Botanical gardens, herbaria, and research institutes **CO 6** Laboratory exercises on the study of anatomical & morphological characters of flowering plants of different families.
	B -309	***Ecology & Economic Botany***	**CO 1** Describe in detail about plant ecology **CO 2** Study the climatic, edaphic & biotic factors affecting plants **CO 3** Describe in detail population ecology & community ecology **CO 4** Study about the plant succession & ecosystem **CO 5** Describe in detail the vegetation of India **CO 6** Explain the general introduction of economic Botany with reference to cereals, starch, sugar plants, vegetables, fruits, spices, beverage plants, fibre plants, wood, rubber, oil leading plants & medicinal plants. **CO 7** Give an account of Ethnobotany **CO 8** Perform the lab exercises on density, pH, and porosity of different types of soils **CO 9** Perform quadrat exercises **CO 10** Identify the economic importance of cereals, beverages, tea, rubber, and wood, oil-yielding plants, spices, fruits, vegetables & medicinal plants.

Program-Specific Outcomes in Zoology

The students at the end Bachelor of Science degree in Zoology will be able to:

PSO 1 Explain the taxonomy and classification of chordates & non-chordates. Study of Phylums, concepts of Cell structure, organelles, nuclear organization, Nucleic

acids, Replication, Transcription & Translation. Concepts of Genetics & developmental processes in detail.

PSO 2 Detailed understanding of Physiological & Biochemistry with basics of Invertebrate. Understanding of Immune system, Microbes & Biotechnology.

PSO 3 Explain the structure & function of chordate types along with the concepts of Ecology and environmental processes with evolutionary processes. Help students understand the fundamentals of Applied zoology, Ethology & Biostatistics.

PSO 4 Detailed demonstration of microscopic studies, specimens, cell biology & genetic studies. Demonstration of Invertebrate types with Practical experience in physiology & biochemistry. Help students to understand the basic structure of anatomical features of vertebrates through specimens/slides and explain the analysis of Soil and Water.

Course Outcome in Zoology

Year	Paper Code	Paper	Course Outcome
Part-I	***Z-101***	***Diversity of Animals***	**CO 1** Student gains knowledge on taxonomy, cladistics, nomenclature. **CO 2** Gain knowledge on concepts of organization levels, Protozoa and Metazoa. **CO 3** Learn about the classification of chordates and Non-chordates: Concepts on symmetry, coelom, segmentation and embryogeny. **CO 4** In-depth knowledge of Non-chordates and Chordates. **CO 5** Learn in detail about Phylum their habitats, habits, morphology, structure, and physiological system. Affinities and Adaptations. **CO 6** Learn in detail about Phylum Ctenophora, Platyhelminthes, Aschelminthes, and Annelida.
		Cell Biology and Genetics	**CO 1** Study on structural and functional aspects of Prokaryotic and Eukaryotic animal cell. **CO 2** Understanding of cell membrane, structure and concept of the unit membrane. **CO 3** Understanding of Transport across the cell membrane, osmosis, facilitated diffusion and active transport. **CO 4** Study about organelles, their structure and function

	Z-102		**CO 5** Imparting in-depth knowledge of the function and Physiological process of the cell. **CO 6** Understanding of Nuclear organization with a detailed account of chromosomes and their organization. **CO 7** Study about Nucleic acids: DNA structure & RNA structure and its type. **CO 8** Gains knowledge on Replication, Transcription &Translation. **CO 9** Students get to know about Genetic code & Cell reproduction: Mitosis, Meiosis & Cell Cycle. **CO 10** Study on detailed concepts of Genetics: Mendel's Law of Inheritance, Chromosomal mutations, Linkage, Genetic Interaction, Multiple Gene Inheritance, Cytoplasm inheritance. **CO 11** Students get to know about Sex determination, *Drosophila*, Genetic disorders & Concept of the gene.
	Z-103	***Gamete and Developmental Biology***	**CO 1** Study on the Concepts of Developmental Processes and stages. **CO 2** Study on the concepts of Gametogenesis, Fertilization & Parthenogenesis. **CO 3** Detailed account on patterns and processes: Cleavage, Fate maps, Embryonic Induction. **CO 4** Understanding of development of chick up to the 96-hour stage. **CO 5** Knowledge of Extra embryonic membranes in chicks their development & function **CO 6** Students get introduced to Paedogenesis and Neoteny. **CO 7** Students will be able to explicate the concepts of Regeneration. **CO 8** Students learn about the concepts of stem cells, their application, and the cloning of animals through different techniques. **CO 9** Students gain knowledge about teratogenesis, the biology of ageing & cell death.
Part-II	***Z-204***	***Structure and Function of Invertebrate Types***	**CO 6** Detailed account of detailed features, organs and systems, affinities & adaptations of Arthropoda, Onychophora, Mollusca, Echinoderms, and Hemichordata. **CO 7** Detailed account of Palaemon, Scorpion, Periplaneta, Apis, Peripatus, Pila, Unio, Sepia, Ascaris, Echinus etc. **CO 8** Salient Features of Hemichordata **CO 9** Introduction to canal system of sponges & parasitic adaptations in Helminthes.

			CO 10 Social organization in termites and honey bees; Direct & indirect development in insects. **CO 11** Understanding of the Water vascular system of starfish. Introduction to Parasitism in Crustacea, Crustacean larvae & mouth parts in insects.
	Z-205	***Animal Physiology and Biochemistry***	**CO 1** Detailed account of Animal Physiology with special reference to mammals. **CO 2** Understanding of the physiology of Digestion, Blood circulation, Respiration, and Excretion. **CO 3** Concepts on Physiology of nerve impulse and reflex action, Physiology of muscle contraction, Reproduction & preliminary idea of neurosecretion, hypothalamic control of Pituitary function **CO 4** Detailed concepts of Biochemistry. **CO 5** Understanding of Carbohydrates. **CO 6** Understanding of Proteins: Structure, Function and Significance. **CO 7** Understanding of Lipids: structure, function and significance, pathways and biosynthesis of biomolecules.
	Z- 206	***Immunology, Microbiology and Biotechnology***	**CO 1** Detailed knowledge of the immune system. **CO 2** Detailed concepts on Antigen-Antibody reactions, Immunity regulating cells, Mechanism of humoral or antibody-mediated immunity and cell-mediated immunity. **CO 3** Introduction to Microbes. **CO 4** Detailed concept of structural organization: Prokaryota (Bacteria) Size, Shapes, Structural organization. **CO 5** Introduction to Genetic Material of Bacteria. **CO 6** Understanding of Reproduction in Bacteria: asexual, Binary fission, budding, sexual reproduction etc. **CO 7** Concepts of Microbial Nutrition & Bacterial of medical importance. **CO 8** Introduction to detailed concepts, scope and application of biotechnology. **CO 9** Understanding of Animal cells, Tissue organs and embryo cultures. **CO 10** Concepts of Genetic Engineering, Knowledge of Protoplast Fusion in Prokaryotes and Eukaryotes. **CO 11** Detailed concepts of Recombinant DNA technology, Monoclonal antibodies and cloning.
Part-III	***Z 307***	***Structure and Function***	**CO 1** Detailed description of chordates with special reference to *Herdmania* and *Branchiostoma.*

		of Chordate Types	**CO 2** Affinities of Hemichordata, Urochordata and Cephalochordata. **CO 3** Ascidian tadpole larva and its metamorphosis. **CO 4** Detailed account of structure, organs and systems of Pisces, Amphibia, Reptilia, Aves and Mammal. **CO 5** Introduction to Chordate Adaptation. **CO 6** Introduction to Parental Care with reference to Amphibia. **CO 7** Introduction to flight adaptations, types of feathers, bird migration for Aves. **CO 8** Adaptive radiation & dentition in Mammals.
	Z-308	***Ecology, Environmental Biology and Evolution***	**CO 1** Introduction to concepts of Ecology, Concepts of limiting factors and Ecosystem: Biotic and Abiotic factors. **CO 2** Detailed account of Ecosystem: Production, Consumption & decomposition in ecosystem. **CO 3** Concepts of Food- chain, Food -web, Trophic structure, Ecological pyramids. **CO 4** Introduction to Biogeochemical cycles of O_2, CO_2, H_2O, N, P. **CO 5** Detailed account of Ecosystem, Population Ecology, Community ecology, Habitat ecology & Ecological succession. **CO 6** Concepts of Ecology and Human future. **CO 7** Introduction to Environment and its concepts, Hydrosphere, Lithosphere and Atmosphere. **CO 8** Detailed concepts of Natural resources, Environmental pollution, Greenhouse effect, ozone layer depletion. **CO 9** Concepts of bioaccumulation, biomagnification, impact of urbanization. **CO 10** Concepts of Wildlife conservation & space Ecology. **CO 11** Introduction to Darwinism, Variations, Isolations, Mutations, Concept of Species and Speciation. **CO 12** Detailed account of Adaptations, Polymorphism, Evolution of Man. **CO 13** Understanding of Zoogeography, Zoogeographical realms and faunal peculiarities.
	Z-309	***Applied Zoology, Ethology and Biostatistics***	**CO 1** Detailed account of Vermiculture, Sericulture, Lac culture, Apiculture, Prawn culture, and Poultry keeping. **CO 2** Introduction to Economic importance of Protozoa, Corals & Coral reefs, Helminthes, Arthropods, Molluscs. **CO 3** Concepts of Insects and their management. **CO 4** Understanding of behaviour through Ethology.

			CO 5 Concepts of Pheromones, Societies, Biological rhythms & biological clocks. **CO 6** Detailed concepts of Biostatistics. **CO 7** Understanding of Frequency distribution, a graphical and tabular representation of data. **CO 6** Concepts of Mean, Mode, Median, Standard Deviation, Standard Error & Hypothesis: Null & Alternative.

PO-CO Mapping of attainment (Science)

Course/ Subject	PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4
Physics P 101 - 309	CO1	X	x									x		x	x
	CO2												x		
	CO3		x									x		x	x
	CO4	X													
	CO5		x									x	x	x	x
Maths M 101-309	CO1	X										x			x
	CO2													x	
	CO3		x									x	x		x
	CO4	X											x	x	x
	CO5	X	x									x	x		x
Chemistry CH 101 -309	CO1						x					x	x	x	x
	CO2						x						x	x	
	CO3					x						x			x
	CO4						x						x		
	CO5					x						x		x	x
Botany B 101-309	CO1							x	x			x			x
	CO2											x		x	
	CO3							x	x				x	x	
	CO4														x
	CO5							x				x	x	x	
Zoology Z 101 - 309	CO1										x		x	x	
	CO2									x		x			x
	CO3												x	x	
	CO4									x	x			x	
	CO5										x		x		x