

Program: B.Sc.(Medical)

Programme Specific Outcomes

- PSO1.** B.Sc. Medical students are able to acquire theoretical as well as practical knowledge regarding Botany, Zoology, Chemistry, Biotechnology, Fish and Fisheries, Plant Tissue, Cell Biology and Genetics.
- PSO2.** Medical Students will be able to define and explain major concepts in the biological sciences and able to correctly use biological instrumentation and proper laboratory techniques, field exploration for flora and fauna.
- PSO3.** Students will be able to communicate biological knowledge in oral and written form and to recognize the relationship between structure and function at all levels: molecular, cellular, organismal and apply ethical principles to biological science
- PSO4.** Students develop various skills like deliver seminars, power-point presentations, internet exploration, Execution & Planning of minor projects which assist them to use the new technologies in life.
- PSO5.** It helps to develop scientific temper and thus can prove to be more beneficial for the society as the scientific developments can make a nation or society to grow at a rapid pace.
- PSO6.** After the completion of this course students have the option to go for higher studies i.e. M. Sc. and able to do research for the betterment of plant, animals, environment and all humankind.
- PSO7.** Science graduates can go to serve in industries, hospitals, minor projects, biological marketing, entrepreneur along with various other options like Civil Services - Indian Forest Service, IAS, Indian Army, Indian Air Force and other competitive examinations, banking sector.

Course Outcomes

Semester: I

Course : Botany Paper I (Diversity of Microbes)

- CO1.** This course explains the unique features of viruses, their mode of replication and a brief summary of mycoplasma.

- CO2. This course illustrates the ultrastructure of bacteria, its mode of reproduction, nutritional types and *cyanobacteria* with special reference to *Oscillatoria*.
- CO3. This course describes the fundamental features and life cycle of fungi with special reference of Kingdom *Chromista*, *Zygomycota* and *Ascomycota*.
- CO4. This course describes the features and life cycle of fungi with special reference of Basidiomycota and Lichens are explained in details.

Course: Botany Paper II (Diversity of Cryptogams)-

- CO1. This course outlines all the basic studies of algae including all the important aspects of it.
- CO2. This course describes the algae with special reference of *Chlorophyceae*, *Xanthophyceae*, *Phaeophyceae* and *Rhodophyceae*.
- CO3. This course deals with the study of bryophytes i.e. amphibians of plant kingdom with special reference to *Funaria* and *Antheroceros*.
- CO4. This course deals with the study of pteridophytes i.e. first vascular plants with special reference of *Psilopodia*, *Lycopsidea*, *Spenopsida* and *Pterospida*.

Course: Zoology Paper I (Cell Biology)-

- CO1. This course aims at providing knowledge about various methods in cell biology such as microscopy (SEM/TEM), staining.
- CO2. Students will learn and have elementary idea about a brief introduction about Plasma membrane and its functioning in osmosis.
- CO3. This course inculcates a basic understanding to students about various cell organelles for instance nucleus, mitochondria, ER etc such as structure and types.
- CO4. Students will learn about biological role and functions of cell organelles.

Course: Zoology Paper II (Biodiversity-I) -

- CO1. This course aims at providing knowledge about various type studies of Protozoa. It discusses classification upto orders with brief ecological note and economic importance of different species of Protozoa.
- CO2. This course expresses a basic understanding to students about detailed study of animal types and introduction to Parasitic Protozoa.
- CO3. The course illustrates about human parasites and parasitic adaptations.
- CO4. Students will learn about identification, classification and structure of invertebrates: porifera.
- CO5. This course provides students material to understand about detailed study of Coelenterate to Annelida animal types and their classification and identification.

Course: Organic Chemistry

CO1: The main aim of this course is to provide the ground information of the organic chemistry. Learners will be able to understand the structure and bonding of the organic compounds by learning the various effects such as inductive effect, resonance effect, hyperconjugation etc.

CO2: To make students capable of understanding and studying the classification of the organic compounds and impart the students a thorough knowledge about the mechanism of the reactions which determines the completion of the reactions

Course: Inorganic Chemistry

CO1: This would facilitate students to get the knowledge about the planck constant and describes that how the wavelength of the particle is calculated. It describes the wave mechanical model of the atom. It helps to know that how many electrons are present in the particular space

CO2: Students will make understanding with the periodic table and the terms related with that and also describes the trends that how they vary with along the period and down the group.

CO3: This will provide the knowledge of the noble gas family and their compound formation as well as reactivity

CO4: It intends the chemical bonding.

Course: Physical Chemistry

CO1: The main outcome of this course is to provide information about Mathematical concepts so that medical students would not face any difficulty in derivations and Students learn to solve differentiation, Integration of different functions which enhance their problem solving ability

CO2: Students learn to find out errors in their Practical and how to correct them .Moreover, Students learn to find out errors in their Practical and how to correct them .This course aims at knowledge of problems related to standard deviation and applicability of F-test and Q-test

CO3: This course facilitates how to differentiate between different states of matter. Students also develop an idea of liquid and gaseous states in which they learn the structural differences in solids, liquids and gases.

CO4: This course aims at knowledge of gases and the most important vanderwaals equation. The most interesting and useful topic 'Joule-Thomson effect' of this course tells the liquefaction of gases and the concept of Inversion Temperature.

CO5: This course facilitates the learners to grab knowledge about structure of molecules and their magnetic properties.

Semester-II

Course Name: Botany Paper III (Cell Biology)

- CO1. This course describes with the general structure and function of nucleus.
- CO2. This course explains the ultrastructure of cell organelles of cell.
- CO3. This course explains the organization of chromosomes and variations in their number.
- CO4. This course defines the envelope system of the cell.

Course Name: Botany Paper IV (Genetics & Evolution)

- CO1 This course describes the DNA and illustrating the structure, replication and other important features of it. Outlines of mitosis and meiosis.
- CO2 This course describes the genetic basis of inheritance with reference to mendelian genetics.
- CO3 This course deals with the expression of gene, transfer of genetic material, protein structure and mutations.
- CO4 This course describes the evidences of evolution and studies of evolution.

Course Name: Zoology Paper I (Biodiversity-II)

- CO1 Students will learn about identification, classification and structure of invertebrates: Arthropoda to Hemichordata
- CO2 This course provides a basic understanding to students about detailed study of animal like *Periplaneta*, Prawn, *Pila*, *Asterias*, Echinoderm larvae and external character and affinities of *Balanoglossus*.
- CO3 Students will be familiar about social organization in insects (Honey bee and Termites)

Course Name: Zoology Paper II (Ecology)

- CO1 Students will know about the importance and scope of ecology. This course illustrates about ecological factors and adaptations.
- CO2 Students will be familiar with basic concepts of ecology, learn the great ecosystems of world and components of ecosystem and its characteristics.
- CO3 This outcome makes students familiar about environmental organization and education. Students will understand about importance of biodiversity, natural resources and factors for degradation of environment.

Course: Organic Chemistry

- CO1: To make students capable of understanding and studying the classification of the organic compounds. To impart the students a thorough knowledge about the mechanism of the reactions which determines the completion of the reactions.

CO2: It provides the description of the allyl and aryl halides and their uses in various fields. These properties help to describe the melting and boiling points of many compounds and their reactivity towards various reactions.

CO3: It intends the naming reactions with different functional groups. The concept of isomerism deals with the nature of organic compounds. It gives the knowledge about the chirality which is the necessary condition for the chirality of the molecules. It deals with the different orientations of the compounds and with different names of the compounds. By using these configurations we can find the nature of compounds.

Course: Inorganic Chemistry

CO1: Students will understand the concept of close packing, ionic structures and factors affecting ionic solids which help them to identify and distinguish between different crystals.

CO2: Students will develop understanding about the properties of alkali and alkaline earth metals.

CO3: It would enable the learner to learn about the structure of diborane, Lewis acid nature of boron trihalides, preparation of carbides, nitrides & other relevant block compounds.

CO4: This course helps in understanding preparations and applications of fullerene, fluorocarbons, silicate compounds.

CO5: It makes the students learn and understand about types of oxides and oxyacids, their structure and reactivity in s block & p block elements, interhalogen compounds, polyhalides compounds.

Course: Physical Chemistry

CO1: The main outcome of this course is to enable the students to understand about solutions used in daily life and methods of expressing their concentration.

CO2: By studying this course learners will be able to think about the nature of solutions and their stability which would help them about the advantages and applications of various types of solutions.

CO3: This course aims at knowledge of different factors affecting rate of reaction and role of acid and base as a catalyst.

Semester-III

Course Name: Botany Paper V (Diversity and Systematics of Gymnosperms)

CO1 The students will discuss about classification, evolution and diversity of higher plant Gymnosperms. Students will learn about fossilization, cytology and economic importance of Indian gymnosperms.

- CO2 This course illustrate about general characters of Pro-gymnosperms, their morphology and origin and evolution of seed habit.
- CO3 This course illustrate about general characters, morphology, anatomy and reproduction of Cycadales and Coniferales .
- CO4 Students will discuss about general characters, morphology, anatomy and reproduction of Ephedrales and Gnetales.

Course Name: Botany Paper VI (Diversity and Systematics of Angiosperms)

- CO1 The students will be illustrated about origin, evolution and primitive and advanced characters of angiosperms.
- CO2 The course will express the detail about taxonomy, identification keys, ICBN and type concept..
- CO3 Apart from this, the course states about classification of gymnosperms.
- CO4 This course express a basic understanding about diagnostic features, technical description and importance of flowering plants as illustrated by members of various families.

Course Name: Zoology Paper I (Chordates I)

- CO1 This course describes the students about the phylum Chordate and basic concepts about chordates
- CO2 This course explains the external morphology and sexual dimorphism in chordates.
- CO3 In this course students are able to explain the various systems, adaptation and dentition in Mammals.
- CO4 This course illustrates the various systems like Digestive, excretory, reproductive and nervous system.

Course Name: Zoology Paper II (Chordates II & Evolution)

- CO1 This course describes the Systematic position and external morphology of chordate.
- CO2 This course enlists the study the various systems like digestive, excretory, reproductive and nervous systems
- CO3 This course classify the phylum Chordate i.e. Pisces, Reptiles, Aves and Mammals.
- CO4 This course describe the external as well as internal characters of classes by studying animals
- CO5 This course includes the study of various systems of aves.

Course: Inorganic Chemistry

- CO1: Develop the knowledge of transition metals to understand the trends in properties and reactivity of the first series of d-block elements and to know the typical physical and chemical properties of the transition metals.

CO2: To study the lanthanide elements to understand the trends in properties and reactivity and to develop the understanding of the typical physical and chemical properties of the transition metals.

CO3: To explain the typical physical and chemical properties of the transition metals especially from second and third transition series. To identify simple compound classes for transition metals and describe their chemical properties

CO4: In order to study transition metals to understand the trends in properties and reactivity of the actinides and its typical physical and chemical properties to understand its applications

Course: Organic Chemistry

CO1: This course will facilitate the learners to classify the types of these functional groups by nomenclature.

CO2: Through the structure and classification of the compounds containing these functional groups, they would be able to make comparison between the reactivity of these compounds.

CO3: This course allows the students to outline the mechanism of various reactions of organic molecules containing the above mentioned functional groups.

CO4: It would help in research work and to develop new chemical reaction with different methods.

CO5: They would be able to grab the knowledge about various naming reactions and they will learn about their applications in field of chemistry.

Course: Physical Chemistry

CO1: They will grab knowledge of the basic concept of thermodynamics

CO2: They will learn how to solve exact and inexact functions

CO3: Students will get information regarding thermochemistry in daily life activities

CO4: Students will be able to get knowledge of the conversant processes of steam dryness

CO5: They will learn about uses of thermodynamics in daily life like in window A.C and refrigerators.

Semester-IV

Course Name: Botany Paper VII (Plant Anatomy)

CO1 This course describe about various types of tissue system such as epidermal, fundamental and vascular tissue system.

CO2 This course express basic understanding about root system, its organization and anatomical details.

CO3 Students will be illustrated about shoot system, its organization, anatomical details and about cambium and its function.

CO4 Apart from this, the course explain about leaf, its anatomy and modifications. Also about study of stomatal types.

Course Name: Botany Paper VIII (Development and Reproduction in Flowering Plants)

CO1 This course illustrates about vegetative reproduction and its numerous applications in floriculture and horticulture.

CO2 This course also expresses the knowledge about flower, its structure, development and types of inflorescence.

CO3 Students will be stated about male and female gametophytes, types of pollination and double fertilization.

CO4 Apart from this, the course will discuss about post fertilization changes, endosperm, seed and fruit types.

Course Name: Zoology Paper I (Biochemistry)

CO1 This course enlists the structure, classification and functions of bio-molecules such as carbohydrate, amino acids, proteins, and lipids.

CO2 In this course students are able to describe the process of energy generation through various cycles.

CO3 .This course describes the process of metabolism of lipids, beta oxidation of fatty acids and gluconeogenesis.

CO4 This course explains the mechanism of metabolism of amino acids and hydrolysis of proteins.

Course Name: Zoology Paper II (Animal Physiology)

CO1 This course describes the mechanism of digestion, circulation, respiration and enlists the organs associated in the mechanism.

CO2 This course helps the students to explain the various components of blood and lymph and their functions.

CO3 In this course students are able to express the process of muscle contraction and propagation of nerve impulse.

CO4 This course makes the students to understand the endocrine system of mammalian body.

Course: Inorganic Chemistry

CO1: Students will be able to understand the applications of various types of complex and their properties

CO2: Develop the knowledge of various process which proceed through the oxidation and reduction and they will able to know the applications of these reactions

CO3: It will develop the understanding of all type of acid and bases and explain the behaviour of these

CO4: Students will be able to understand the applications of various non aqueous solvents and their properties with chemical behavior

Course: Organic Chemistry

CO1: Students will learn about the method of preparation, properties and uses of carboxylic acid along with their characteristic test

CO2: Students will learn about the method of preparation, properties and uses of derivatives of carboxylic acid along with their characteristic test

CO3: Students will learn about the method of preparation, properties and uses of ether along with epoxides.

CO4: Students will learn about the method of preparation, properties and uses of fats along with their commercial application.

CO5: Students will learn about the method of preparation, properties and uses of Organic compounds containing Nitrogen along with their distinguishable test

Course: Physical Chemistry

CO1: Phase diagrams are useful because they allow us to understand in what state matter exists under certain conditions. Phase equilibrium has wide range of applications in industries including production of different allotropes of carbon, lowering of freezing point of water by dissolving salt, purification of components by distillation, usage of emulsions in food production, pharmaceutical industry

CO2: Conductivity measurements are used routinely in many industrial and environmental applications as a fast, inexpensive and reliable way of measuring the ionic content in a solution.

CO3: These articles are depends on the movement of the boundary between two adjacent electrolytes under the influence of an electric field and the speed of the moving boundary can be measured and used to determine the ion transference numbers.

CO4: Nernst equation can be used to find the cell potential at any moment in during a reaction or at conditions other than standard-state, by knowing this students can determine the equilibrium constant or Gibbs free energy. In Concentration Cell students can know about how we can select anode or cathode. Nernst equation can be used to find the cell potential at any moment in during a reaction or at conditions other than standard-state, by knowing this students can determine the equilibrium constant or

Gibbs free energy. In Concentration Cell students can know about how we can select anode or cathode and also how e.m.f be calculated from those. Students will also learn about that how we can prevent our metallic things from corrosion.

Semester-V

Course Name: Botany Paper IX (Plant Physiology)

- CO1 This course explains the plant-water relations, importance of water to plant life, mechanism of opening & closing of stomata, macro- and micro- elements, mineral take, toxicity symptoms.
- CO2 This course illustrates the transport of organic substances, factors affecting translocation, basics of enzymology.
- CO3 This course describes the significance & concept of photosynthesis, Calvin cycle, CAM plants, C₄ pathway, photorespiration. Respiration: kreb's cycle, electron transport chain, pentose phosphate pathway.
- CO4 This course describes the nitrogen metabolism, ammonium assimilation. Lipid metabolism: fatty acid biosynthesis, saturated & unsaturated fatty acids..

Course Name: Botany Paper X (Plant Growth, Development and Biotechnology)

- CO1 This course outlines phases of growth, growth kinetics, plant hormones, bioassays, application of hormones.
- CO2 This course describes the photomorphogenesis, discovery, structure and mechanism of action of phytochrome and cryptochrome. Photoperiodism, vernalization, biological clocks and abscission.
- CO3 This course deals with the study of physiology of seed dormancy and seed germination. Tools and techniques of recombinant DNA technology, PCR, c-DNA library.
- CO4 This course deals with the study of basic concept of plant tissue culture, anther culture, somatic hybridization. Biotechnology and its application in human welfare.

Course Name: Zoology Paper I (Developmental Biology)

- CO1 This course describes the process of formation of gametes- spermatozoa and ovum through processes of spermatogenesis and oogenesis.
- CO2 Students will be able to describe the process of formation of different components of egg and vitellogenesis, egg membrane.

CO3 This course explains the formation of zygote from gametes by fertilization and parthenogenesis process.

CO4 Students will be able to know the cleavage pattern of embryo and study of various developmental stages- morula, gastrula and blastula in various animals.

Course Name: Zoology Paper II (Genetics)

CO1 This course explains the Mendel's experiments and statements of Mendel's laws which describe the inheritance of characters from one generation to next and students will be able to know how two genes interact together to show a trait and in which manner the vast genetic material is organized in a very small chromosomes.

CO2 This course describes the inheritance of character through the extra-nuclear material of cell.

CO3 This course explains the students about evolution in population genetics- calculation of allelic and gene frequency.

CO4 This course describes the causes and occurrence of variations and mutations in chromosomes due to duplication, deletion, translocation etc. and explains the causes and occurrence of variations and mutations in chromosomes due to duplication, deletion, translocation etc.

CO5 Students will be able to differentiate between the recombinant DNA technology, gene cloning and DNA fingerprinting

Course: Inorganic Chemistry

CO1: Students will be able to use Crystal Field Theory to understand the magnetic properties (and in simple terms the colour) of coordination compounds which facilitate them to describe the shapes and structures of coordination complexes with coordination numbers 6 and 4

Co2: Learner will develop the understanding of the stability of metal complexes by the use of formation constants and to calculate thermodynamic parameters from them. They will be able to describe rate of reactions of complexes and type of reactions in complexes

CO3: Student will be able to describe magnetic properties of complexes, various kind of magnetic materials and effect of temp on magnetic characters. They will also be able to describe methods of determining magnetic moments

CO4: Student will be able to describe quantum numbers, orbital and spin angular momenta of electrons. And To understand electronic transition, term symbol and concept of spectra.

Course: Organic Chemistry

CO1: It will make the learner to develop interest about the Synthesis, Properties and applications of Organo-metallic compounds

CO2: Students will learn about the Synthesis and Properties Organo-Sulphur compounds and their comparison with analogous compounds

CO3: Students will learn about the Principle, working and application of UV-Vis spectroscopy which will help them study the conjugation in organic compounds

CO4: Students will learn about the Principle, working and application of IR spectroscopy which will enable them to detect the various Functional group in organic compounds

CO5: Students will get knowledge about Principle, working and application of NMR spectroscopy which will help them in structure elucidation through C13-NMR & PMR

Course: Physical Chemistry

CO1: The main outcome of this course is to provide information about Quantum Mechanics and Spectroscopy .and Quantum Chemistry enables them to know about Schrodinger equation and its application

CO2: Students learn about rotation & vibration spectroscopy and the electromagnetic radiations used in these spectra. And Through rotational spectroscopy they will learn the energy level diagrams of rigid & non rigid rotors. This course aims at applications of rotational and vibrational spectroscopy

Semester-VI

Course Name: Botany Paper XI (Plant Ecology)

CO1 This course explains the concept of ecology and its scope, population ecology, growth forms, carrying capacity, ecotypes & ecads.

CO2 This course illustrates the community ecology, frequency, density & abundance. Ecological succession & Gause principle of competitive exclusion.

CO3 This course describes the structure and concept of ecosystem, ecological pyramids, food chain & food web, ecological productivity. A brief idea of air, water, soil pollution, global warming & ozone depletion.

CO4 This course describes the biodiversity, hot spots, biomes & vegetation types. Ecological adaptations in xerophytes, hydrophytes and halophytes, biogeochemical cycles are also described.

Course Name: Botany Paper XII (Plant Utilization)

- CO1 This course outlines the importance and nature of plant products, forest products, history & origin of food plants.
- CO2 This course describes the cultivation practices, vegetables and fruits: their family, botanical name, season and area of cultivation.
- CO3 This course deals with the study of spices, medicinal plants, their family, name, part used etc.
- CO4 This course deals with the study of beverages their cultivation, name, family etc. Narcotics: Cannabis, Tobacco & Opium.

Course Name: Zoology Paper I (Medical Zoology)

- CO1 This course glances on Pathogenic microbes, Parasitology with study of life cycle, mode of infection and pathogenicity of arthropod vectors causing disease in human beings, Pathogenic protozoans, Pathogenic helminthes and some of the viral and bacterial diseases as well.
- CO2 This course describes the symptoms and control measures of the parasitic diseases and the life cycles of arthropod vectors of various human diseases.
- CO3 In this course students are able to understand the eradication programmes of various endemic diseases like typhoid, cholera, small pox.
- CO4 The course provides a brief understanding about human defence mechanism, Vaccines, Antigen and Serodiagnostic assays. Alongwith this detailed discussion on Immunoglobulins, Cell mediated and Humoral Immune Response.

Course Name: Zoology Paper II (Medical Laboratory Technology)

- CO1 This course also gives knowledge about Laboratory Safety rules, hazards and precautions taken during sample collection and laboratory investigation.
- CO2 Students are able to understand the various Laboratory Techniques such as :Colorimetry, microscopy, autoclaving, centrifugation and spectrophotometry.
- CO3 In this course students are able to explain the detailed learning about Bacteriology, Hematology, Histopathology and Biochemistry test for analysis of blood or urine sample.

Course: Inorganic Chemistry

- CO1: On the completion of course the student will have knowledge of Pearson's HSAB concept, acid-base strength and hardness and softness. Symbiosis, theoretical basis of hardness and softness.
- CO2 : The aim of the course is the teaching and understanding of the basic principles of Biological Inorganic Chemistry - Bioinorganic Chemistry that are considered necessary for the completion of postgraduate students' education. Also, the aim of this course is to present and describe bioinorganic systems through the correlation of the function, structure and activity of inorganic elements within the organisms. In particular, this course will include: a) a systematic study of trace element biosystems; b) the effect of the concentration of trace elements on health and the environment;
- CO3: On the completion of course the student have knowledge of Silicones and Phosphazenes as examples of inorganic polymers, nature of bonding in triphosphazenes.
- CO4: The focus of this course is on the synthesis, structure and bonding, properties and reactivity of main group organometallics (including Grignard reagents, organolithium reagents, organotin compounds, etc), organotransition metal chemistry and organometallic catalysis. And On the completion of course the student have knowledge of metal-ethylene complexes and homogeneous hydrogenation, mononuclear carbonyls and the nature of bonding in metal carbonyls.

Course: Organic Chemistry

- CO1: Students would have knowledge about the structure, preparation and properties of heterocyclic compounds after completion of this course.
- CO2: The main focus of this course is to make the Students familiar with the classification, synthesis and application of various polymers
- CO3: Students will learn the importance of enolates as starting material in organic synthesis
- CO4: Students will get knowledge about the classification, conversion and application of carbohydrates
- CO5: Students will learn about the classification, conversion and application of protein

Course: Physical Chemistry

- CO1: To make them familiar in the study of surfaces and of heterointerfaces between constituents layers
- CO2: On completion of this course they will know about the orbital concept
- CO3: Helpful in determination of the geometrical structure of molecules in triplet state

CO4: Study is helpful for structure identification

CO5: Student able to know how laser and masers are work which are used in wide range of field

CO6: Student would be able to study the structure using Xrays

CO7: Complete study about strucutre for the compounds used in daily life.

CO8: Students would be able to know the reactions occurane in which state

CO9: laws study helpful in research work

CO10: Mechanism of different processes is studying

CO11: Daily used light applications

CO12: Students able to know how the energy transfer in different processes

CO13: Student able to know how laser and masers are work which are used in wide range of field