



Ujjwal Bahu-Uddeshiya Sanstha, Nagpur

College code- 401

D.D. BHOJAR COLLEGE OF ARTS AND SCIENCE, MOUDA

Tah.: Mouda, Dist.: Nagpur, Pin - 441104

Affiliated to RTM Nagpur University, Nagpur, Approved by Government of Maharashtra

Email : dd.bhojar@rediffmail.com Website : ddbhojar.ac.in

Tel : 07115 - 281979 Mob. : 9158003321

Course Outcomes of Chemistry

M.Sc. Chemistry Semester-I

Course name: Inorganic Chemistry (CH-1T1)

CO1: Be able to predict the geometry of individual molecules or complexes

CO2: Be able to understand the complex formation equilibria in solution and to know unusual methods to the study of reaction rates.

CO3: Be informed with boron hydrides, or polyboranes which are the original cluster compounds as well as the first known family of electron-deficient compounds

CO4: Be able to study of clustering of metal atoms.

Course name: Organic Chemistry (CII-IT2)

CO1: Be able to understand the applicability of concepts like delocalized bonding, conjugation, cross conjugation, resonance, in various carbon containing Compounds and develop the understanding of the reactive intermediates.

CO2: Be able to study optical activity in compounds without chirality and analyse stereochemical aspects involved in various compounds and the corresponding chemical reactions.

CO 3: Be able to reactions and understand mechanisms of various substitution nucleophilic basic knowledge about the anchimeric assistance and isotope effects.

CO 4: Be able to understand mechanisms of various Aromatic nucleophilic and electrophilic substitution reactions and get acquainted with assorted outcomes like resonance, field, steric effects & its quantitative treatment.

Course name: Physical Chemistry (CH-IT3)

CO1: Get acquainted with various laws of thermodynamics and its application.

CO2: Be able to understand partial molar Quantities its determination and reduced phase rule in various components

CO 3: Be able to recapitulation of terms of surface tension and different adsorption isotherms and be able to validate the newly developed analytical method as well as reported methods

CO 4: Able to propose some new methods or modify existing methods of qualitative and quantitative analysis.



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Course name: Analytical Chemistry (CH-IT4)

CO1: Get acquainted with various terminology and fundamentals of analytical Chemistry including classical and instrumental methods.

CO2: Recapitulate the separation techniques like Chromatography

CO 3: Be able to explain analytical techniques in terms of working principles of Volumetry and gravimetry.

CO 3: Able to propose some new methods or modify existing methods of qualitative and quantitative analysis

Course name: Practical Inorganic Chemistry (CH-1P1)

CO : Be able to understand the basic principles involved in separation and estimation of acidic and basic radicals and be able to apply the knowledge in real sample analysis for quantitative estimation as well as qualitative detection and also be able to assign a numerical value to variables by the quantitative analysis is to reflect reality mathematically.

Course name: Practical Physical Chemistry (CH-1P2)

CO: Be able to understand the principles of physical chemistry and interpret them through small experimental performances.

Course name: Seminar (IS)

On completion of seminar, the student will be in a position to present the topic in front of subject audience that will enhance confidence level and lead to personality development.



M.Sc. Chemistry Semester-II

Course name: Inorganic Chemistry (CH-2T1)

CO1: Will be able to understand the origin of colors in complexes and their magnetic Behavior.

CO2: Develop ability to understand various reactions of transition metal complexes

CO3: Will know the concept of bonding in various metal carbonyls.

CO4: Will be able to know chemistry behind the metal nitrosyls

Course name: Organic Chemistry (CH-2T2)

CO1: Be able to acquire knowledge and understand applicability of carbon-carbon multiple bond and carbon-hetero atom multiple bond addition reaction and develop understanding of reaction mechanism in metal hydride reduction

CO2: Be able to analyse various mechanism of molecular rearrangement and concept of elimination reactions.

CO3: Be able to understand free radical reactions

CO4: Be able to comprehend various aspects of green chemistry

Course name: Physical Chemistry (CH-2T3)

CO1: Be able to understand the Eigen value and Eigen function and application of Schrödinger wave functions to various system.

CO2: Be able to determine the activity coefficients and ionic strength

CO3: Able to identify symmetry elements in crystals

CO4: Get the knowledge about various statistics and understand working of different counters

Course name: Analytical Chemistry (CH-2T4)

CO1: Be able to understand the working principles and techniques involved in methods of analysis.

CO2: Be able to explain the advantages of modern methods over the classical ones.

CO3 : Apply the principles of spectroscopic techniques in the qualitative and quantitative analysis of various samples..

CO4 : Be able to develop their own methods for quantitative analysis of metal ions using instrumental methods.



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Course name: Practical Organic Chemistry (CH-2P1)

CO: Be able to perform the qualitative analysis of organic binary mixture and be able to get hands on training for the synthesis of commercially important organic compounds (single and two stage organic)

Course name: Practical Analytical Chemistry (CH-2P2)

CO: Get expertise in titrimetric analysis based on neutralization, redox and complexometric analysis, gravimetric estimation of barium and calcium, separation technique of paper chromatography and electroanalytical techniques as Potentiometry, Conductometry and optical methods like Colorimetry.

Course name: Seminar (2S1)

CO: On completion of seminar, the student will have an improved knowledge about the Subject and will be in a position to Present the topic more confidently.

M.Sc. Chemistry Semester-III

Course name: Inorganic Chemistry Special paper-I (CH-3T1)

CO1: Be able to understand the role of various essential and trace metals in biological systems and also medicinal use of metals and metal complexes

CO2: Be able to develop knowledge of energetic involved in biomolecules.

CO3: Be able to explain the structure and functions of different biomolecules including storage and transport of dioxygen in them.

CO4: Know the principle and role of various metals in coenzyme molecules

Course name: Organic Chemistry Special paper-I (CH-3T1)

CO1: Be able to explain what happens when organic molecules are excited by irradiation and be capable to discuss the photochemistry in nature and in various photochemical reactions.

CO2: Pericyclic reactions are used in a vast way in nature and also by organic chemist. This course gives the student the theoretical basis of this kind of reaction and also helps them to find a way to carry out these types of reaction

CO3: Get well versed with the various oxidizing and reducing agents and the stereochemical aspects involved in various chemical reactions

CO4: Acquire knowledge about the chemistry of compounds of phosphorus and sulphur and the application of organoboranes and organosilicon compounds in organic synthesis



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Course name: Physical Chemistry Special paper-I (CH-3T1)

CO1: Be able to understand the statistical aspects of thermodynamic functions.

CO2: Get acquainted with theory of double layer and get some knowledge about electro catalysis and electrocardiography.

CO3: Acquire knowledge of dynamics of complex reactions and fast reactions.

CO4: Able to understand different photophysical phenomenon and photochemical Reactions.

Course name: Analytical Chemistry Special paper-I (CH-3T1)

CO1: Be able to describe various terminology and fundamentals of radio analytical and electrochemical methods of analysis.

CO2: Be able to differentiate between similar techniques like stripping vs cyclic Voltammetry, nephelometry vs turbidimetry etc

CO3: Be able to choose appropriate technique of analysis among these depending on the nature of sample and analyte.

CO4: Able to propose new electrochemical sensor for the analysis of environmentally important species and pharmaceutical compounds

Course name: Inorganic Chemistry Special paper-II (CH-3T2)

CO1: Be able to acquire detail knowledge of structure of ionic and covalent crystals and also the structures of AB AB₂ and ABO₃ type of compounds.

CO2: Be exposed to defects in solids and spinel chemistry.

CO3: Be introduced to material chemistry, physical phenomenon and nano materials

CO4: Study the chemistry of liquid crystals.

Course name: Organic Chemistry Special paper-II (CH-3T2)

CO1: Be able to acquire knowledge about terpenoids and porphyrins, the stereochemistry involved along with the structure determination and synthesis of some representative molecules.

CO2: Be able to build a learning about alkaloids, the stereochemistry involved along with the structure determination and acquire brief idea about prostaglandins.

CO3: Be able to develop the understanding of steroids chemistry and plant pigments.



CO4: Be able to quantify the contributions of carbohydrates in nature and get well versed with the properties of amino acids, and structural features of polypeptide.

Course name: Physical Chemistry Special paper-II (CH-3T2)

CO1: Be able to understand the electronic structure of atoms and application of Huckel theory to various molecules

CO2: Get knowledge about different characterization techniques for nanoparticles.

CO3: Able to understand the structure of double layer and different models used for double layer.

CO4: Be to get knowledge of different phenomenological equations, to study rate of Entropy production and its application to the cases of chemical reactions.

Course name: Analytical Chemistry Special paper-II (CH-3T2)

CO1: Be able to understand the difference between organic and inorganic quantitative analysis and terminology involved such as micro, semi-micro, ultramicro, proximate, ultimate analysis etc.

CO2: Summarize various methods of analysis of environmental components like water and air and industrial products like ores and cement.

CO3: Able to calculate percentage of various components in these samples.

CO4: Summarize the causes and consequences of water and air pollution and the remedies for it.

Course name: Polymer Chemistry Elective paper (CH-3T3)

CO1: Be able to understand different types of Polymers.

CO2: Capable of understanding different techniques of molecular mass determination.

CO3: Get knowledge about morphology and order in crystalline polymers.

CO4: Get acquainted with synthesis application of Commercial polymers.

Course name: Spectroscopy-I (core subject centric) paper (CH-3T4)

CO1: Be able to understand symmetry elements and operations to organic and inorganic Molecules

CO2: Learn the mass spectrometry technique and will be able to identify the molecule on the basis of the fragmentation pattern in mass spectrum and learn application of radioactive molecules in Mossbaur spectroscopy



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CO3: Be able to understand energy changes at very lower level and capable of predicting the satellite patterns of geographical areas. ESR techniques are used to determine the presence of unpaired electron especially on complexes.

CO4: Elucidate the structure determination of organic molecules by IR spectroscopy. Problem based on IR Spectra.

Course name: Foundation Course: Applied Analytical Chemistry-I (CH-3T4)

CO1: Get acquainted with various analytical procedures of analysis of pesticides and Fertilizers.

CO2: Be able to understand the application of analytical chemistry in forensic

CO3: Be able to Carry out analysis of petroleum and petroleum products.

CO4: Be able to analyze various alloys commonly used in daily life

Course name: Practical Inorganic Chemistry Special (CH-3PI)

CO :Get hands on training of many instrumentation techniques used for study of inorganic compounds and bioinorganic compounds and also become an expert in handling instruments that will be helpful to him/her while working in research Laboratory in future.

Course name: Practical Organic Chemistry Special (CH-3PI)

CO :Be able to isolate natural Products using fractional distillations, column chromatography and extraction methods, get hands on the technique involved for the qualitative analysis of a mixture of three organic compounds and be able to understand application of volumetric analysis in the estimation of organic analyte from given solutions.

Course name: Practical Physical Chemistry Special (CH-3PI)

CO :Be able to learn the setting up various experiments in Kinetics, Thermodynamics, Potentiometry, Conductometry and spectrophotometry.

Course name: Practical Analytical Chemistry Special (CH-3PI)

CO : Get hands on training of all of various instrumentation techniques like conductometry, potentiometry, spectrophotometry, flame photometry, polarography, polarimetry, nephelometry, cyclic voltammetry and radioanalytical techniques.

Course name: Practical Polymer Chemistry Elective (CH-3P2)

CO: Be able to synthesize various polymers and get knowledge about characterization of polymers.



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Course name: Seminar (3S1)

CO: On completion of seminar, the student will be able to consolidate idea about the Subject and there by develop knowledge about the subject which will boost their confidence.

Course Outcome: M.Sc. IV

Course name: Inorganic Chemistry Special (CH-4T1)

CO1: Be able to describe fundamentals of nanochemistry and mechanism of solid State reactions.

CO2: Be able to illustrate the formation of coordination polymers and analytical techniques for polymer characterization.

CO3 : Be able to understand detail knowledge of catalysis .

CO4: Be able to understand the use of inorganic chemistry in electronic world and application of films in various fields

Course name: Organic Chemistry Special paper-I (CH-4T2)

CO1: Be able to quantify the applicability of carbanion intermediate in organic Synthesis.

CO2: Be able to understand modern methods of organic synthesis using transition metals and organometallic reagents.

CO3: Be able to be well familiar with the advanced terminologies, rules and concepts involved in stereochemistry and will have a deeper knowledge about the applicability of stereochemical and the protection deprotection concepts.

CO 4: The students will be able to apply logic behind organic synthesis using retro synthetic approach.

Course name: Physical Chemistry Special paper-I (CH-4T1)

CO1: Able to understand Arrhenius law and reactions in solution Phase.

CO2: Be able to understand types, reasons and protection from corrosion and corrosion analysis

CO 3: Get knowledge about interaction of radiation with matter.

CO 4: Able to understand classical free electron theory and quantum theory for electrons.

Course name: Analytical Chemistry Special paper-I (CH-4T1)

CO1: Be able to describe fundamentals of radioanalytical techniques and applications of them.

CO2: Be able to illustrate these analytical techniques of XRF and PIXE.



CO 3: Be able to compare between similar techniques like TGA, DSC and DTA.

CO 4: Be able to choose appropriate technique of analysis among these depending on the nature of sample and analyte.

Course name: Inorganic Chemistry Special paper-II (CH-4T2)

CO1: Get introduced to photochemistry involving excited states of metal complexes..

CO2 : Acquaint with role of redox reactions in metal complexes.

CO3 : Be introduced to organotransition metal chemistry.

CO4 : Be able to study the transition metal pi Complexes.

Course name: Organic Chemistry Special paper-II (CH-4T2)

CO1: Get acquainted with basic terminology involved in enzyme chemistry which is important to understand several life processes .

CO2 : Come to know importance of heterocyclic compounds as a part of many natural products as well as pharmaceutical drugs.

CO3 : Be able to analyze structure of nucleic acids, lipids and vitamins which are important building blocks of living systems.

CO 4 : Be able to have a brief idea about the terminologies and concepts involved in drugs dyes and Polymer Chemistry.

Course name: Physical Chemistry Special paper-II (CH-4T2)

CO1: Be able to understand types of solids electronic band structures and magnetic properties of solids.

CO2: Get basic ideas of electrostatic interactions

CO3: Get acquainted with different theory of liquids and methods of determination of surface tension.

CO4: Be able to understand different models of supercooled liquids and working and application of different batteries.

Course name: Polymer Chemistry Elective paper (CH-4T3)

CO1: Get knowledge about types of polymerization

CO2: Get acquainted with different technique of polymerization methods.

CO3: Be able to understand methods to study characterization of polymers

CO4: Get knowledge of synthesis and application of biomedical, inorganic and coordination polymers.

Course name: Spectroscopy-II (core subject centric) paper (CH-4T4)

CO1: Be able to understand theoretical aspects of UV, NMR and electron spectroscopies.

CO2: Be able to identify various molecular excitations and calculations of wavelengths of absorptions.

CO3: Be able to elucidate the structure of molecule based on NMR spectra and be in a position to carry out the central analysis for structure determination.

CO4: Comprehend the XRD data for crystal structure determination.



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Course name: Foundation Course: Applied Analytical Chemistry-II (CH-4T4)

CO1: Be able to understand the chemistry involved in water treatment for hardness removal and desalination.

CO2: Carry out the analysis of leather and Polymers

CO3: Comprehend the various processes involved in the metallurgy and extraction of metals from ores.

CO4: Be able to carry out analysis of clinical samples like blood and urine

Course name: Practical Inorganic Chemistry Special (CH-4P1)

CO1: Get hands on synthesis and electroanalytical characterization techniques, various methods of synthesis of inorganic compounds and be in a condition to carry out Quantitative analysis of various species using these techniques.

Course name: Practical Organic Chemistry Special (CH-4P1)

CO1: Be able to carry out elemental analysis of organic compounds, get expertise in the estimation of biomolecules and some organic drug molecules. The students will get hands on training of multi-step preparation of small organic molecules and will develop ability to identify various unknown organic molecules using NMR, IR, Mass and UV spectra.

Course name: Practical Physical Chemistry Special (CH-4P1)

CO: Be able to apply the theoretical knowledge of subject in actual processes like, adsorption, biological kinetic methods of analysis, and experimentally determine the Physical parameters like hydrolysis constant, pKa, transport number, etc.

Course name: Practical Analytical Chemistry Special (CH-4P1)

CO: Get hands on training of all separation techniques like solvent extraction, paper chromatography, ion exchange etc and organ analytical techniques of estimation of nitrogen, sulphur and halogen with environmental analysis.

Course name: Project (CH-4P2)

CO: Learn how to carry out literature survey in a specific area of research, work on a small idea to develop their own observations, analyze the results obtained from the experiments carried out, validate the methods developed by him/her and develop an overall research attitude so that he can become a good researcher in future.



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Course name: Seminar (4SI)

CO: After successful completion these four seminars assigned to them, they will be in a position to explain the concepts they learned from the dais in front of any number of audiences. This will lead to overall personality development of the student for entering into teaching profession



Course Outcomes of ZOOLOGY

M.Sc. Zoology Semester-I

MZO1T01 Paper- Biology of Non- Chordata

Course Outcomes (COs)

Students will be able to identify, classify, describe, discuss and explain invertebrate specimen in the field as well as maintain and organize museum specimen. Develop a skill to demonstrate and explain different anatomical systems, physiological body processes and diversity of invertebrates, animal architecture and functions. Create the awareness of the economic importance, significance and explain structural and functional relationship between invertebrate phyla. Assess and evaluate a taxonomic status of primitive members of arthropods and molluscs. Describe and analyze the sea star's body plan, elucidate the origins and evolutionary significance of echinoderm larval forms, comprehend the mechanism of movements based on fluid filled cavities in invertebrates and identify and classify minor invertebrate specimen. Perform the whole mount preparations of given invertebrate material.

MZO1T02- Cell Biology and Genetics

Course Outcomes (COs)

Students will be able to describe and explain the structure and function of plasma membrane through fluid mosaic model, types of membrane proteins, transport and organization of cytoskeleton, cell organelles and endomembrane system. Differentiate and illustrate the mechanism of Cell division, cell cycle regulation, types of cell signalling, signal transduction pathways and various receptors involved in cell signalling. Describe and differentiate the types and functions of cellular communication, cell adherence molecule and extracellular matrix interaction. Differentiate Mendelian, non-Mendelian inheritance and solve the problems of inheritance based on probability. Explain, differentiate and compare codominance, incomplete dominance, gene interactions, linkage, crossing over, sex limited and sex influenced characters. Illustrate and differentiate the mode of inheritance of polygenic and monogenic traits, role of genetic and environmental factors of inheritance, inbreeding and its consequences and deduce coefficient of inbreeding and consanguinity. Explain, distinguish and describe the mutation and its types, structural and numerical alterations of chromosomes as well as the extrachromosomal inheritance, maternal inheritance, microbial genetics, genetic mapping and human genetics by using pedigree analysis and types of genetic disorders. They could demonstrate metaphasic chromosomes, Barr body and Polytene chromosomes.



MZO1T03 2. Digestive and Excretory Physiology

Course Outcomes (COs)

The students will be able to differentiate and compare the types, anatomical structures, secretory and endocrine cells present in the histological structure, mechanism of secretion along with the neural and chemical control secretion of different digestive glands such as the salivary gland, stomach, pancreas, liver and intestine etc. along with movement of GIT. Demonstrate the effects of various factors on the activity of digestive enzymes. Describe, explain and compare gut brain axis, mechanism of digestion of various biomolecules such as carbohydrates, proteins and lipids and disorders associated with the GIT. Describe, explain and compare the anatomy of kidney, types and ultra structure of nephron, mechanism of urine formation, concentration and dilution of urine and normal and abnormal constituents of urine along with micturition. Determine the regulation of urine and body fluid concentration and volume along with water, electrolyte and acid base balance. Describe, explain and compare mechanism of ADH, RAAS system, renal clearance, physiology of nitrogen excretion and causes, symptoms and treatments of renal failure. They will be able to qualitatively demonstrate the presence of various normal and abnormal constituents of urine. Further, they will demonstrate the presence of normal and abnormal urine crystals

MZO1T04 - Research Methodology

Course Outcomes (COs)

Students will be able to learn, describe and imbibe animal ethics in research, as well as various guidelines provided by IAEC and CCSEA. Students will be able to compare the model organisms used in biological science. They will be able to discuss and determine the animal facilities to laboratories, transportation, hygiene, environment, maintenance, ethical, legal and policy issues. Encourage students to pursue their interests in research and to investigate selecting appropriate methodology of scientific research. Students could design the experiments properly. They will be able to write scientific reports, research proposals, patents, review articles, and will be aware of major funding agencies. Improve the knowledge of computer skills. They will be able to use basic computer programmes such as MS-Office, Coral Draw, and Photoshop. Students will analyse and use statistics to analyse data in biological research. They will be able to be acquainted with AI and its use in Life Science as well as to apply various statistical tools like central tendency, dispersion, skewness, and kurtosis measures to analyze results in the research work. They also learn measures of relationship tests of hypothesis testing of significance and know about statistical software. Students will also be able to learn and be acquainted with IPR and Patent registration.



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M.Sc. Zoology Semester II

MZO2T05 - Biology of Chordata

Course Outcomes (COs)

Students will be able to describe and recognize unique characters, life functions, connecting link between non-chordates and chordates and the diversity of urochordates, cephalochordates, cyclostomes and fish. Describe the structural, physiological and evolutionary correlation of different vertebrates; elaborate how kidneys represented successful evolutionary responses to the surrounding environmental pressures. List some migratory bird species, conduct bird tracking and watching activity. Facilitate students to explore the world of cetaceans and the marine environment. Gain a better understanding of the forces that drive evolution, speciation and the diversity of life on our planet. Identify, describe and differentiate the basic structure and functions of the central and peripheral nervous systems and define learning and memory. Compare and contrast the organization and evolution of the vertebrate circulatory system and heart. Describe specialized sensory organs of vertebrates and relate their role to their habitat. Comprehend the gradual development and evolutionary history of man. Identify, classify, describe and explain vertebrate specimen in the field as well as maintain and organize museum specimen. Develop a skill to demonstrate and explain different anatomical systems of vertebrate, and perform whole mount preparations of given vertebrate materials, different steps of microtomy and staining procedure. They could use, handle and maintain the instruments like microtome and oven. Students will able to identify, demonstrate, explain and compare the histological structure and functions of internal organs of vertebrates.

MZO2T06 - Advanced Developmental Biology

Course Outcomes (COs)

Students will be able to differentiate and explain the basic developmental concept of insects, cast differentiation in insects, amphibian metamorphosis and aves with its hormonal control and regeneration process in vertebrates. Illustrate and classify the type, structure, function and hormones of the placenta, analyse the cell differentiation, organ formation, cell death, and multiple physiological levels of aging. They will be able to analyse the process of advanced cattle breeding with the help of MOET, cloning techniques, acquire knowledge about embryonic sexing to diagnose the genetic disorder, the economic and clinical significance of embryonic stem cells. Comprehend birth control method that uses the body's immune response and classical contraceptive techniques to prevent pregnancy. Explain different anti-androgen and anti-spermiogenic compounds and also discuss transgenic animals that elevated the potential of biological research for human welfare. They will able to demonstrate the development of Lymnea and mounting of Chick embryo



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2. Brain and Muscle Physiology

Course Outcomes (COs)

Students will be able to differentiate and classify the various morphological differentiation and analysis of the mammalian brain, brain stem and cerebellum. Elaborate on the physiology and mechanism of learning, memory and sleep. Classify and illustrate the ultrastructure of neurons and synapses, functional and bioelectrical properties of the neurons, molecular mechanism of synaptic transmission and mechanism of neurotrophins and growth factors affecting the neuronal growth. Classify and analyse the biosynthesis, storage, release and mechanism of the action of various neurotransmitters and neuropeptides. Differentiate between the structure and physiology of various organs involved in photoreception and phonoreception. Analyse the various causes, symptoms, mechanism of pathogenesis, diagnosis and treatment of neurodegenerative disorders. Explain and describe the classification, ultrastructure, properties and structural proteins of muscle. Illustrate the molecular mechanism of muscular contraction, ultrastructure of the neuromuscular junction and types, causes, symptoms and treatment of various neuromuscular disorders. They could able to demonstrate and estimate liver and muscle glycogen, protein and lipid

MZO2P03-

On Job Training

Cos

Students will gain hands on training of any activity associated with Zoology



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M.Sc. Zoology Semester-III

MZO3T08 - Parasitology and Immunology

Course Outcomes (COs)

Students will be able to illustrate and differentiate life cycle, mode of transmission, infection and treatment of various bacterial infection and viral infections such as covid, dengue, hepatitis. Describe, explain, classify and differentiate organs of immune system, innate immunity, adaptive immunity, antigen, antibodies, toxin anti-toxin and their cellular target. Demonstrate antigen-antibody interaction with the help of ODD. Illustrate the maturation, activation, differentiation of T and B cell, inheritance of MHC molecules and various pathways of complement system. Classify, describe and differentiate various types of cytokines, hypersensitivity, autoimmunity and immunodeficiency diseases. Explain and describe activation and migration of leucocyte, mast cell, transplantation, tumor immunology, various infectious diseases and vaccines. Illustrate and differentiate working principle and significance of immune techniques such as RIA and ELISA.

MZO3T09 - Wild Life and Avian Biology

Course Outcomes (COs)

Students will explain, describe and analyze importance of wildlife and its conservation, international conservation bodies, predator-prey relationship, population dynamics of ungulates and carnivores. They could also explain, describe and analyze morphology, morphometry of birds, birds diversity, techniques of bird counting, bird breeding population and breeding group maps, bird hotspots, bird sanctuaries and role of birds in ecosystem

2. Blood and Cardiac Physiology

Course Outcomes (COs)

The students will be able to illustrate the structure, properties and function of cardiac muscle along with the anatomy, histology, nerve innervation and valves of the heart. They will further be able to classify and compare the pacemakers and conducting fibers present in the heart, and illustrate various types, causes, symptoms, diagnosis, and factors affecting blood pressure and treatment. Illustrate and compare the mechanism of the cardiac cycle, heart sound, working principle of ECG, cardiac output, hemodynamic, haemorrhage, cardiac murmur, circulatory shock and cardiac failure. Describe, explain and compare the cellular composition and functions of blood, blood groups, blood transfusion, bone marrow aspiration and pathological conditions of blood glucose and lipids along with blood coagulation. Compare and illustrate the transport of gases by blood, diagnosis, symptoms and treatment of bleeding disorders and blood cancer. Illustrate the mechanism of formation, composition, transport and functions of lymph. Differentiate, describe and explain anaemia and polycythemia, platelets and Blood substitute. Students will be able to demonstrate the components of the blood such as RBCs, WBCs, DLCs, Hb etc. along with the blood group.



MZO3P07, Research Project (RP) Minor Work

Course Outcomes (COs)

After completion of minor research project, the student will be able to search research articles online and offline. Draft scientific write up and submit in the form of report. They will be able to check the script for Plagiarism. Discuss particular topic and could arrange it in a proper manner. Learn and write bibliography by various styles.

M.Sc. Zoology Semester-IV

MZO4T12 - Biotechniques, Biostatistics, Toxicology and Bioinformatics

Course Outcomes (COs)

Students will be able to elaborate, discuss and describe sterilization, animal cells, tissue culture, primary culture, cell lines, cell quantification, and growth kinetics and cryopreservation technique. Describe, demonstrate and explain the principle and working mechanism of sedimentation, centrifugation, TLC, gas chromatography and electrophoretic technique. Illustrate and explain the biostatistical measures such as central tendency, dispersion, probability, sampling types, methods and significance test. Describe and explain neuronal genetics, environmental components in the development of animal behaviour, organization and functions of animal ethics. Illustrate and explain about the significance of toxicity test in the projects and research. Describe and explain the importance and scope of bioinformatics, various biological databases such as BLAST and FASTA, PSI-BLAST etc. and various program runs for the construction of phylogenetic tree like MEGA. Students could construct, analyze and interpret phylogenetic tree.

MZO4T13- Radiation and Chronobiology

Course Outcomes (COs)

The students will be able to define and explain the scope and significance of radiobiological scope in human welfare. Identify ionizing radiation, linear energy transfer, radiation dose and units and conceptualize the radiation types. Describe, explain and analyze application of radiology and gainful and harmful effects of radiation. Comprehend the concept of circadian rhythm, central clock system and peripheral clock system. Students will describe, explain and analyze centers of biological clock, relevance of biological clock in human welfare, mechanism of regulation of biological clock and effects of irregularity of biological clock and its remedies.

MZO4T14 -Molecular Biology and Biotechnology

Course Outcomes (COs)

Students will be able to analyse the basics of cellular genome, organization of genetic material, fundamental process of duplication of genetic material in prokaryotes and eukaryotes important for cell division. Evaluate the different types of DNA damage and repair mechanism. Illustrate the fundamentals of various mobile DNA elements useful in horizontal gene transfer, evolutionary process and gene expression in prokaryotes and eukaryotes. Explain the mechanisms and regulation of operon models significant in regulation of gene expression in prokaryotes. Illustrate the fundamental process of protein synthesis with explanation of antisense and ribozyme technology. They could differentiate and distinguish DNA sequencing and gene amplification methods, cloning by different cloning vectors for recombinant DNA technology. Explain and describe the applications of molecular biology and biotechnology. They could demonstrate and estimate DNA, RNA, Protein and Carbohydrates.



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Respiratory and Reproductive Physiology

Course Outcomes (COs)

The students will be able to describe and explain the physiological anatomy of the respiratory system and illustrate the mechanism of respiration along with breathing and the exchange of respiratory gases at the pulmonary surface. Illustrate the mechanism of transport of respiratory gases (O_2 and CO_2) by blood. Describe and explain lung volumes and capacities, and partial pressure of gases. Illustrate and compare the neural and chemical regulation of respiration, hypoxia and cyanosis. Describe, explain and compare artificial respiration, oxygen therapy and various infectious respiratory diseases (COVID-19, SARS, Swine Flu). Describe and explain the structure of the male and female reproductive systems, hormonal regulation, menstrual cycle, menstrual abnormalities, and ropause and menopause. Describe and explain the mechanism and hormonal regulation of pregnancy, development of mammary glands along with synthesis, secretion, ejection and composition of milk and effects of lactation on the menstrual cycle. Compare and differentiate physiological roles of ovarian and testicular steroid hormones. They could illustrate the causes, symptoms and treatment of infertility in males and females along with In-Vitro Fertilization (IVF). They will be able to demonstrate the percentage of lactose in the milk. Further they will able to demonstrate the effects of various factors on the dissolved oxygen of water



Course Outcomes of Botany :

Sr.No	Name of the course (Paper)	Course Code	Course Outcome
1	Microbiology,Algaeand Fungi	1T1	<p>Objective:</p> <p>Understanding & Application the structure, reproduction eco. imp. bacteria, viruses and archaeobacteria., Understanding & Application classification, life cycles, eco. imp. Of various groups of algae and fungi., Understanding & Application symptoms, histopathology,etiologyand identification of plant diseases and measurements</p> <p>Outcomes:</p> <p>After completion of the course, the student will be able to., Identify the structure, life cycles, economic importances etc of bacteria, virus, arhaebacteria, algae, fungi and apply this knowledge., Based on symptoms, identify plant diseases and apply knowledge for control of diseases., Perform various microbial culture techniques and apply for development of various cultures.</p>
2	Bryophytes & Pteridophytes	1T2	<p>Objectives:</p> <p>Understanding general characters, ecology, fossil history, classification, various types of bryophytes, pteridophytes. Learn evolutionary trends of various orders of Bryophytes, Pteridophytes and their different organs</p> <p>Outcomes:</p> <p>After successful completion of the course the students will be able to Learnvarious types of bryophytes, Pteridophytes characters for identification in lab and nature. Understand various types of fossils in bryophytes and Pteridophytes Understand evolutionary trends in bryophytes and pteridophytes</p>



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3	Paleobotany and Gymnosperms	1T3	<p>Objectives:</p> <p>Understand fossils formation, history ,preservation, geologicaltimescale ,reconstructionandnomenclatureof varioustypesoffossils.,Learntheoriginofgymnosperms, classification, evolution, eco. imp. of gymnosperms.</p> <p>Outcomes:</p> <p>After successful completion of the course the students will be able to Identification, nomenclature, reconstruction of fossils and their significance in time scale Identification of various gymnosperms, evolution of gymnosperms and their relationships</p>
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4	Cytology & Genetics	1T4	<p>Objectives:</p> <p>Understand the laws of inheritance, various modifications, types of chromosomal inheritance patterns., Understand multiple alleles and multiple gene inheritance, cytoplasmic inheritance., Learn structural and numerical changes in chromosomes, mutations and inheritance patterns in various biological organisms and in their populations</p> <p>Outcomes:</p> <p>After successful completion of the course the students will be able to. Know various types of inheritances in biological organisms and analyzed inheritance patterns., Understanding population genetics and equilibrium affecting various factors Understand the molecular mechanism of mutations and its role in crops improvement</p>
5	1P1		
6	1P2		
7	1S1- Seminar		
8	Plant Physiology and Biochemistry	2T1	<p>Objectives:</p> <p>Understandingphotosynthesisandrespirationinplants.Understandingmechanistic underpinnings of the plant hormones and sensory photobiology.</p> <p>Understanding Enzymology. Understanding the solute transport system and metabolism.</p>



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			<p>Outcomes:</p> <p>After successful completion of the course the students will be able to Understand the aspects of plant respiration and photosynthesis., Understand the aspects of metabolism of different components, Perform and check the enzymatic activities of different components</p>
9	Plant Development & Reproduction	2T2	<p>Objectives:</p> <p>Understanding the basic growth Kinetics and growth Patterns in plants .Understanding the plant growth the regulators with respect to plant growth and metabolism .understanding dormancy ,senescence and the influence on Plant growth and reproduction.</p> <p>Outcomes:</p> <p>After Successful completion of the course the students will be able to Know the basic growth kinetics and role of phytohormones in plant development Know the molecular mechanism of growth and differentiation of root, leaf flowers and seeds Learn to use biomolecules for flower formation, seed setting, senescence effects</p>
10	Cell and Molecular Biology-I	2T3	<p>Objectives:</p> <p>Understanding the structures and functions of the cell wall, plasma membrane and Plasmodesmata, Understanding the structures and functions of cell organelles, cytoskeleton ,nuclear envelope, and structure of DNA, Understanding various types of stresses and defense mechanisms in plants and apply this knowledge.</p> <p>Outcomes:</p> <p>After successful completion of the course the students will be able to, Know the cell wall & cellular organization of the eukaryotic and prokaryotic cells, Learn the cell cytoskeleton and its role, Learn and apply techniques of stress related problems in plants.</p>



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11	Angiosperms-I and Ethnobotany	2T4	<p>Objectives:</p> <p>Understanding the morphology of flowers of dicot and monocots for proper identification of angiosperm plants, Understanding plant taxonomy and modern trends in taxonomy and conservation methods of ethnobotanical plants</p> <p>Outcomes:</p> <p>After successful completion of the course the students will be able to, Learn basic</p>
			<p>structure of flowers for identification and distinguish them, Apply taxonomic tools in taxonomic classification, modern and numerical taxonomy and phylogeny</p>
12	2P1		
13	2P2		
14	2S1-Seminar		
15	Plant Ecology and Conservation Biology	3T1	<p>Objectives:</p> <p>Understanding the concept of community, ecological succession trends and climax. Understanding the structures and functions of ecosystem., and applying various methods of plant conservation; importance and maintenance of National parks, sanctuaries, Biospheres, botanical gardens etc.</p> <p>Outcomes:</p> <p>After successful completion of the course the students will be able to, Learn structure and function of ecosystems and their succession and climax formation, Learn and apply the knowledge of conservation methods .Learn and apply techniques of Botanical gardens .</p>



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16	Angiosperms-II	3T2	<p>Objectives:</p> <p>Understanding the morphology and descriptions of various dicot and monocots groups for proper identification of angiosperm plants, Understanding plant biodiversity concept, role.</p> <p>Outcomes:</p> <p>After successful completion of the course the students will be able to, Learn and apply knowledge basic structure of flowers for identification and distinguish them family-wise. Training in usage of floras for identification of species, field trips for preparation of field notes and compilation of plant data.</p>
17	Elective-1:PlantPhysiology-I	3T3	<p>Objectives:</p> <p>Understanding Plant growth and Development., Understanding the function of different growth regulators., Understanding seed physiology., Understanding stress physiology.</p>
			<p>Outcomes:</p> <p>After successful completion of the course the students will be able to., Understand the aspects of plant growth and development , Understand the aspects of seed physiology and stress physiology</p>
18	Foundation 1:-Aesthetic Botany	3T4	<p>Objectives:</p> <p>Knowledge on floristic regions of the world and India, endemism, hotspots etc., Understanding the scope, components of the garden and features of the garden., Knowledge on scope of floriculture, methods of propagation and its importance in designs. Understanding the scope of land scape, elements of landscape, importance of polyhouses, designing of lawns and cactus garden.</p>



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			<p>Outcomes:</p> <p>After successful completion of the course the students will be able to. Learn phyto geographical regions of India, world, scope of gardening, landscaping., Learn designing of lawns and cactus, ornamental gardens.</p>
19	3P1		
20	3P2		
21	3S1-Seminar		
22	Cell and Molecular Biology-II	4T1	<p>Objectives:</p> <p>Knowledge on structure and functions of ribosomes, mechanism of transcription and translation in pro- and eukaryotes., Understanding the gene structure and regulation of gene expression. Knowledge on genome organization and recombination mechanisms., Understanding the mechanism of cell cycle, apoptosis, techniques in cell biology</p>
			<p>Outcomes:</p> <p>After successful completion of the course the students will be able to. Learn structure and functions of ribosomes mechanism of transcription and translation., Learn gene structure and regulation of gene expression., Learn mechanism of cell cycle, apoptosis, application of cell biology techniques.</p>
23	Plant Biotechnology and Plant Breeding	4T2	<p>Objectives:</p> <p>Understanding the principles and techniques of gene cloning, types of vectors. Knowledge on recombinant DNA technology & its tools, microbial genetic manipulations. Understanding the basic concepts of tissue culture and knowledge on transgenic., Practical knowledge and analysis skills in usage of various bioinformatic tools.</p>



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			<p>Outcomes:</p> <p>After successful completion of the course the students will be able to. Learn gene cloning, recombinant DNA technology etc. Learn tissue culture methods. Learn and apply bioinformatic tools for analysis of bioinformation data.</p>
24	ElectiveII:- PlantPhysiology-II	4T3	<p>Objectives:</p> <p>Understanding the role of secondary metabolites inplant, Understanding various industrial applicable concepts and nanobiotechnology. Understanding neuro and electro physiology Understanding the signal transduction in plant cells.</p> <p>Outcomes:</p> <p>After successful completion of the course the students will be able to. Understand the importance of secondary metabolites and their medicinal importance. Understand the applicability of learnt concepts at industrial level. Understand the pathways and proteins involved for different signaling response at cellular level.</p>
25	FoundationII:-Applied Botany	4T4	<p>Objectives:</p> <p>Know the concept and types of entrepreneurshp, types of start-ups. Understanding the production of various plant products. Understanding green herbal and cultural techniques., Knowledge on different types of garden, floriculture, silviculture developments, post-harvent techniques.</p>
			<p>Outcomes:</p> <p>After successful completion of the course the students will be able to., Learn the production of plant bio-products., Applying knowledge with reference to green herbal techniques, culture technique and cultivation of garden, silviculture ,post-harvesting techniques etc.</p>
26	4P1		



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27	4P2		
28	4S1-Seminar		