

B.Sc. (P) Life Science

PAPER	COURSE LEARNING OUTCOMES
BOTANY	
Biodiversity (Microbes, Algae, Fungi and Archegoniatae)	Upon successfully completing the course student <ul style="list-style-type: none">• Gain information about the fascinating world of microbes, algae, fungi and archegoniate• Understand the evolution of plant on earth• Able identify the common plant disease in field• Understand the ecological and economic importance of this group of organism
Plant Ecology and Taxonomy	Upon successfully completing the course student will <ul style="list-style-type: none">• Understand the complex interrelationship between organisms and its environment and plant nomenclature system• Able to explain the methods used to study vegetation and plant community• Identify some common flowering plants• Understand strategies for biodiversity conservation
Plant Anatomy and Embryology	Upon successfully completing the course student <ul style="list-style-type: none">• Gain knowledge about plant internal structure, different stages of plant growth and differentiation• Understand the plant cellular composition and reproduction• Able to correlate its structure with its function• Can explain the evolution of tissues, plant structure and function with respect to its environment
Biofertilizers	Upon successfully completing the course student will <ul style="list-style-type: none">• Understanding about these eco-friendly fertilizers• Gain knowledge on conditions required for the growth and multiplication of these microorganisms• Able to utilize the knowledge gain for developing methods for decomposition of organic waste
Plant Physiology and Metabolism	Upon successfully completing the course student will <ul style="list-style-type: none">• Understand the relation of plant morphology and anatomy to the functioning of plant system• Gain knowledge on various metabolic processes in plant and their importance• Understand the role of different phytohormones and flowering stimulus• Able to explain the mechanism of uptake of water and nutrients by plant• Can apply the knowledge gained on light, nutrient and hormone importance, in cultivating healthy plants

Medicinal Botany	<p>Upon successfully completing the course student will</p> <ul style="list-style-type: none"> • Gain knowledge about alternative medicine approach • Become aware about the rich medicinal plant biodiversity in India • Able to utilize his skill in promoting holistic treatment approach involving modern medicine system with traditional one
Cell and Molecular Biology	<p>This course will be able to demonstrate foundational knowledge in understanding of: The relationship between the properties of macromolecules, their cellular activities and biological responses Understanding of Cell metabolism, chemical composition, physiochemical and functional organization of organelle Contemporary approaches in modern cell and molecular biology. Understanding of nucleic acid, organization of DNA in prokaryotes and Eukaryotes, DNA replication mechanism, genetic code and transcription process. Processing and modification of RNA and translation process, function and regulation of expression. Application in biotechnology</p>
Bioinformatics	<p>Upon successfully completing the course student will</p> <ul style="list-style-type: none"> • Gain knowledge of various biological resources available and their usage in research • Developed the skill of biological data analysis and retrieval • Utilize their skill in higher education, biological research and bioinformatics industry like drug designing, genomics
Ethnobotany	<p>Upon successfully completing the course student will</p> <ul style="list-style-type: none"> • Have understanding of the plants used by tribal's and local communities in medicine and nutrition • Also gain knowledge about the different conservative practices followed by these ethnic groups • Develop the skills in identification of most of these medicinal plants and will be able to utilize in field of herbal medicine
Economic Botany and Biotechnology	<p>Upon successfully completing the course student will</p> <ul style="list-style-type: none"> • Understand the plant morphology and cultivation process • Became familiar with different processing methods used to obtain plant based products, concept of Center of Origin in cultivated plants • Understand the various biotechnological tools and techniques used in plant science • Able to explain the importance of transgenic crops in global food security
Analytical Techniques in Plant Sciences	<p>Upon successfully completing the course student will</p> <ul style="list-style-type: none"> • Gain acquaintance on various instruments and techniques used in plant science • Utilize this knowledge in higher education and biological research
IPR	<p>Students would have deep understanding of patents copyrights, their importance. They can think about the importance of traditional knowledge, bio-prospecting, biopiracy. They would gain the knowledge of farmers rights and the importance on indigenous plant varieties, concept of novelty and biotechnological inventions</p>

CHEMISTRY

Atomic Structure,
Bonding, General
Organic Chemistry &
Aliphatic
Hydrocarbons

By the end of the course, the students will be able to:

- Solve the conceptual questions using the knowledge gained by studying the quantum mechanical model of the atom, quantum numbers, electronic configuration, radial and angular distribution curves, shapes of s, p, and d orbitals, and periodicity in atomic radii, ionic radii, ionization energy and electron affinity of elements.
- Draw the plausible structures and geometries of molecules using radius ratio rules, VSEPR theory and MO diagrams (homo- & hetero-nuclear diatomic molecules).
- Understand and explain the differential behavior of organic compounds based on fundamental concepts learnt.
- Formulate the mechanism of organic reactions by recalling and correlating the fundamental properties of the reactants involved.
- Learn and identify many organic reaction mechanisms including free radical substitution, electrophilic addition and electrophilic aromatic substitution.

Chemical Energetics,
Equilibria and
Functional Group Org

By the end of this course, students will be able to:

- Understand the laws of thermodynamics, thermo chemistry and equilibria.
- Understand concept of pH and its effect on the various physical and chemical properties of the compounds.
- Use the concepts learnt to predict feasibility of chemical reactions and to study the behavior of reactions in equilibrium.
- Understand the fundamentals of functional group chemistry through the study of methods of preparation, properties and chemical reactions with underlying mechanism.
- Use concepts learnt to understand stereochemistry of a reaction and predict the reaction outcome
- Design newer synthetic routes for various organic compounds.

Solutions, Phase
Equilibrium,
Conductance,
Electrochemistry and
Functional Group
Organic Chemistry-II

By the end of the course, the students will be able to:

- Explain the concepts of different types of binary solutions-miscible, partially miscible and immiscible along with their applications.
- Explain the thermodynamic aspects of equilibria between phases and draw phase diagrams of simple one component and two component systems.
- Explain the factors that affect conductance, migration of ions and application of conductance measurement.
- Understand different types of galvanic cells, their Nernst equations, measurement of emf, calculations of thermodynamic properties and other parameters from the emf measurements.
- Understand and demonstrate how the structure of biomolecules determines their chemical properties, reactivity and biological uses.
- Design newer synthetic routes for various organic compounds.

Chemistry of Cosmetics and Perfumes	<p>By the end of this course, the students will be able to:</p> <ul style="list-style-type: none"> • Learn basic of cosmetics, various cosmetic formulation, ingredients and their roles in cosmetic products. • Learn the use of safe, economic and body-friendly cosmetics • Prepare new innovative formulations.
Chemistry of s- and p-Block Elements, States of Matter and Chemical Kinetics	<p>By the end of the course, the students will be able to:</p> <ul style="list-style-type: none"> • Understand the chemistry and applications of s- and p-block elements. • Derive ideal gas law from kinetic theory of gases and explain why the real gases deviate from ideal behavior. • Explain Maxwell-Boltzmann distribution, critical constants and viscosity of gases. • Explain the properties of liquids especially surface tension and viscosity. • Explain symmetry elements, crystal structure specially NaCl, KCl and CsCl • Define rate of reactions and the factors that affect the rates of reaction. • Understand the concept of rate laws e.g., order, molecularity, half-life and their determination • Learn about various theories of reaction rates and how these account for experimental observations.
Basic Analytical Chemistry	<p>By the end of this course, students will be able to:</p> <ul style="list-style-type: none"> • Handle analytical data • Determine composition and pH of soil, which can be useful in agriculture • Do quantitative analysis of metal ions in water • Separate mixtures using separation techniques • Estimate macro nutrients using Flame photometry
Chemistry of d-block elements, Quantum Chemistry and Spectroscopy (compulsory)	<p>By the end of the course, the students will be able to:</p> <ul style="list-style-type: none"> • Understand chemistry of d and f block elements, Latimer diagrams, properties of coordination compounds and VBT and CFT for bonding in coordination compounds • Understand basic principles of quantum mechanics: operators, eigen values, averages, probability distributions. • Understand and use basic concepts of microwave, IR and UV-VIS spectroscopy for interpretation of spectra. • Explain Lambert-Beer's law, quantum efficiency and photochemical processes.

<p>Green Methods in Chemistry</p>	<p>By the end of this course, students will be able to:</p> <ul style="list-style-type: none"> • Get idea of toxicology, environmental law, energy and the environment • Think to design and develop materials and processes that reduce the use and generation of hazardous substances in industry. • Think of chemical methods for recovering metals from used electronics materials. • Get ideas of innovative approaches to environmental and societal challenges. • Know how chemicals can have an adverse/potentially damaging effect on human and vegetation. • Critically analyze the existing traditional chemical pathways and processes and creatively think about bringing environmentally benign reformations in these protocols. • Convert biomass into valuable chemicals through green technologies.
<p>Organometallics, Bioinorganic chemistry, Polynuclear hydrocarbons and UV, IR Spectroscopy</p>	<p>By the end of the course, the students will be able to:</p> <ul style="list-style-type: none"> • Understand the chemistry and applications of 3d elements including their oxidation states and important properties of the familiar compounds potassium dichromate, potassium permanganate and potassium ferrocyanide • Use IR data to explain the extent of back bonding in carbonyl complexes • Get a general idea of toxicity of metal ions through the study of Hg²⁺ and Cd²⁺ in the physiological system • Understand the fundamentals of functional group chemistry, polynuclear hydrocarbons and heterocyclic compounds through the study of methods of preparation, properties and chemical reactions with underlying mechanism. • Gain insight into the basic fundamental principles of IR and UV-Vis spectroscopic techniques. • Use basic theoretical principles underlying UV-visible and IR spectroscopy as a tool for functional group identification in organic molecules.
<p>Pharmaceutical Chemistry</p>	<p>By the end of this course, students will be able to:</p> <ul style="list-style-type: none"> • Gain insight into retro-synthesis approach in relation to drug design and drug discovery. • Learn synthetic pathways of major drug classes. • Understand the fermentation process and production of ethanol, citric acids, antibiotics and some classes of vitamins.

ZOOLOGY

Animal Diversity	<p>Upon completion of the course, students will be able to:</p> <ul style="list-style-type: none"> • Learn Morpho-taxonomy and structural organization of non-chordate and chordate groups. • Acquire knowledge of diversity of non-chordate and chordate groups. • Learn evolutionary relationships and phylogeny of non-chordates and chordates through functional and structural similarities. • Understand the economic importance of non-chordates and chordates and their significance in the ecosystem. • Promote shared learning through practical classes, class room presentations and projects.
Comparative Anatomy and Developmental Biology of Vertebrates	<p>Upon completion of this course, students should be able to:</p> <ul style="list-style-type: none"> • Know about the levels of organization among different groups of vertebrates. • Understand that different organs and organ systems integrate with each other to impart proper regulation of a particular function. • Understand how the various organs evolved during the course of evolution through succession. • Know the evolution of different concepts in developmental biology. • Be able to understand the process of gamete formation from stem cell population to mature ova and sperm. • Be able to comprehend the sequence of steps leading to the formation of gametes and development of embryo. • Learn the mechanisms underpinning cellular diversity and specificity in animals. • Study the methods and tools related to developmental biology which help to understand different processes of embryogenesis.
Physiology and Biochemistry	<p>Course Learning Outcome: Upon completion of the course, students would be able to:</p> <ul style="list-style-type: none"> • Have an increased knowledge of human physiology and be able to appreciate its functions. • Understand the functions of major physiological systems in body. • Recognise and identify principal tissue structures. • Have understanding of the metabolic pathways of carbohydrates, proteins and fats; and appreciate how the cells harness energy. • Understand the importance of enzymes, mechanism of working and kinetics. • Relate how biochemical systems interact to yield integrated physiological responses. • Understand the principles and approach to experimental design • Perform, analyse and interpret basic experiments and observations in physiology and biochemistry.

<p>Medical Diagnostics</p>	<p>After completing this course, the students should be able to:</p> <ul style="list-style-type: none"> • Gain knowledge about various infectious, non-infectious and lifestyle diseases, tumors and their diagnosis. • Understand the use of histology and biochemistry of clinical diagnostics and learn about the molecular diagnostic tools and their relation to precision medicine. • Develop their skills in various types of tests and staining procedure involved in hematology, clinical biochemistry and will know the basics of instrument handling. • Learn scientific approaches/techniques used in the clinical laboratories to investigate various diseases and will be skilled to work in research laboratories. • Gain knowledge about common imaging technologies and their utility in the clinic to diagnose a specific disease.
<p>Genetics and Evolutionary Biology</p>	<p>Students would be able to understand the fundamentals of Mendelian inheritance and its exceptions. They would be able to appreciate various other gene interactions like co-dominance, incomplete dominance, lethal alleles and pleiotropy. Further, students would be able to describe the concepts of linkage and crossing over and their usage in constructing gene maps.</p> <ul style="list-style-type: none"> • Help students understand the basic principles of pedigree analysis and will be able to construct and analyze pedigree related problems for inherited traits. • Students would gain knowledge on chromosomal and genetic mutation. • Students would be able to describe the chromosomal sex-determination mechanisms and dosage compensation. • Students would be able to understand the major events in history of life and major theories of evolution. • Students would be able to appreciate the contribution of fossil studies in evolution and the phylogeny of horse. • Students would be able to calculate the gene and allele frequency using Hardy-Weinberg law and analyse population genetics problems. T • Students would understand the fundamental concepts of natural selection, speciation, mass extinction and macro-evolution.
<p>Aquarium Fish Keeping</p>	<p>Upon completion of the course, students should be able to:</p> <ul style="list-style-type: none"> • Acquire knowledge about different kinds of fishes, their compatibility in aquarium. • Become aware of Aquarium as commercial, decorative and of scientific studies. • Develop personal skills on maintenance of aquarium. • Know about the basic needs to set up an aquarium, i.e., dechlorinated water, reflector, filters, scavenger, aquatic plants etc. and the ways to make it cost-effective.

Animal Biotechnology	<p>Upon completion of the course, students will be able to:</p> <ul style="list-style-type: none"> • Use or demonstrate the basic techniques of biotechnology; like DNA isolation, PCR, transformation, restriction, digestion etc. • Devise a strategy to manipulate genetic structure of an organism for the improvement in any trait or its well-being based on the techniques. • Understand the ethical and social issues raised regarding GMOs. • Apply the knowledge for designing a proposal for research project.
Apiculture	<p>Upon completion of the course, students should be able to:</p> <ul style="list-style-type: none"> • Learn about the various species of honey bees in India, their social organization and importance. • Be aware about the opportunities and employment in apiculture – in public, private and government sector. • Gain thorough knowledge about the techniques involved in bee keeping and honey production. • Know about various products obtained from beekeeping sector and their importance. • Develop entrepreneurial skills necessary for self-employment in beekeeping sector. • Enhance collaborative learning and communication skills through practical sessions, team work, group discussions, assignments and projects.
Immunology	<p>Upon completion of the course, students will be able to:</p> <ul style="list-style-type: none"> • Study hematopoiesis to know the concepts of stem cells and their differentiation into progenitor stem cells and adult lineages. • Learn the concepts of innate and acquired immunity. • Understand adaptive immune responses and sequential phases-antigen recognition by lymphocytes, their proliferation, differentiation into effectors and memory cells and elimination of pathogens. • Learn about major histocompatibility complex and their role in transplantation immunity and autoimmunity • Gain knowledge about the Complement system and how they interact and activate a catalytic cascade to remove immunogens. • Study the role of various cytokines involved in cell to cell communication in the removal of pathogens. • Understand the advent of hypersensitivities due to inappropriate innate and adaptive immune responses. • Know the basic immunological aspects to comprehend the newer strategies in vaccine design, and efforts to treat autoimmunity, hypersensitivity and immunodeficiency.

Public Health and Hygiene

Upon completion of the course, students will be able to:

- Get familiarised with various aspects of environmental risks and hazards.
- Sensitize about the climate change due to human activities.
- Be aware about the various impacts of environmental degradation on human health through case studies and modes of prevention.
- Learn about the nuclear and chemical disasters and their aftereffects through cases studies.
- Know about the various waste management technologies and their utility.
- Learn about diagnosis of various diseases and methods to prevent them.
- Be sensitized enough to understand the importance of conservation of nature for betterment of human race and all living beings.