

VIDYA VIKAS ARTS, COMMERCE & SCIENCE  
COLLEGE, SAMUDRAPUR DIST. WARDHA



**PROGRAM OUTCOMES  
(POS) & COURSE  
OUTCOME (CO)**

## PROGRAM OUTCOMES (POS) – B.SC. AS PER NEP-2020

### PROGRAM OUTCOMES (POS) FOR B. SC. PROGRAMME

**PO1. Critical Thinking:** Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.

**PO2. Problem Solving:** Solve problems from the disciplines of concern using the knowledge, skills and attitudes acquired from sciences/ mathematics/ social sciences/ humanities.

**PO3. Effective Communication:** Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.

**PO4. Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in wide variety of settings.

**PO5. Ethics:** Understand multiple value systems including your own, the moral dimensions of your decisions, and accept responsibility for them.

**PO6. Environment and sustainability:** Understand the impact of technology and business practices in societal and environmental contexts, and sustainable development.

**PO7. Self-directed and life-long learning:** Demonstrate the ability to engage in independent and life-long learning in the broadest context socio-technological changes.

**PO8. Design/Development of Solutions:** Design solutions for complex science problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

**PO9. Computational Thinking:** Understand data-based reasoning through translation of data into abstract concepts using computing technology-based tools.

**PO10. Effective Citizenship:** Demonstrate empathetic social concern and equity centred national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

**PO11. Global Perspective:** Understand the economic, social and ecological connections that link the world's nations and people.

**PO12. Aesthetic Engagement:** Demonstrate and master the ability to engage with the arts and draw meaning and value from artistic expression that integrates the intuitive dimensions of participation in the arts with broader social, cultural and theoretical frameworks.

## DEPARTMENT OF BOTANY

### Program Outcomes: B.Sc. Botany

After successful completion of three years degree program in the subject Botany, the students are able to:

#### Program Outcomes (PO)

**PO1:** Students know about different types of lower & higher plants their evolution in from algae to angiosperm & also their economic and ecological importance.

**PO2:** Cell biology gives knowledge about cell organelles & their functions.

**PO3:** Molecular biology gives knowledge about chemical properties of nucleic acid and their role in living systems.

**PO4:** Genetics provides knowledge about laws of inheritance, various genetic interactions, chromosomal aberrations & multiple alleles.

**PO5:** Cell biology gives knowledge about structural changes in chromosomes.

**PO6:** Taxonomy provides basic information to student and they can describe morphological & reproductive characters of plant and also identified different plant families and classification.

**PO7:** In ethnobotany students know economic importance of various plant products & artificial methods of plant propagation.

**PO8:** Ecology gives knowledge of various concepts in ecology and phytogeography.

**PO9:** Use modern Botanical techniques and decent equipment.

**PO10:** To inculcates the scientific temperament in the students and outside the scientific community.

#### Program Specific Outcomes (PSO)

**PSO1:** Students acquire fundamental Botanical knowledge through theory and practical.

**PSO2:** To explain basis plant of life, anatomy, reproduction and their survival in nature.

**PSO3:** Helped to understand role of living and fossil plants in our life.

**PSO4:** Understand good laboratory practices and safety.

**PSO5:** To create awareness about cultivation, conservation and sustainable utilization of biodiversity.

**PSO6:** To know advance techniques in plant sciences like tissue culture, plant disease management, artificial gene transfer etc.

PSO7: Students understand about the phytogeography of India, ethnobotanically important plants and their use.

## **COURSE OUTCOMES B.SC. BOTANY**

### **COURSE OUTCOME FOR SEMESTER-I**

#### **Paper-I: Viruses, Prokaryotes, Algae & Biofertilizers**

- CO1: Study of Microbes and algae to understand their Diversity.
- CO2: Know the systematics, morphology and structure of Viruses, bacteria, Mycoplasma and algae.
- CO3: Know life cycle pattern of microbes and their economic importance.
- CO4: Know evolution of microbes and algae.
- CO5: Learn skill of preparation and use of biofertilizers for sustainable development.

#### **Paper-II: Fungi, Lichen, Plant Pathology, Bryophyta & Mushroom Cultivation**

- CO1: Study of Fungi, Lichens, plant pathology and Bryophyta.
- CO2: Know the systematics, morphology and structure of fungi, Lichens, plant pathogens, hosts and Bryophytes
- CO3: Know life cycle pattern of fungi, lichens, plant pathogens and bryophytes.
- CO4: Know economic importance of fungi, lichens and Bryophytes.
- CO5: Know evolution of fungi, lichens and Bryophytes.
- CO6: Learn skill of cultivation and importance of mushrooms for human consumption.

#### **Lab Work:**

- To get acquainted with ultrastructure of viruses and bacteria, to study staining method of bacteria
- To study structure and reproduction of *Nostoc*
- To study the structure and reproduction in Algae, like *Chara*, *Vaucheria*, *Ectocarpus* and *Batrachospermum*
- To learn the method of identification and characterization of bacteria useful in biofertilizers.
- To learn staining method of fungi and bryophytes.
- To get acquainted with different plant pathogens and lichens and to learn the technique of mushroom cultivation

## **COURSE OUTCOME FOR SEMESTER-II**

### **Paper-I: Palaeobotany, Pteridophyta, Gymnosperms & Soil Analysis**

- CO1: Study of Palaeobotany, geological time scale and morphology of angiosperms.
- CO2: To know life cycle pattern of Pteridophyta and Gymnosperms.
- CO3: To know the systematics, morphology and structure of Pteridophyta and Gymnosperms.
- CO4: To know economic importance of Pteridophyta and Gymnosperms.
- CO5: To know evolution of Pteridophyta and Gymnosperms.
- CO6: To learn the skill of soil analysis for cultivation of variety of plants.

### **Paper-II: Morphology of Angiosperms & Floriculture**

- CO1: To study the morphology of angiosperms with respect to evolution of plants.
- CO2: To the evolution of different floral organ for sexual reproduction in angiosperms.
- CO3: To know the variation among the reproductive organs of the angiosperms.
- CO4: To know the systematics, morphology and structure of angiosperms.
- CO5: To know the adaptive pollination and reproductive biology of angiosperms.
- CO6: To learn the skill of floriculture and its tools and techniques.

## **COURSE OUTCOME FOR SEMESTER-III**

### **Paper-I: Angiosperm Systematics, Embryology & Indoor Gardening**

- CO1: To Study vegetative and floral characters of angiosperms.
- CO2: To know the preparation of floral formulae and floral diagrams of angiosperms.
- CO3: To know economic importance of angiosperms families.
- CO4: To know the pattern of embryogenesis in various angiosperms plants.
- CO5: To learn the skill for development of indoor gardening and its importance.

### **Paper-II: Angiosperm Anatomy & Horticulture**

- CO1: To gain knowledge of different plant tissue and tissue systems.

**CO2:** To understand structure and type of cells and tissues in plants, type of vascular bundles and stellar systems.

**CO3:** To know the simple and complex tissues and its functions.

**CO4:** To know the process of secondary growth and its role in formation of wood and periderm

**CO5:** To learn the skill for horticultural practices used.

### **COURSE OUTCOME FOR SEMESTER-IV**

#### **Paper-I: Cell Biology, Plant Breeding, Evolution & Seed Technology**

**CO1:** Gain knowledge about cell and its function.

**CO2:** Learn the scope and importance of Cell and Molecular biology.

**CO3:** To understand ultrastructure of cell wall, plasma membrane and cell organelles

**CO4:** To understand the morphology and structure of chromosomes.

**CO5:** To understand the different techniques used in plant breeding.

**CO6:** To know the process of evolution of plants in universe

**CO7:** To learn the skill used in seed technology

#### **Paper-II: Genetics, Molecular Biology & Plant Nursery**

**CO1:** To study structure, biochemical nature and role of nucleic acids.

**CO2:** To understand the type and applications of mutations.

**CO3:** Understand the Mendelian and neo-Mendelian genetics.

**CO4:** Know about interaction of genes, multiple alleles, linkage and crossing over.

**CO5:** To learn the skill for preparation of plant nurseries and its importance for nature conservation.

### **COURSE OUTCOME FOR SEMESTER-V**

#### **Paper-I: Plant Physiology, Mineral Nutrition & Hydroponics**

**CO1:** To know the scope and importance of plant physiology.

**CO2:** To understand plant & water relation and mineral nutrition.

**CO3:** Understand process of photosynthesis, C3, C4, CAM pathways.

**CO4:** Understand the process of respiration, nitrogen metabolism and plant movement

**CO5:** To learn the technique of development of hydroponics.

### **Paper-II: Plant Ecology & Organic Farming**

**CO1:** To study concept of ecology and ecosystems.

**CO2:** To understand climatic and edaphic factors.

**CO3:** To know physiographic factors and interrelations among the living organisms.

**CO4:** To understand the components of ecosystems, autecology, synecology and plant succession.

**CO5:** To know the adaptations of plants.

**CO6:** To learn the skill and importance of organic farming for healthy life.

### **COURSE OUTCOME FOR SEMESTER-VI**

#### **Paper-I: Biochemistry, Biotechnology & Herbal Technology**

**CO1:** To study carbohydrates, lipids, amino acids and enzymology.

**CO2:** To know the plant tissue culture techniques and applications.

**CO3:** To understand tools and techniques used in genetic engineering.

**CO4:** To know the artificial gene transfer techniques.

**CO5:** To learn the skill used in formation of dye and cosmetics from plants.

**CO6:** To know the basic concept of herbal technology.

#### **Paper-II: Phytogeography, Utilization Of Plants, Techniques & Pharmacognosy**

**CO1:** To know the phytogeography of India and world

**CO2:** To know the natural resources and various types of pollutions and its impact on living organism.

**CO3:** To study the natural resources and its conservation strategies.

**CO4:** To know the economic importance of plants and ethnobotany.

**CO5:** To study microscopy, electrophoresis, centrifugation and chromatography.

**CO6:** To learn the basics of pharmacognosy and skill for used of plants in pharmacognosy.

#### **Lab Work:**

- To study the biochemical experiments
- To study the different instruments and equipment used in biotechnology
- To study the different techniques used in herbal technology

- To learn types of pollution parameters.
- To get acquainted with ethnobotany and economic botany with suitable examples
- To study the techniques used in pharmacognosy

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## PROGRAMME SPECIFIC OUTCOMES

### M. SC. (BOTANY), AFFILIATED COLLEGES OF UNIVERSITY

Number of courses: 29

**Targeted graduate attributes:** Disciplinary knowledge, Critical thinking, Problem solving, Analytical reasoning, Communication skills, Teamwork, Moral and ethical awareness

#### Programme Specific Outcomes (PSO)

- **PSO1:** The student is capable to demonstrate comprehensive knowledge and understanding of one or more branches of Botany, and of critical and clear thought about the plant world.
- **PSO2:** The student develops the ability to analyse and contemplate on the various aspects of plants.
- **PSO3:** The student is capable to undertake supervised research, identifying the problem, survey the literature, design & execute the experiments, generate the data and draw conclusions.
- **PSO4:** The student gets the hands-on experience in the routinely used laboratory techniques and equipment.
- **PSO5:** The student develops the professional skills like identification of plants/algae/fungi, laboratory technician, scientific writing, data analysis, techniques in plant tissue culture, environmental impact assessment etc.
- **PSO6:** The student is capable to write report and present the scientific data in form of figures, images and tables.
- **PSO7:** The student is capable to undertake field tours for floristic, environmental and other exploratory surveys.
- **PSO8:** A life-long inquisitiveness about plants and ways to put them at work for enhancing the quality of life is instilled in the student.
- **PSO9:** The student is capable to derive benefits from the traditional knowledge of India.
- **PSO10:** The student develops the qualities of a responsible global citizen and is able to work in a team.

# M. SC. BOTANY SYLLABUS AS PER NEP- 2020 SEMESTER-I

## MANDATORY PAPER 1 (MBO1T01): MICROBIOLOGY, ALGAE AND FUNGI

### Course Outcomes (CO)

- The diversity among the microbes is revealed to the student in the class, laboratory and field.
- The student appreciates the variability among the algae and fungi and also acknowledges their economic importance.
- The student is able to trace the phylogenetic relationship among the algae and fungi.
- The student is conversed with the common diseases of plants and their control measures.

## Mandatory Paper 2 (MBO1T02): Bryophytes and Pteridophytes

### Course Outcomes (CO)

- The student acknowledges the diversity among lower plants in the class.
- The student develops an insight to correlate the structural variations with the phylogenetic relationship among plants.
- The student understands the importance of lower plants in the ecosystem and the daily life.

## Elective Paper 3 (MBO1T03): Palaeobotany and Gymnosperms

### Course Outcomes (CO)

- The student is sensitised about the paleoclimate, fossil flora and the process of fossilisation.
- The student acknowledges the diversity among the Gymnosperms in the class.
- The student develops an insight to correlate the structural variations in the extinct and extant plants with the phylogenetic relationships.

## Research Methodology Paper 4 (MBO1T04)

### Course Outcomes (CO)

- The students are acquainted with the process of selection of a research problem and techniques and tools to be employed in completing a research project.
- The students are capable of Analysis and Interpretation of Data and Paper Writing.
- The students are acquainted with the skills of qualitative and quantitative data analysis and presentation.
- The students will be abreast with the employability skills required for various academic research & industrial units.

**Mandatory Lab 1 (MBO1L1): Microbiology, Algae, Fungi, Plant pathology, Bryophytes, Pteridophytes**

**Course Outcomes (CO)**

- The diversity among the microbes and lower plants is revealed to the student in the laboratory and field.
- The student appreciates the variability among the microbes and lower plants and also acknowledges their economic importance.
- The student is conversed with the common diseases of plants and their control measures.

**Mandatory Lab 2 (MBO1L2): Palaeobotany, Gymnosperms, Cytology, Genetics, Cell biology, and Research Methodology**

**Course Outcomes (CO)**

- The student is sensitised about the fossil flora.
- The student acknowledges the diversity among the Gymnosperms the laboratory and field.
- The student is equipped with techniques to prepare stains and study chromosomes and to analyse the data to decipher underlying genetical phenomenon.
- The student is equipped with the techniques to isolate and quantify DNA.
- The student is conversant with the technique to evaluate the effect of stress on plants.

**SEMESTER II**

**MANDATORY PAPER 5 (MBO2T01): CYTOLOGY AND GENETICS**

**Course Outcomes (CO)**

- The student interprets the observations in nature in the light of laws of genetics and/or underlying cytological aspects.
- The student employs the knowledge of Genetics and induced mutations for crop improvement.

**MANDATORY PAPER 6 (MBO2T02): PLANT PHYSIOLOGY AND BIOCHEMISTRY**

**Course Outcomes (CO)**

- The student realises the role and mechanism of physical and chemical factors affecting the plant life.
- The student learns about the diversity of the biological molecules.
- The student develops strategies to mitigate the adverse effect of environmental stresses on plants.
- The student learns to manipulate the physiological processes to enhance the crop yield and for crop improvement.

## **ELECTIVE PAPER 7 (MBO2T3): CELL BIOLOGY**

### **Course Outcomes (CO)**

- The student is acquainted with the details of the structure and role of the cell organelles.
- The student is acquainted with the structure of DNA and the mechanisms involved in its replication and protecting its structure.
- The student is equipped with the effect of stress on plants.
- The student is able to devise the strategies to mitigate the adverse effect of the stress on the plants.

## **MANDATORY LAB 3 (MBO2L2): PLANT PHYSIOLOGY, MOLECULAR BIOLOGY, PLANT BIOTECHNOLOGY, PLANT BREEDING**

### **Course Outcomes (CO)**

- The student learns to prepare buffers, solutions and carries-out the experiment.
- The student is trained in routinely used molecular techniques.
- The student learns to handle the equipment in the laboratory.
- The student is able to present the data and interpret the results.

## **MANDATORY LAB 4 (MBO2L3): PLANT DEVELOPMENT & REPRODUCTION, TAXONOMY, ECOLOGY**

### **Course Outcomes (CO)**

- The student studies the morphology, anatomy and embryology of the local plants.
- The student learns the biostatistical computations.
- The student is acquainted with the techniques and equipment to study the ecosystem and to describe & identify the plant.
- The student becomes familiar with the local flora and prepares the field report.

## **M. SC. BOTANY (NEP-2020) SEMESTER III**

### **Mandatory Paper: DSC: MBO3T08: Plant Development & Reproduction**

#### **Course Outcomes (CO)**

- The student discovers the variation in Angiosperms at morphological and anatomical level.
- The student understands the mechanisms leading to development of the plant organ.
- The student realizes the interplay of genetic and environmental cues in plant development.
- The student admires the alternatives to sexual reproduction and is able to put them for practical application.
- The student understands the role of cell death in plant development.

### **Mandatory Paper: DSC: MBO3T09: ANGIOSPERMS – I**

#### **Course Outcomes (CO)**

- Comprehend the basic concepts and use scientific terminology accurately.
- Know the relationship and evolutionary processes and patterns in the major plant groups.
- Handle, analyse and identify plant materials in the laboratory, herbarium collections and in the field.
- Through effective oral and written communication and use dichotomous keys in floristic manual.
- The student explores various characters, which can be used to classify the plants.

### **Mandatory Paper: DSC: MBO3T10: Plant Ecology and Conservation Biology**

#### **Course Outcomes (CO)**

- The student acknowledges the role of each factor involved in the development and maintenance of the ecosystem.
- The student realizes the ways leading to sustainable development.
- The student is skilled with the techniques to study the ecosystem and the methods to conserve the biodiversity.
- The student will comprehend the process of carbon sequestration as greenhouse mitigation policy

### **Elective Paper: DSE: MBO3T11: Molecular biology and Plant Biotechnology- I**

#### **Course Outcomes (CO)**

- The student is able to isolate, clone, express & characterize the desired gene in the host.
- The student is informed about the techniques to manipulate the gene and chromosome as desired.

- The student compares the nucleotide and protein sequences and deduces their structural and functional features.
- The student deduces the phylogenetic relationship between organisms.

### **Practical's Based on Elective**

#### **Lab-5: DSC: MBO3P05: Molecular Biology & Plant Biotechnology**

##### **Course Outcomes (CO)**

- The student is trained in the lab techniques used in a specialized branch of Botany.
- The student presents the data in various forms and prepares the report.

#### **Elective Paper: DSC: MB03T11: Plant Physiology - I**

##### **Course Outcomes (CO)**

- 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

### **M.SC. BOTANY (NEP-2020) SEMESTER IV**

#### **Mandatory Paper: DSC: MBO4T12: Angiosperm-II**

##### **Course Outcomes (CO)**

- Understand the basic principles of plant systematics, including identification, nomenclature and classification.
- The student traces the phylogeny of angiosperms with the probable ancestors and develop an insight to correlate the characters and interpret to decipher the evolutionary riddles.
- The student realizes the floristic wealth of the world and appreciates the commercial importance of plants
- The student correlates the geographical factors with the development of vegetation and distribution of plants.

#### **Mandatory Paper: DSC: MBO4T13: Molecular Biology**

##### **Course Outcomes (CO)**

- The student appreciates the significance of gene expression, cell cycle and signal transduction in the life of a plant and other organisms.

- The student takes a stance to employ the knowledge of the mechanism and regulation of gene expression, cell cycle and signal transduction to mitigate the stress and apply it for the benefit of humans using appropriate tools.
- The student is equipped with skill to map the genes in viruses, bacteria and eukaryotes.

**Mandatory Paper: DSC: MBTO4T14: Plant Biotechnology & Plant Breeding**

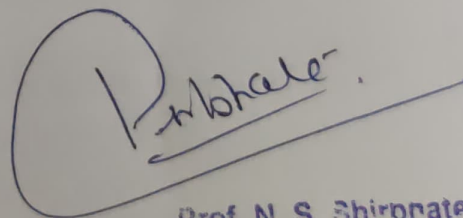
**Course Outcomes (CO)**

- Learn gene cloning, recombinant DNA technology etc.
- The student is equipped with skills to isolate the gene, identify its function and transfer it to the suitable host.
- The student develops the expertise to in vitro cultivation of plants.
- Culture the plants in vitro.
- Learn and apply bioinformatic tools for analysis of bioinformation data.
- The student is skilled with the basic know-how required for crop improvement.

**Elective Paper: DSE: MBO4T15: Plant Physiology-II**

**Course Outcomes (CO)**

- 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 signalling response at cellular level



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**DEPARTMENT OF CHEMISTRY**  
**PROGRAMME: B. Sc.**

**Programme Specific Outcomes (PSOs) in B.Sc. (Hons/Res) Chemistry**

The B.Sc.(Hons/Res) programme in Chemistry is designed to develop in students in depth knowledge of the core concepts and principles that are central to the understanding of this core science discipline. Undergraduates pursuing this programme of study go through laboratory work that specifically develops their quantitative and qualitative skills, provides opportunities for critical thinking and team work, and exposes them to techniques useful for applied areas of scientific study.

**1. Knowledge:** Width and depth: Students acquire theoretical knowledge and understanding of the fundamental concepts, principles and processes in main branches of chemistry, namely, organic chemistry, inorganic chemistry, physical chemistry, analytical chemistry and biochemistry. In depth understanding is the outcome of transactional effectiveness and treatment of specialized course contents. Width results from the choice of electives that students are offered.

**2. Laboratory Skills:** Quantitative, analytical and instrument based: A much valued learning outcome of this programme is the laboratory skills that students develop during the course. Quantitative techniques gained through hands on methods opens choice of joining the industrial laboratory work force early on. The programme also provides ample training in handling basic chemical laboratory instruments and their use in analytical and biochemical determinations. Undergraduates on completion of this programme can cross branches to join analytical, pharmaceutical, material testing and biochemical labs besides standard chemical laboratories.

**3. Communication:** Communication is a highly desirable attribute to possess. Opportunities to enhance students' ability to write methodical, logical and precise reports are inherent to the structure of the programme. Techniques that effectively communicate scientific chemical content to large audiences are acquired through oral and poster presentations and regular laboratory report writing.

**4. Capacity Enhancement:** Modern day scientific environment requires students to possess ability to think independently as well as be able to work productively in groups. This requires some degree of balancing. The chemistry honours programme course is designed to take care of this important aspect of student development through effective teaching learning process.



**5. Portable Skills:** Besides communication skills, the programme develops a range of portable or transferable skills in students that they can carry with them to their new work environment after completion of chemistry honours programme. These are problem solving, numeracy and mathematical skills- error analysis, units and conversions, information retrieval skills, IT skills and organizational skills. These are valued across work environments.

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**B.Sc. Semester – I**

**Course Code - BCH1T01**

**Inorganic Chemistry-1 (Atomic structure, bonding and main group elements)**

**Theory 2 credits + Practical 1 credit**

**Course Outcomes**

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

1. 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 properties.
  2. Draw the plausible structures and geometries of molecules using VSEPR theory.
  3. Explain geometries and properties of molecules based on VBT.
  4. Understand the concept of lattice energy using Born-Haber Cycle.
  5. Rationalize the metallic properties based on various theories.
  6. Elaborate structures and properties of common compounds formed by main group elements.
  7. Identify acidic and basic radicals in simple inorganic salts.
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**Organic Chemistry-1 (Fundamentals, stereochemistry and hydrocarbons)**

**Course Code- BCH1T02**

**Theory 2 credits + Practical 1 credit**

**Course Outcomes**

On completion of the course, the student will be able to:

1. Understand and explain the different nature and behaviour of organic compounds based on fundamental concepts learnt.
2. Formulate the mechanism of organic reactions by recalling and correlating the fundamental properties of the reactants involved.

3. Learn and identify many organic reaction mechanisms including Free Radical Substitution, Electrophilic Addition and Electrophilic Aromatic Substitution.
  4. Understand the fundamental concepts of stereochemistry.
  5. Elaborate various properties of aliphatic and aromatic hydrocarbons.
  6. Experimentally identify extra element and functional group in the given organic compound.
  7. Synthesize various organic compounds making use of selective reagents.
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### **Vocational Skill Course (VSC)**

#### **BVS1P01: Soap, detergent and disinfectant Technology**

##### **Practical 2 credits**

#### **Course Outcomes**

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

1. Gain an understanding of the history and influences behind modern soap creation processes and projected trends in the future of soap.
  2. The analytical approach of this course is to enhance the reasoning and to understand the mechanical part of the industry.
  3. Learn the most common formulations of soap products by exploring compositions and physical chemistry.
  4. Understand the different aspects of industrial processes of Manufacturing disinfectants.
  5. Optimise use of limited resources of harmful chemicals.
  6. Suggest remedial measures for surfactant quality and threshold quantity improvement.
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### **B.Sc. Semester – I SEC (Chemistry)**

#### **BVS1P02: Food Adulteration Analysis Practical 2 credits**

#### **Course Outcomes**

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

1. Get basic knowledge on various foods and about adulteration.
  2. Understand the adulteration of common foods and their adverse impact on health
  3. Comprehend certain skills of detecting adulteration of common foods.
  4. Be able to extend their knowledge to other kinds of adulteration, detection and remedies.
  5. Know the basic laws and procedures regarding food adulteration and consumer protection.
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## **BVE1T01: ENVIRONMENTAL SCIENCE**

### **COURSE OUTCOMES:**

At the end of the course, students shall be able to:

- Explain the basics of Environmental Science and Atmospheric Science along-with the components of Environment
  - Explicate the importance of Environmental Education.
  - Elucidate the fundamentals of atmospheric science including formation, depletion and effects of ozone layer and acid rain on environment.
  - Describe the various physical and chemical characteristics and properties of Water and Soil
  - Understand the Ecology and its allied branches
  - Comprehend about Population and Community Ecology
  - Study the changes in Population by understanding the concept of Population ecology.
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## **Indian Knowledge System (IKS)**

### **SEM1: VEDIC MATHEMATICS (BIK1T0 1)**

**Course Outcomes:** This course will enable the students to

1. Improve speed and accuracy in numerical calculations
  2. Acquire IQ skills and high-end technical knowledge
  3. gain test taking skills & creativity of calculations
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## **Course code - BGO1T01: Food Adulteration**

**Theory: 2 credits**

### **Course Outcomes**

After successful completion of the course, students will be able to:

1. Understand the adulteration of common foods and their adverse impact on health.
  2. Comprehend certain basic skills of detecting adulteration in common foods.
  3. The students are able to understand role and importance of food additives.
  4. Apply their knowledge of food safety and regulations.
  5. Prevent food adulteration in the day to day life.
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## **Course Code - BGO1T02: Cosmetic Chemistry**

**Theory: 2 credits**

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

- Understand the basic principles of cosmetic chemistry.
  - Identify and describe the function of various cosmetic ingredients.
  - Formulate and evaluate different types of cosmetic products.
  - Apply knowledge of skin and hair biology to cosmetic product development.
- Understand the regulatory and safety considerations in the cosmetic industry
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**B.Sc. Semester – II**

**Organic Chemistry-2 (Functional group chemistry)**

**Course Code - BCH2T03**

**Theory 2 credits + Practical 1 credit**

**Course Outcomes**

On completion of the course, the student will be able to:

1. Understand preparation, properties and reactions of haloalkanes, haloarenes and oxygen containing functional groups.
  2. Use the synthetic chemistry learnt in this course to do functional group transformations.
  3. To propose plausible mechanisms for various reactions.
  4. Suggest synthesis routes for desired product from initial reactant.
  5. Identify given organic compound by systematic chemical analysis.
  6. Synthesize derivatives of given organic compound.
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**BCH2T04**

**Physical Chemistry-1 (Thermodynamics, gaseous and liquid states)**

**Theory 2 credits + Practical 1 credit**

**Course Outcomes**

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

1. Solve fundamental mathematical function based problems in chemistry.
2. Understand the three laws of thermodynamics, concept of State and Path functions, extensive and intensive properties.
3. Derive the expressions of  $\Delta U$ ,  $\Delta H$ ,  $\Delta S$ ,  $\Delta G$ ,  $\Delta A$  for ideal gases under different conditions.
4. Evaluate thermodynamics of various physical and chemical processes.
5. Analyse and explain properties of ideal gas, real gas and liquids.

- Evaluate thermodynamic constants through calorimetric studies.
- Use various properties of liquids for determination of their concentration and composition.

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**Vocational Skill Course (VSC)**

**BVS2P03: Drug synthesis and analysis**

**Practical 2 credits**

**Course Outcomes**

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

- A foundational understanding of the principles and concepts of medicinal chemistry, including drug design and development.
  - Gaining practical experience in common laboratory techniques used in medicinal chemistry, such as synthesis and purification.
  - Ability to design and perform experiments to test the effectiveness of potential drug candidates, including assays.
  - Develop an understanding of the Physico-Chemical properties of drugs through fundamentals of volumetric analytical skills.
- 

**(Chemistry) Skill Enhancement Course (SEC)**

**Water and wastewater analysis (BVS2P04)**

**Practical 2 credits**

**Course Outcomes**

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

- Identify sampling locations for different types of water samples.
  - Carry out sampling of water and wastewater from various sources.
  - Analyze spot parameters at sampling location.
  - Carry out complete physico-chemical analysis of different types of water samples.
  - Suggest remedial measures for water detoxification
- 

**Indian Knowledge System (IKS)**

**SEM2: INDIAN ASTRONOMY (BIK2T0 2)**

**Course Outcomes:**

This course will enable the students to understand that

1. It is possible to create a map of the intellectual growth of a culture using astronomy as a probe.
  2. The growth of Indian astronomy occurs in distinct stages analogous to phase transitions of the evolution of cultures
  3. Indian Astronomy therefore provides an excellent window to the past dramatic transitions.
- 

### **BGO2T03: Kitchen and Nutrition Chemistry**

**Theory: 2 credits**

#### **Course Outcomes**

After the completion of this course, student will be able to

1. Understand the chemical composition of food, including macromolecules, nutrients, and additives, and their significance in cooking, nutrition, and medical applications
  2. Apply knowledge of macromolecules, cooking chemistry, and food additives to analyse and optimize cooking processes, ensuring the preservation of nutritional value and sensory quality in prepared foods.
  3. Evaluate the classification and sources of nutrients in food, considering macronutrients, micronutrients, and additives, to make informed dietary choices that support overall health and well-being.
  4. Critically analyse the role of food additives in food preservation and flavour enhancement, considering their chemical composition and potential impacts on human health and food quality.
- 

### **BGO2T04: Basics of Environmental Pollution**

**Theory: 2 credits**

#### **Course Outcomes:-**

1. Evaluate the classification of pollutants and understand the sources and effects of noise pollution.
  2. Explicate the importance of water and thermal pollution.
  3. Learn the basics of solid waste management and soil pollution.
  4. Understand the effects of air and radioactive pollutions.
-

### **CH – 301:Paper- I (Inorganic Chemistry )**

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

- Understand the concepts of molecular orbital theory.
  - Understand the properties of d and f block elements.
  - Understand the role of non aqueous solvents.
  - Understand concepts of errors and evaluation in chemical analysis.
- 

### **B. Sc. Sem-III**

#### **CH-302 : Paper- II (Organic Chemistry)**

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

- Understand the structure and chemical bonding in aryl ,alkyl halides,aldehydes.
  - Understand the structure and chemical bonding in alcohols and phenols..
  - Understand chemical reactions of acids, alcohols, phenols etc.
- 

### **B. Sc. Sem-III**

#### **CH- 303: Laboratory Course**

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

- Perform volumetric analysis for the estimation of Zn,Fe and alkali content in given sample.
  - identify given organic compound by organic qualitative analysis.
- 

### **B. Sc. Sem-IV**

#### **CH – 401:Paper- I (Inorganic Chemistry)**

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

- Understand the properties of coordination compounds.
  - Overview of organometallic chemistry.
  - Understand the importance of essential elements in living organism.
  - To understand the Concept of hard and soft acid base theory.
- 

### **B. Sc. Sem-IV**

#### **CH – 402:Paper- II ( Physical Chemistry)**

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

- Understand second law of thermodynamics.

- Use spectroscopy for chemical analysis.
  - Understand electrochemistry of reversible and irreversible cells.
  - Understand the nuclear properties of atom.
- 

**B. Sc. Sem-IV**

**CH-403: Laboratory Course**

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

- Perform gravimetric analysis of Ni, Ba.
  - To estimate amount of constituents present in given solution by conductometer, potentiometer.
- 

**B. Sc. Sem-V**

**CH- 501:Paper- I (Organic Chemistry)**

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

- Understand heterocyclic chemistry.
  - Understand the theory behind the organic qualitative analysis.
  - Understand the chemistry of organomagnesium and organozinc compound.
- 

**B. Sc. Sem-V**

**CH- 502:Paper- II ( Physical Chemistry)**

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

- Understand quantum chemistry and its application.
  - Understand molecular orbital theory.
  - Understand photochemistry and Raman spectroscopy
- 

**B. Sc. Sem-V**

**CH- 503**

Laboratory Course

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

- Perform estimation of different functional groups present in organic compound.
  - Perform analysis based on viscosity,colorimetry,refractometry.
- 

**B. Sc. Sem-VI**



### CH – 601: Paper- I (Inorganic Chemistry)

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

- Understand metal-ligand bonding in co-ordination compounds.
  - Understand electronic spectra of transition metal complexes.
  - Understand separation techniques used in analysis and purification.
  - Understand the importance of inorganic polymers.
- 

### B. Sc. Sem-VI

### CH- 602: Paper- II (Organic Chemistry)

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

- Understand the theory behind Nuclear magnetic resonance spectroscopy.
- Understand structure and properties of biomolecules.
- understand the importance of synthetic dyes, synthetic drugs and synthetic polymers .



Dr. R. G. Gajbhiye



Dr. M. K. Narule  
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Dr. S. W. Awaghode

## **POST GRADUATE DEPARTMENT OF CHEMISTRY**

### **M.Sc. SEMESTER I**

#### **Paper 1 MCH1T01: Inorganic Chemistry**

##### **COURSE OUTCOMES:**

1. predict the nature of bond and its properties through various electronic structural methods; bonding models
  2. design new coordination compounds based on a fundamental understanding of their electronic properties
  3. develop the possible catalytic pathways leading to desired products
  4. apply the principles of transition metal coordination complexes to derive reaction mechanisms.
- 

#### **Paper 2 MCH1T02: Physical Chemistry**

##### **COURSE OUTCOMES:**

1. Understand, analyze and exercise the principles of classical thermodynamics in various applications
  2. Understand and execute the quantum mechanical problems and their applications
  3. Understand the concept of adsorption and its application in surface chemistry
  4. Analyze and understand the characterization techniques for polymer
  5. Understand the principles of chemical kinetics and their applications in chemical dynamics
- 

#### **Paper 3 (Elective) MCH1T03: Analytical Separation Techniques**

##### **COURSE OUTCOMES:**

1. Understand various separation technique based on sample and target analyte
  2. Elaborate the working principles of various separation techniques.
  3. Apply logic behind working and applicability of each technique.
  4. Identify most suitable separation tool resolution of mixtures.
  5. Develop separation methods for multicomponent analysis.
  6. Evaluate efficiency of separation of mixture based on analysis parameters.
- 

#### **Paper 4 MCH1T04: Research Methodology**

**COURSE OUTCOMES:**

1. understand what research is and what is not.
  2. raise awareness of crucial aspect of the nature of Knowledge and the value of scientific method.
  3. Introduce the concept at the heart of every research project – the research problem - and to discuss what a researchable problem is.
  4. evaluate literature, form a variety of sources, pertinent to the research objectives.
  5. identify and justify the basic components of the research framework, relevant to the tackled research problem.
  6. explain and justify how researchers will collect research data.
  7. discuss how to cite sources, and justify this choice.
  8. put forward a credible research proposal.
  9. warn the common mistakes in the field of research methodology.
- 

**Practical 2 MCH1P02: Physical Chemistry including RM****COURSE OUTCOMES:**

1. Understand the basic principle involved in physical chemistry.
  2. Evaluate various physical parameters
  3. Interpret the experimental results.
  4. Calculation involved in interpreting results.
- 

**SEMESTER II****Paper 5 MCH2T05: Organic Chemistry****COURSE OUTCOMES:**

1. Implement rules of aromaticity to organic molecules
  2. Sketch organic molecules in different projection formula and assign its configuration.
  3. Apply their understanding about the organic reactions of industrial significance with respect to the chemo- selectivity, regioselectivity and enantioselectivity.
  4. Analyze the product distribution and the stereochemistry of various organic products.
  5. Evaluate the relationship between structure and reactivity.
- 

**Paper 6 MCH2T06: Analytical Chemistry****COURSE OUTCOMES:**

1. Select a specific analytical technique based on sample and target analyte

2. Develop analytical ability and critical thinking in selection of statistics and their use in making interpretation meaningful and productive.
  3. Explain the logic behind working of indicator used in each type of titration
  4. Elaborate interaction of radiation with matter and its application in chemical analysis.
  5. Develop spectral methods of analysis for desired analytes.
  6. Apply electroanalytical techniques based on conductance and emf measurements.
- 

### **Paper 7 (Elective) MCH2T07: Organic Reaction Mechanism**

#### **COURSE OUTCOMES:**

1. Predict the orientation and stereochemistry of the product of addition and elimination reaction
  2. Apply enolate chemistry to achieve molecular complexity
  3. Design organic reactions in order to achieve the required product(s)
  4. Formulate green chemistry synthesis to increase atom economy
  5. Application of free radicals in functional group transformation
- 

### **Practical 3 MCH2P03: On Job Training/Field Project**

#### **COURSE OUTCOMES:**

1. Every student admitted to M.Sc. Second Semester is compulsorily required to undergo this course bearing 4 credits.
  2. During second semester, all students will have to undergo OJT/Internship/FP of 120 Hours.
  3. Each student will be required to submit a detailed report to the Department/ College/ Institute for work undertaken during this period within 7 days of completion of the training following which the evaluation and assessment for OJT/Internship/FP will be done by the college/institute concerned. The Report submitted must be according to the Learning outcomes and in tune with the rubric for evaluation.
  4. College/Institute is required to assign Supervisor/Mentor to students for OJT/Internship/FP who will guide the students in attaining the outcomes of this course.
  5. The Internal Examiner and External Examiner shall jointly evaluate the report submitted by the student and her/his seminar and shall immediately submit the evaluation report in the prescribed format provided along with.
- 

### **Practical 4 MCH2P04: Organic Chemistry**

#### **COURSE OUTCOMES:**

1. Handling of the hazardous chemicals by safely
2. Predict and analysis of the major and minor products of a variety of organic reactions
3. Monitoring of the chemical reactions
4. Calculation of yield, percentage yield of the chemical reactions

5. Understand the concept of Qualitative analysis

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### **Practical 5 MCH2P05: Analytical Chemistry**

#### **COURSE OUTCOMES:**

1. Carry out calibration of glassware available in the laboratory.
  2. Analyze the data obtained through experiments using statistical analysis parameters.
  3. Estimate quantitatively analyte present in different samples using classical and instrumental methods of analysis.
  4. Design experiments based on classical and instrumental techniques.
  5. Understand the principles involved in visual and instrumental volumetric techniques.
  6. Formulate experiments based on optical and electroanalytical techniques.
- 

### **SEMESTER III**

#### **Paper 8 MCH3T08: Spectroscopy-I**

#### **COURSE OUTCOMES:**

1. Understand the symmetry properties of molecules
  2. Interpret the structure of simple organic molecules using mass spectrometry
  3. Correlate the presence of functional groups with IR frequencies
  4. Apply the IR and Raman spectroscopy to simple molecules.
- 

#### **Paper 9 MCH3T09: Advanced Organic Chemistry-I**

#### **COURSE OUTCOMES:**

1. Identify a pericyclic reaction and categorize it as a cycloaddition, a group transfer reaction, a sigmatropic rearrangement, or an electrocyclic reaction,
  2. Apply frontier molecular orbital (FMO) theory to rationalize selectivity and reactivity aspects of pericyclic reactions.
  3. Understand the reaction mechanism of various common reagents employed in organic synthesis
  4. Understand the reactivity of sulphur, silicon and phosphorous elements.
  5. Apply pericyclic reactions for the synthesis of complex organic molecules .
- 

#### **Paper 10 MCH3T10: Advanced Inorganic Chemistry**

**COURSE OUTCOMES:**

1. Understand the crystal structures of simple inorganic molecules.
  2. Understand the industrial applications of catalysis.
  3. Apply the mechanism of metallo-enzyme actions in various life processes.
  4. Apply simple methods of synthesis and characterization to nanomaterials.
- 

**Paper 11 MCH3T11: Elective (b) Organic Chemistry Special-I**

**COURSE OUTCOMES:**

1. Learn the important aspects of steroids and terpenoids.
  2. Understand the biosynthesis of natural products.
  3. Analyze the enzyme reactions involved in various life processes
  4. Illustrate the structure elucidation of unknown naturally occurring organic compound
  5. Apply the knowledge of organic reactions for the total synthesis of useful natural products.
- 

**Practical 6 MCH3P06: Elective (b) Organic Chemistry Special Practical**

**COURSE OUTCOMES:**

1. Understand the types of reactions involved in organic synthesis.
  2. Realize the various functional groups which are commonly present in simple organic molecules.
  3. Develop skills to understand the reactions of different functional groups by the hands-on experience.
  4. Characterize the synthesized compounds using IR spectroscopy
  5. Draw the structures using Chem-Draw.
- 

**Paper 12 MCH 4T12: Spectroscopy-II**

**COURSE OUTCOMES:**

1. Interpret the structures of simple molecules using physical methods of analysis
  2. Understand and interpret the NMR data
  3. Analyze X ray diffraction data
  4. Develop the skills of analytical ability
  5. Execute out the combined application of spectral method.
- 

**SEMESTER IV**

**Paper 13 MCH 4T13: Advanced Organic Chemistry II**

**COURSE OUTCOMES:**

1. Recognize the chemical reactions of carbonyl compounds and alkenes under photochemical conditions
  2. Understand the stereochemistry of complex organic molecules
  3. Apply the knowledge of enolate chemistry in modern organic synthesis
  4. Demonstrate the applications of stereochemistry of common organic reactions
  5. Analyze the philosophy of synthesis of small molecule.
- 

### **Paper 14 MCH 4T14: Advanced Physical Chemistry**

#### **COURSE OUTCOMES:**

1. Understand the types and behavior of solids based on their structure.
  2. Estimate various dependent parameters of under different influences.
  3. Understand solid state reactions and synthesis process.
  4. Understanding nano chemistry.
  5. Identification of crystals and their analysis.
- 

### **Paper 15 MCH4T15: Elective (b) Organic Chemistry Special-II**

#### **COURSE OUTCOMES:**

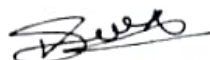
1. Understand the reactivity of organometallic compounds
  2. Demonstrate the applications of organometallic reagents in C-C bond formation
  3. Understands the reactivity of heterocyclic compounds in various reaction conditions
  4. Understand the electrophilic, nucleophilic reactions and synthesis of various heterocycles
  5. Justify the need of protecting groups in organic synthesis.
- 



Dr. M. N. Narule



Dr. R. G. Gajbhiye



Ms. S. W. Awaghade

Vidya Vikas Arts Commerce and Science College, Samudrapur

Department of Mathematics

2024-25

## Program Outcomes

### PROGRAM: B.Sc. Mathematics (NEP)

**PO1. Critical Thinking:** Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.

**PO2. Problem Solving:** Solve problems from the disciplines of concern using the knowledge, skills and attitudes acquired from mathematics/ sciences/social sciences/humanities.

**PO3. Effective Communication:** Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.

**PO4. Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in wide variety of settings.

**PO5. Ethics:** Understand multiple value systems including your own, the moral dimensions of your decisions, and accept responsibility for them.

**PO6. Environment and sustainability:** Understand the impact of technology and business practices in societal and environmental contexts, and sustainable development.

**PO7. Self-directed and life-long learning:** Demonstrate the ability to engage in independent and life-long learning in the broadest context socio-technological changes.

**PO8. Design/Development of Solutions:** Design solutions for complex science problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

**PO9. Computational Thinking:** Understand data-based reasoning through translation of data into abstract concepts using computing technology-based tools.

**PO10. Effective Citizenship:** Demonstrate empathetic social concern and equity centred national development, and the ability to act with an informed awareness of issues and



participate in civic life through volunteering.

**PO11. Global Perspective:** Understand the economic, social and ecological connections that link the world's nations and people.

**PO12. Aesthetic Engagement:** Demonstrate and master the ability to engage with the arts and draw meaning and value from artistic expression that integrates the intuitive dimensions of participation in the arts with broader social, cultural and theoretical frameworks

#### Program Specific Outcome

**PSO1: Rational Thinking:** Students be able to formulate and develop Mathematical arguments in a logical manner to unravel the gist hidden in the problem at hand.

**PSO2: Problem solving ability:** Student should be able to think in a critical manner to process the data, and develop Mathematical problem-solving ability.

**PSO3: Revisiting the question:** Students should be able to recall basic facts, important milestones, discoveries in Mathematics and inculcate habit of rational thinking by which the problem at hand can be revisited, time and again, that helps in solving it.

**PSO4: Analytical ability:** In the growing field of research, it is necessary for students to learn to use some packages like Matlab, Scilab, Mathematica, Maxima, etc, so that analytical tools be available to investigate the functions, problems through graphs, programming, etc.

**PSO5: Numerical Ability:** Using packages, students can make programs to solve some problems of which exact solutions are not available, using tools of Numerical analysis.

**PSO6: Simulation Ability:** The problems that cannot be solved directly, can at times be solved through techniques of simulation by honors/research students.

**PSO7: Research:** Students thus motivated would prepare themselves for research studies in Mathematics and related fields.

**PSO8: Application:** Student will be able to apply their skills and knowledge in Mathematics to various fields of studies including, science, engineering, commerce and management etc.

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Department of Mathematics

2024-25

### Course outcomes

<b>B. Sc. Mathematics(NEP)</b>
<b>Paper 1 :Algebra and Trigonometry</b>
<b>CO1: Foundational Knowledge:</b> Students will be able to update their basics of Set Theory, Matrices, Theory of equations and Complex variables and its applied aspects.
<b>CO2: Elementary Skills:</b> Students will be able to understand the importance of hyperbolic functions and their relationships with trigonometric functions.
<b>CO3: Basic Analytic skills:</b> The main outcome of the course is to equip students with necessary basic analytic skills for problem solving.
<b>CO4: Application:</b> By applying the principles of basic tools through the course curriculum, students can solve a variety of practical problems in science and engineering.
<b>Paper 2: Differential Calculus</b>
<b>CO1: Foundational Knowledge:</b> Students will be able to update their basic knowledge of Maxima and Minima of functions of single variables and their application.
<b>CO2: Elementary Skills:</b> Students will undergo problem solving training by learning Indeterminate forms and L' Hospital's Rule and their applicability.
<b>CO3: New Concepts learning:</b> Students will be able to learn new concept of functions of two variables, Taylor series, and maxima and minima of such functions.
<b>CO4: Analytic Skills:</b> The problem-solving skills will bring forth the importance of Jacobian in understanding the existence of inverse transformation and other aspects of independence of pair of functions.
<b>CO5: Application:</b> By applying the principles of basic tools through the course curriculum, students can solve a variety of practical problems in science and engineering.

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2024-25

## Program Outcomes

### **PROGRAM: M. Sc. Mathematics(NEP)**

**PO1. Critical Thinking:** Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.

**PO2. Problem Solving:** Solve problems from the disciplines of concern using the knowledge, skills and attitudes acquired from mathematics/ sciences/social sciences/humanities.

**PO3. Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in wide variety of settings.

**PO4. Ethics:** Understand multiple value systems including your own, the moral dimensions of your decisions, and accept responsibility for them.

**PO5. Self-directed and life-long learning:** Demonstrate the ability to engage in independent and life-long learning in the broadest context socio-technological changes.

**PO6. Design/Development of Solutions:** Design solutions for complex science problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

**PO7. Computational Thinking:** Understand data-based reasoning through translation of data into abstract concepts using computing technology-based tools.

**PO8. Aesthetic Engagement:** Demonstrate and master the ability to engage with the arts and draw meaning and value from artistic expression that integrates the intuitive dimensions of participation in the arts with broader social, cultural and theoretical frameworks.

## Program Specific Outcome

**PSO1: Rational Thinking:** Students be able to formulate and develop Mathematical arguments in a logical manner to unravel the gist hidden in the problem at hand.

**PSO2: Problem solving ability:** Student should be able to think in a critical manner to process the data, and develop Mathematical problem-solving ability.

**PSO3: Revisiting the question:** Students should be able to recall basic facts, important milestones, discoveries in Mathematics and inculcate habit of rational thinking by which the problem at hand can be revisited, time and again, that helps in solving it.

**PSO4: Analytical ability:** In the growing field of research, it is necessary for students to learn to use some packages like Matlab, Scilab, Mathematica, Maxima, etc, so that 3 analytical tools be available to investigate the functions, problems through graphs, programming, etc.

**PSO5: Numerical Ability:** Using packages, students can make programs to solve some problems of which exact solutions are not available, using tools of Numerical analysis.

**PSO6: Simulation Ability:** The problems that cannot be solved directly, can at times be solved through techniques of simulation by student analytical tools be available to investigate the functions, problems through graphs, programming, etc.

**PSO7: Research:** Students thus motivated would prepare themselves for research studies in Mathematics and related fields.

**PSO8: Application:** Student will be able to apply their skills and knowledge in Mathematics to various fields of studies including, science, engineering, commerce and management etc

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Department of Mathematics

2024-25

## Courses Outcomes

### M. Sc. Mathematics(NEP)

#### M.Sc. Sem I ALGEBRA

**CO1: Foundational Knowledge:** Students will be able to update their basics of Group Theory, Discuss on various topic of group in algebra.

**CO2: Elementary Skills:** Students will be able to understand the importance of Solvable and Nilpotent, Alternating groups.

**CO3: Basic Analytic skills:** The main outcome of the course is to equip students with necessary basic analytic skills for problem solving on Sylow theorems.

**CO4: Application:** By applying the principles of basic theorems of Algebra through the course curriculum, students can solve a variety of logical problems in science and engineering

#### M.Sc. Sem I TOPOLOGY

**CO1: Foundational Knowledge:** Students will learn the basic concepts of topological space, metric spaces, product topology, closed sets, limit points and continuous function. Students will also get to know about interrelating these concepts with one another.

**CO2: Elementary Skills:** Students will study about the connectedness of topological spaces. They will get to know about connectedness on real line with standard examples

**CO3: Basic Analytic skills:** Students will study about covering spaces and relate it with compactness of the spaces. Students will gain analytical skill to relate compactness on real line, limit point compactness and local compactness.

**CO4: Application:** Students will be able to think critically and apply the knowledge of topological spaces in the study of analysis and will be able to prove the standard results regarding countability and separation axioms.

#### M.Sc. Sem I ORDINARY DIFFERENTIAL EQUATION

**CO1: Foundational Knowledge:** Students will be able to study basic notions in Differential Equations and use the results in developing advanced mathematics.

**CO2: Elementary Skills:** Students will be able to solve problems modeled using linear differential equations having ordinary points and regular singular points and solve them by method of power series.

**CO3: Basic Analytic skills:** The main outcome of the course is to equip students to develop techniques to solve differential equations that would help students sharpen their understanding of the Mathematical solutions with their characteristics.

**CO4: Application:** By applying the principles of basic tools through the course curriculum, students can solve a variety of practical problems involving ordinary differential equations in science and engineering

#### M.Sc. Sem I INTEGRAL EQUATIONS

**CO1: Foundational Knowledge:** The new concept of 'Integral Equations' will be introduced to students in which they will study different types of integral equations and various methods to solve them. Also, they will be taught integral transforms such as Hilbert transform.

**CO2: Elementary Skills:** Students will be able to understand integral equations with different types of kernel and will be able to recognize their solving methods.

**CO3: Basic Analytic skills:** The main outcome of the course is to teach student about integral equations and solving them using various transforms such as Laplace transform, Fourier transform, Hilbert transform, etc.

**CO4: Application:** By applying the solving techniques, students can solve Fredholm Integral equations, Volterra Integral equations, Non-linear Integral equations and Integro-differential equations.

#### M.Sc. Sem II REAL ANALYSIS

**CO1: Foundational Knowledge:** Students will be able to update their basics knowledge in sequence, series, limit, continuity and differentiability.

**CO2: Elementary Skills:** Students will be able to understand the importance of uniform convergence and topological manifold.

**CO3: Basic Analytic skills:** The main outcome of the course is to equip students with necessary basic analytic skills for problem solving with functions of several variables.

**CO4: Application:** By applying the principles of basic tools through the course curriculum, students can solve a variety of practical problems involving Manifold, sub-manifold and differentiable manifold.

#### M.Sc. Sem II DIFFERENTIAL GEOMETRY

**CO1: Foundational Knowledge:** Students will be introduced to the fundamentals of Differential Geometry primarily by focusing on the theory of curves and surfaces in three dimensional space.

**CO2: Elementary Skills:** Students will be study about the curves and their global

properties. Students will get to know about Geodesic curve and its existence conditions.

**CO3: Basic Analytic skills:** Students will get the knowledge of fundamental quadratic forms of a surface, intrinsic and extrinsic geometry of surface, problem of Metrization and Triangulation.

**CO4: Application:** By applying various definitions, theorems and formulas, students can solve different problems based on curved surfaces and their curvatures. It can be further used to analyse shapes and data on non-flat surfaces.

#### M.Sc. Sem II ADVANCE NUMERICAL METHODS

**CO1: Foundational Knowledge:** Students will learn the basic methods and tools of numerical methods in root finding for linear and non-linear equations. They will learn about Newton's method, Muller's method and System of non-linear equations.

**CO2: Elementary Skills:** Students will develop skills in analysing the methods of interpolation for a given data using polynomial interpolation, Newton's divided difference, forward differences and Hermite interpolation.

**CO3: Basic Analytic skills:** Students will develop skills to approximate a function using appropriate theorems and numerical methods as a solution to the problems.

**CO4: Application:** Students will be able to think critically to use Trapezoidal rule, Simpson's rule and Newton cotes integration formula for solving Mathematics modelling problems. They will be able to compare results of the problems by different methods.

#### M.Sc. Sem II CLASSICAL MECHANICS

**CO1: Foundational Knowledge:** Students will be able to update their basics of variational principle.

**CO2: Elementary Skills:** Students will be able to understand the importance of Lagrange's equation of motion.

**CO3: Basic Analytic skills:** The main outcome of the course is to equip students with necessary basic analytic skills for problem solving using Lagrange's and Hamilton's equations of motion.

**CO4: Application:** By applying the course curriculum, students can solve a variety of practical problems in research.

#### M.Sc. Sem III COMPLEX ANALYSIS

**CO1: Foundational Knowledge:** Students will be able to learn about complex number. They will get the knowledge about complex number in polar coordinate as well.

**CO2: Elementary Skills:** Students will be able to learn the Mobius Transformation, they come to know about the Analytic Function and Elementary Properties, Power Series.

**CO3: Basic Analytic skills: The Objective of this Course is to study the topic like Cauchy-Riemann Equations, Poles and Residues, Mobius Transformation.**

**CO4: Application: By applying the principles of basic tools through the course curriculum, Student can solve variety of practical problems.**

**M.Sc. Sem III FUNCTIONAL ANALYSIS**

**CO1: Foundational Knowledge: Students will be able to update their basics knowledge in spaces, subspace, sequences, continuity and Normed space**

**CO2: Elementary Skills: Students will able to understand the importance of uniform convergence, inner product space, orthogonal sets and orthonormal sets.**

**CO3: Basic Analytic skills: The main outcome of the course is to equip students with necessary basic analytical skills and to help sharpen the student's understanding of the mathematical structure of the subject.**

**CO4: Application: By applying the principles of basic tools through the course curriculum, students can solve a variety of practical problems in science and engineering**

**M.Sc. Sem III ADVANCE MATHEMATICAL METHODS**

**CO1: Application in Engineering: By applying the principles of basic formulae of Fourier series through the course curriculum, students can solve a variety of logical problems in science and engineering.**

**CO2: Application in physics to Solve Boundary value Problem: Students will be able to understand the importance of Laplace Transform to solve physical and Electrical Problem.**

**CO3: Application to Solve Boundary Value Problem: The main outcome of the course is to equip students with necessary basic analytic skills for problem solving on Partial Differential Equation.**

**CO4: Application in Engineering: By applying the principles of basic formulae of Z-Transform through the course curriculum, students can solve a variety of logical problems in science and Electrical engineering.**

**M.Sc. Sem III GENERAL THEORY OF RELATIVITY**

**CO1: Foundational Knowledge: Students will be able to update their basics of Tensors and learn different types of tensors with their applications.**

**CO2: Elementary Skills: Students will be able to understand the approximation theories of Newton's equations to Poisson equations and vice-versa**

**CO3: Basic Analytic skills: The main outcome of the course is to equip students with necessary basic analytic skills for problem solving.**



**CO4: Application:** By applying the principles of basic tools, like Christoffel symbols, through the course curriculum, students can solve a variety of practical problems in cosmology

**M.Sc. Semester IV DYNAMICAL SYSTEM**

**CO1: Foundational Knowledge:** Students will learn the basic concepts related to Dynamical System. They will also gain the knowledge about The Flow of a Differential Equation and understand their global dynamics.

**CO2: Elementary Skills:** Students will study about the nonlinear phenomena in physical systems by using a basic knowledge. They will be Capable of determining fixed points and their stability and solve the mathematical problems.

**CO3: Basic Analytic skills:** Students will study about limits sets, flow boxes, Poincare Bendixson Theorem and its application . Students will gain analytical skill to describe the time evolution of systems which arise from biology and others subjects.

**CO4: Application:** Students will be able to think critically about how autonomous and non autonomous Differential equation are differentiated. They will be apply the knowledge of Dynamical systems in the study of analysis using mathematical Concepts and techniques.

**M.Sc. Semester IV MEASURE AND INTEGRATION THEORY**

**CO1: Foundational Knowledge:** Students will be able to understand the fundamental concept of measure and Lebesgue measure. Students should be able to understand the construction of the Lebesgue integral and know its key properties.

**CO2: Elementary Skills:** Students will be able to investigate fundamental concepts of measure and integration theory and apply the definition and properties of Lebesgue Measure and measurable sets.

**CO3: Basic Analytic skills:** The main outcome of the course is to equip students with necessary basic analytic skills for problem solving with various types of measurable sets, measurable functions, and solution to a problem of the Lebesgue integral of the bounded measurable functions, unbounded measurable function and integral of a non-negative functions.

**CO4: Application:** By applying the principles of basic tools through the course curriculum, students can solve a variety of practical problems involving borel measurability sets, measurable functions, Riemann and Lebesgue integral

**M.Sc. Semester IV PARTIAL DIFFERENTIAL EQUATIONS**

**CO1: Foundational Knowledge:** Students will be able to classify partial differential equations upon their linearity and find corresponding integral surfaces.

**CO2: Elementary Skills:** Students will be able to solve linear partial differential equations of both first and second order.

**CO3: Basic Analytic skills:** Students will be able to classify partial differential equations and transform second order partial differential equations into canonical form.

**CO4: Application:** Students will be able to solve boundary value problems for Laplace's equation, the heat equation, the wave equation by separation of variables, in Cartesian, polar, spherical and cylindrical coordinates

**M.Sc. Semester IV COSMOLOGY**

**CO1: Foundational Knowledge:** Student will be able to update their basis knowledge about cosmology studies. How the history of universe led to the stars, galaxies, and other features we can observe today.

**CO2: Elementary Skills:** Student will able to study of cosmology. Cosmology is the study of outer space or the universe came to be, what its structure is like, and what the future may hold.

**CO3: Basic Analytic Skills:** The main outcome of the course is to equip student to develop techniques to solve cosmological problem to find the new model.

**CO4: Application:** Cosmology helps to understand how the universe began and how it has evolved over the nature of the universe.

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HOD, Mathematics

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## Program Outcomes B Sc Physics (UG)


### Program Outcomes (POs) of B.Sc. :

- Develop the knowledge with facts and figures related to various subjects in sciences.
- Understand the basic concepts, fundamental principles, and the scientific theories related to various scientific phenomena and their relevancies in the day-to-day life.
- Develop the skills of observations and drawing logical inferences from the scientific experiments.
- Acquire the skills in handling scientific instruments, planning and performing in laboratory experiments.
- Develop scientific outlook not only with respect to science subjects but also in all aspects related to life.
- Students will be able to present ideas clearly and confidently with skills to negotiate with others. They will be able to evaluate primary literature, in oral and written form and subsequently articulate the information.
- Students will be able to analyze information objectively and make a reasoned judgment by observation, understanding and evaluation of sources, such as data, facts and research findings.

### Program Specific outcomes for B Sc. Physics with Mathematics, Computer Science:

- PSO1. Enabling students to develop a keen interest in the subjects, which they have opted for in their graduate program. The program help the students to develop conceptual understanding so that, they can recognize, recall and apply the definitions, concepts and techniques which they have studied.
- PSO2. Helping the students to acquire good knowledge and understanding in advanced areas so that, they are able to set appropriate goals and choose their future career by pursuing higher education in the areas / courses like- M. Sc., M.C.A, M.B.A, Actuarial Science, Clinical research, Data Science, Machine Learning, Financial

  
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Mathematics, Biostatistics etc.

- PSO3. Knowledge in Mathematics, Physics, Electronics, Statistics, Computer Science subjects will be helpful for students in working on field projects / market surveys and real life problems/ technical issues, in order to provide them experiential training on- applying statistical techniques / electronic technical tools / computational algorithms / mathematical modeling etc , for arriving at the conclusion / problem solving status.
- PSO4. Mathematical Science develops scientific temper and analytical ability amongst students so that, they are ever ready to welcome new project, new knowledge and experiments or to join research development in multidisciplinary research.
- PSO5. Studying three subjects throughout a 3- year degree program, enhances student's overall development, critical thinking, analytical aptitude and problem solving skill.
- PSO6. Students will be able to demonstrate understanding of their scientific knowledge by participating / presenting their ideas /work in student seminars / research talks as well as will be keen in knowing the current trends in their subject(s) of interest.

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## B Sc Physics Course Outcome:

On completion of the course students will be able to -

<b>B. Sc. Semester-I Discipline Specific Core Course (DSC-1)-PHYSICS - Paper-I (BPH1T01) (Measurements, Mechanics, and Properties of Matter)</b>
<ul style="list-style-type: none"><li>• Develop interest in measurement with conceptual knowledge of physics.</li></ul>
<ul style="list-style-type: none"><li>• Develop practical skills in accurate measurements with minimal errors.</li></ul>
<ul style="list-style-type: none"><li>• Understand and practice these skills while performing physics practical.</li></ul>
<ul style="list-style-type: none"><li>• Understand the use of apparatus and their use without fear.</li></ul>
<ul style="list-style-type: none"><li>• Correlate their physics theory concepts with practical outcomes.</li></ul>
<ul style="list-style-type: none"><li>• Understand the concepts of errors and their estimation.</li></ul>
<b>B. Sc. Semester-I Discipline Specific Core Course (DSC-2)-PHYSICS - Paper- II (BPH1T02) (Kinetic theory of gases and Thermodynamics)</b>
<ul style="list-style-type: none"><li>• Understand the assumptions of kinetic theory of gases, ideal and real gases.</li></ul>
<ul style="list-style-type: none"><li>• Understand the nature of calorimetry by specific heat of solids and gases.</li></ul>
<ul style="list-style-type: none"><li>• Analyses different transport phenomena in gases</li></ul>
<ul style="list-style-type: none"><li>• Describe basic concepts of Thermodynamics.</li></ul>
<ul style="list-style-type: none"><li>• Analyses the laws of thermodynamics in different cases and entropy.</li></ul>
<ul style="list-style-type: none"><li>• Restate definition of system, surrounding, closed and open system, extensive and intensive variables and properties.</li></ul>
<ul style="list-style-type: none"><li>• Design various types of basic heat engines.</li></ul>
<ul style="list-style-type: none"><li>• Understanding the low temperature physics</li></ul>
<b>B. Sc. Semester-I Vocational Skill Course (VSC - 1) - PHYSICS Course Code (BVS1P01) (Electronic and Electrical Components)</b>
<ul style="list-style-type: none"><li>• Get acquainted hands-on practice for electronic components and their uses in electronic circuits</li></ul>
<ul style="list-style-type: none"><li>• Get acquainted hands-on practice for electrical components and their uses in electrical</li></ul>


  
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circuits
<ul style="list-style-type: none"><li>• Apply the practical knowledge in conducting various practical during graduation.</li><li>• Apply the practical knowledge in repairing household electronic and electrical gadgets.</li></ul>
<b>B. Sc. Semester-II Discipline Specific Core Course (DSC-)-PHYSICS - Paper-III (BPH2T03) (Acoustic and Ultrasonics)</b>
<ul style="list-style-type: none"><li>• Understand the different aspects and attributes of a musical sounds. Also response of ear to sound and audible limits of human ear.</li><li>• Learn about various musical scales and musical instruments.</li><li>• Learn about acoustics of a hall and requirement of a good acoustic of a hall.</li><li>• Learn about different microphones their design and action and also about loudspeaker.</li><li>• Learn about the characteristics and production method as well as detection of USW.</li><li>• Learn about different applications of USW like SONAR, soldering, cleaning and medical applications like sonography etc.</li></ul>
<b>B. Sc. Semester-II Discipline Specific Core Course (DSC-4)-PHYSICS - Paper-IV (BPH2T04) (Oscillations and Black body radiation)</b>
<ul style="list-style-type: none"><li>• Understand the simple harmonic motion, and properties of different oscillatory motion of an object</li><li>• Understand the damped and forced oscillation</li><li>• Understand mechanical waves in a medium and wave equation of the transverse waves on string and longitudinal waves in a fluid.</li><li>• Understand black body radiation and development of quantised nature of blackbody radiation.</li><li>• Understand the temperature of heavenly bodies</li></ul>

  
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**B. Sc. Semester-II Vocational Skill Course (VSC) - PHYSICS Course Code (BVS2P03) (Instrumental Errors in Measurement)**


- Understand the function of different instruments.
- Choose and apply proper instrument for the measurement.
- Handle the instrument carefully and apply the practical knowledge in his further study.
- Find the different man made and instrumental errors in doing different practical.


**B. Sc. Semester-I Generic Elective / Open Elective Course (GE/OE-1) (BGO1T01) (Space Science)**

- Get acquainted with the space related events
- Get knowledge about solar system and planets
- Determine the average distance and sizes of heavenly bodies
- Understand the concept of black hole and other giants
- Know the measurement related to large distance
- Understand the communication time requirement for longer distances

**B Sc Semester-II Generic Elective / Open Elective Course (GE/OE-2) (BGO2T03) (Energy Sources)**

- To impart knowledge of basic concepts of Conventional and Non-conventional Energy Sources.
- To get the knowledge and methodology necessary for Solar, Ocean, geothermal, Hydro and Biomass energy resources.
- To learn the efficiency of the technology available for using source of energy and the environmental impact of using that source.
- To apply the knowledge of Energy Sources to real life problems.
- To create scientific temperament related to Energy Sources.

  
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## Programme Outcomes M Sc Physics

### Programme Objectives (POs):

M Sc (Physics) Programme is meant to systematize and give a method and structure to learner experiences with imparting students with an in-depth knowledge and understanding through the core courses which form the basis of Physics. The elective courses are designed for more specialized and/or interdisciplinary content to equip students with a broader knowledge base. The recent developments in physical sciences, has been included in the curricula to meet out the present day needs of academic and research, institutions, and industries. Research methodology, on the job training and research-based projects included in the curricula will enrich the students towards new findings leading to inspiration for research degree and orientation for job opportunities. After completing this Programme the learner,

**PO 1:** will have knowledge of fundamental laws and principles of physics along with their applications in diverse areas.

**PO 2:** will develop teaching and research skills which might include advanced Laboratory techniques, numerical methods, computer interfacing, etc.

**PO 3:** will become effective teacher and/or researcher; and will be able to exhibit good scientific knowledge and temperament in diverse fields/environment.

**PO 4:** will develop the skill to plan, execute and report on experimental and/or theoretical physics problems with effective scientific approach in future endeavor.



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## Programme Specific Outcomes (PSOs):

While studying M.Sc., Physics Programme, the learner shall be able to

**PSO 1:** provide well defined study of theoretical and experimental physics to impart in depth understanding in fundamental aspects of all core areas of Physics.

**PSO 2:** acquire core as well as specialized/disciplinary knowledge in physics.

**PSO 3:** equip the student to pursue research and development in any areas of theoretical, experimental, and computational physics.

**PSO 4:** learn how to design and conduct experiments demonstrating their understanding of scientific methods/processes/phenomena; and understand analytical methods required to interpret and analyse results and draw conclusions.

**PSO 5:** bridge the gap between textbook knowledge and practical problems through well- designed laboratory sessions.

**PSO 6:** develop written and oral communications skills in communicating physics- related topics; and realize and develop an understanding of the impact of science particularly physics on the society.

**PSO 7:** apply conceptual understanding and critical thinking of the physics to general real- world situations; and learn to analyse physical problems and develop correct solutions using theoretical and experimental techniques/tools and skills.



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## M Sc Physics Course Outcome (CO )

On completion of the course students will be able to -


<b>Course Name: Paper 1 (Core 1) Mathematical Physics (MPH1T01)</b>
<ul style="list-style-type: none"><li>• Understand the methods of mathematical physics.</li></ul>
<ul style="list-style-type: none"><li>• Understand the basic elements of mathematical physics and demonstrate an ability to use vector analysis in the solution of physical problems.</li></ul>
<ul style="list-style-type: none"><li>• Analyse the various types of matrix operations for solving problems in various branches of physics.</li></ul>
<ul style="list-style-type: none"><li>• Apply mathematical skills to solve problems in quantum mechanics, electrodynamics, and other fields of theoretical physics. Impart knowledge about various mathematical tools employed to study physics problems.</li></ul>
<b>Course Name: (Elective -1B) Experimental Techniques in Physics (MPH1T03B)</b>
<ul style="list-style-type: none"><li>• Understand the different types of radiation and the concept of detection of radiation using various detectors.</li></ul>
<ul style="list-style-type: none"><li>• Learn the fundamental aspect of classification of sensors and their principle of operation.</li></ul>
<ul style="list-style-type: none"><li>• Describe the principle of working of TGA, DTA, DSC used for thermal analysis.</li></ul>
<ul style="list-style-type: none"><li>• Understand the experimental technique for magnetic characterization using VSM and dielectric properties using impedance analyser.</li></ul>
<ul style="list-style-type: none"><li>• Explain the spectroscopic techniques of FTIR, UV-VIS, DRS, XPS, ESR, NMR used for materials characterization.</li></ul>
<b>Course Name: IT2: Electronic Electronics (MPH1T02)</b>
<ul style="list-style-type: none"><li>• Learn the general characteristics of important semiconductor materials and PN junction for the construction of various types of transistors.</li></ul>
<ul style="list-style-type: none"><li>• Understand the use of semiconductor devices in linear and digital circuits.</li></ul>
<ul style="list-style-type: none"><li>• Analyse and design basic op-amp circuits, particularly various linear and non-linear circuits, active filters and signal generators, and data converters.</li></ul>
<ul style="list-style-type: none"><li>• Evaluate the characteristics of classification of memories and sequential memory and analyse the working of various A/D and D/A Converters.</li></ul>
<ul style="list-style-type: none"><li>• Understand the basic principle of amplitude, frequency and phase modulation in Communication Electronics.</li></ul>


  
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<b>Course name: Paper 4 (RM) Research Methodology (MPH1T04)</b>
<ul style="list-style-type: none"><li>• Understand the basic concepts regarding importance of research.</li></ul>
<ul style="list-style-type: none"><li>• Impart knowledge about research problems identification, research question and formulation of hypotheses.</li></ul>
<ul style="list-style-type: none"><li>• Understand the differences of qualitative vs. quantitative research methodology, field experiments vs. laboratory experiments.</li></ul>
<ul style="list-style-type: none"><li>• Execute the methods of data collection and strategies of data processing and analysis.</li></ul>
<ul style="list-style-type: none"><li>• Learn the ethical issues including copy right, royalty, intellectual property rights, patent law, and plagiarism in publishing research.</li></ul>
<b>Course Name: Paper 5 (Core 3) Complex Analysis and Numerical Methods (MPH2T05)</b>
<ul style="list-style-type: none"><li>• Represent complex numbers, analyse limit, continuity, and differentiation of functions of complex variables.</li></ul>
<ul style="list-style-type: none"><li>• Learn analytic functions, Cauchy Reimann conditions, how to find roots of nonlinear equations numerically and understand how iterations work.</li></ul>
<ul style="list-style-type: none"><li>• Interpolate with evenly or unevenly spaced data.</li></ul>
<ul style="list-style-type: none"><li>• Interpret and apply the basic methodology of numerical differentiation and numerical integration to a broad range of physics problems.</li></ul>
<ul style="list-style-type: none"><li>• Enrich with various computational methods like Euler, Newton-Raphson and Runge- Kutta etc. to solve the problems.</li></ul>
<b>Course Name: Paper 6 (Core 4) Statistical Physics (MPH2T06)</b>
<ul style="list-style-type: none"><li>• Understand various models in statistical mechanics and apply statistical tools to solve the problems in Physics.</li></ul>
<ul style="list-style-type: none"><li>• Identify the connection between statistical mechanics and thermodynamics.</li></ul>
<ul style="list-style-type: none"><li>• Understand Bose's concept of fifth state of matter and any possibility of sixth state of matter or not.</li></ul>
<ul style="list-style-type: none"><li>• Understand the significance and characteristics of phase transitions and critical phenomena.</li></ul>
<ul style="list-style-type: none"><li>• Learn Einstein's theoretical analysis and Langevin theory of Brownian motion.</li></ul>
<b>Course Name: Paper 7 (Elective - 2 A) Spectroscopy (MPH2T07A)</b>
<ul style="list-style-type: none"><li>• Explain Zeeman effect, Stark effect and hyperfine structure of spectral lines of hydrogen.</li></ul>


  
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<ul style="list-style-type: none"><li>Analyse the information from IR rotational vibration spectroscopy to determine the bond lengths of heteronuclear diatomic molecules and applications of FTIR spectroscopy.</li></ul>
<ul style="list-style-type: none"><li>Explain Raman effect and application of Raman spectroscopy.</li></ul>
<ul style="list-style-type: none"><li>Describe the Bloch Equation and principle of High-Resolution NMR Spectrometer.</li></ul>
<ul style="list-style-type: none"><li>Understand molecular vibrations with the interaction of matter and electromagnetic waves and explain the Mossbauer Effect.</li></ul>
<b>Course Name: Paper 8 (Core 5) Classical Mechanics (MPH3T08)</b>
<ul style="list-style-type: none"><li>Interpret the notion of degrees of freedom, identify them for a given mechanical system and D'Alembert's principle, Formulation of Lagrangian mechanics and problem solving.</li></ul>
<ul style="list-style-type: none"><li>Describe the Canonical transformations and generating functions and properties of Poisson's bracket.</li></ul>
<ul style="list-style-type: none"><li>Enable to solve Hamilton-Jacobi equations and use it for the solution of harmonic oscillator problem.</li></ul>
<ul style="list-style-type: none"><li>Demonstrate an understanding of intermediate classical mechanics topics such as coordinate transformations, oscillatory motion, gravitation and other central forces, and Lagrangian mechanics.</li></ul>
<ul style="list-style-type: none"><li>Evaluate the Central Force Problems and Relativistic Mechanics.</li></ul>
<b>Course Name: Paper 9 (Core 6) Quantum Mechanics – I (MPH3T09)</b>
<ul style="list-style-type: none"><li>Introduce postulates and working principles of quantum mechanics.</li></ul>
<ul style="list-style-type: none"><li>Familiarity with operator and matrix formalism of quantum mechanics.</li></ul>
<ul style="list-style-type: none"><li>Solve Schrodinger equation for simple systems.</li></ul>
<ul style="list-style-type: none"><li>Formulate the Heisenberg &amp; Dirac formulation of quantum mechanics.</li></ul>
<ul style="list-style-type: none"><li>Learn angular momentum operator, spin and be able to add angular momenta.</li></ul>
<b>Course Name: Paper 10 (Core 7) Electrodynamics (MPH3T10)</b>
<ul style="list-style-type: none"><li>Provide basic understanding of the concepts of electricity, magnetism and electromagnetic waves.</li></ul>
<ul style="list-style-type: none"><li>Describe EM waves in vacuum as well as matter to solve the difficult problems of electrodynamics.</li></ul>
<ul style="list-style-type: none"><li>Analyse and apply the laws of electromagnetism and Maxwell's equations.</li></ul>


  
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<ul style="list-style-type: none"><li>• Understand the basics of electrostatics and magnetostatics to solve the electric and magnetic fields problems for different configurations.</li></ul>
<ul style="list-style-type: none"><li>• Describe relativistic electrodynamics to understand the magnetism as a relativistic phenomenon.</li></ul>
<b>Course Name: Paper 11 (Elective - 3 A) Materials Science (MPH3T11A)</b>
<ul style="list-style-type: none"><li>• Review of principle of thermodynamics and understand the fundamental concepts of phase rule and phase diagram.</li></ul>
<ul style="list-style-type: none"><li>• Understand the kinetics of phase transformation, homogeneous and heterogeneous nucleation and growth of particles.</li></ul>
<ul style="list-style-type: none"><li>• Explain the concept of equilibrium and nonequilibrium processing of materials and their importance.</li></ul>
<ul style="list-style-type: none"><li>• Describe the various physical and chemical route of materials synthesis.</li></ul>
<ul style="list-style-type: none"><li>• Understand the metallic and non-metallic, ceramic and other materials processing and heat treatment methodologies.</li></ul>
<b>Course Name: Paper 11 (Elective - 3 B) Basic Nanoscience and Nanotechnology (MPH3T11B)</b>
<ul style="list-style-type: none"><li>• Explain the term Nanoscience and Nanotechnology and quantum confinement, zero, one and two-dimension nano structures.</li></ul>
<ul style="list-style-type: none"><li>• Identify the various techniques to investigate the different properties such as optical, structural and morphology of nanoparticles.</li></ul>
<ul style="list-style-type: none"><li>• Acquire knowledge of basic approaches like Bottom up and Top down to synthesize inorganic colloidal nanoparticles and their self-assembly in solution and surfaces.</li></ul>
<ul style="list-style-type: none"><li>• Apply their acquired knowledge in research level to synthesis by various techniques and characterize the nanomaterials by microscopic and spectroscopic techniques.</li></ul>
<ul style="list-style-type: none"><li>• Understand the techniques of preparation of special nanomaterials and the properties of nanomaterials for future applications.</li></ul>
<b>Course Name: Paper 12 (Core 8) Nuclear and Particle Physics (MPH4T12)</b>
<ul style="list-style-type: none"><li>• Explain the nuclear structure and properties, nuclear forces and two body problems.</li></ul>
<ul style="list-style-type: none"><li>• Discuss the stability and properties of different nuclei by various nuclear models.</li></ul>
<ul style="list-style-type: none"><li>• Describe radioactive <math>\alpha</math>, <math>\beta</math>, <math>\gamma</math> -decay of nuclei by their respective quantum mechanical theories, Conservation laws and various nuclear reactions.</li></ul>
<ul style="list-style-type: none"><li>• Know various nuclear radiation detectors and particle accelerators.</li></ul>
<ul style="list-style-type: none"><li>• Discuss the Elementary particles as the building blocks of matter and interacting fields. Describe Quark Hypothesis, Quark structures of Mesons and Baryons.</li></ul>


  
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<b>Course Name: Paper 13 (Core 9) Quantum Mechanics - II (MPH4T13)</b>
<ul style="list-style-type: none"><li>• Discuss the time independent perturbation theory and its application (Zeeman and Stark effect).</li></ul>
<ul style="list-style-type: none"><li>• Explain the time dependent perturbation theory and semi-classical theory of radiations and its applications.</li></ul>
<ul style="list-style-type: none"><li>• Describe the ground state of helium atom using WKB approximation.</li></ul>
<ul style="list-style-type: none"><li>• Analyse and apply the central field approximation for system of identical particles and system of non-interacting particles, Born-Oppenheimer approximation.</li></ul>
<ul style="list-style-type: none"><li>• Understand Klein- Gordon equation, Dirac's relativistic equation, Field quantization of the non-relativistic Schrodinger equation.</li></ul>
<b>Course Name: Paper 14 (Core 10) Solid State Physics (MPH4T14)</b>
<ul style="list-style-type: none"><li>• Understand the basics of free electron theory and band theory.</li></ul>
<ul style="list-style-type: none"><li>• Understand lattice vibrations of linear monoatomic and diatomic chains, dispersion relations, acoustic and optical phonons.</li></ul>
<ul style="list-style-type: none"><li>• Describe Dulong and Petit's law, Einstein and Debye models, <math>T^3</math> law, etc theories of lattice specific heat.</li></ul>
<ul style="list-style-type: none"><li>• Explain electrical conductivity, Hall effect and magnetic properties of solids.</li></ul>
<ul style="list-style-type: none"><li>• Describe type I and II superconductors, elements of BCS theory, and elementary of high temperature superconductor and applications.</li></ul>
<b>Course Name: Paper 15 (Elective - 4 B) Applied Nanoscience and Nanotechnology (MPH4T15B)</b>
<ul style="list-style-type: none"><li>• Understand accurate description of optical properties of material and basics of non-linear optics at nanoscale.</li></ul>
<ul style="list-style-type: none"><li>• Understand the basic magnetic parameters, the magneto-transport in nanoscale systems and gain the basic mechanisms for tuning the magnetic properties.</li></ul>
<ul style="list-style-type: none"><li>• Implicate the basic knowledge of Nano-CMOS to design the circuit and physical design for the single electron transistor.</li></ul>
<ul style="list-style-type: none"><li>• Know the meaning of composite materials and preparation techniques.</li></ul>
<ul style="list-style-type: none"><li>• Analyse the essential data on nanoscale materials dispersed in, or chemically bonded with metal/ceramic/polymer matrix.</li></ul>

  
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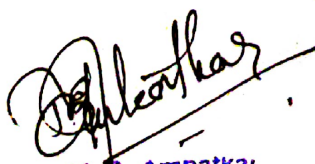
  
Dr.N. D. Shambharkar

## Programme Specific Outcomes (PSOs) of Undergraduate Programme for Zoology:

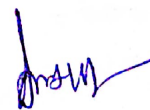
### B.Sc. SEM 1

Students will be able to describe, identified, classified and differentiate the animals of different taxonomic ranks. They could differentiate morphological, anatomical, and histological features of different organs and organ-systems of different animal groups. They could understand and analyze the different evolutionary trends among different animal groups.

- Students could describe different component of environment and ecosystems and could understand and explain the significance of consequences of deterioration of ecosystem and biodiversity. They could estimate and evaluate the different physico-chemical parameters of waters like DO, dissolved CO<sub>2</sub>, pH, hardness etc. to deduce its status.
- Students could be able to describe, sketch and differentiate different cell organelles of animal cell and could examine normal and abnormal cellular physiology. Students could demonstrate cell organelles and acellular components in tissues as well as be able to estimate protein, lipid and carbohydrates in tissues.
- They could be able to describe, interpret inheritance pattern in animals. They could differentiate varied mechanisms controlling inheritance in animals.
- They could describe, analyze the different aspect of Applied Zoology. They could understand the practices of apiculture, sericulture, fisheries etc. and acquainted themselves with economic benefit of these practices as well as explain it to others.
- Students understand, analyze, interpret the innate and learned behaviour of different animal groups.
- Students will be able to perform different experiments which could help them to prove their hypotheses. They could be able to analyze the data with help of different statistical tools. Students will develop capabilities which help them to design and investigate the scientific research work. They could be able to draft a scientific write up and could argue, defend his findings based on standard practices of research in Life Science.



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**B.Sc. Sem. I. DSC: BZO1T01 Life and Diversity of Animals - Nonchordates  
(Protozoa to Annelida)**

**Course Outcomes (COs):**

- Students will be able to understand about early phyla viz., Protozoa, Porifera, Coelenterata, Platyhelminthes, Aschelminthes and Annelida.
- Students could be able to identify, classify and analyze different animals belonging to phylum Protozoa to Annelida on the basis of levels or grades of organization, symmetry, coelom etc. upto class.
- Students will learn, analyze, describe a representative animal belonging to phylum Protozoa to Annelida
- Students could elucidate and explain uniqueness of phylum Protozoa to Annelida and they could be able to demonstrate peculiar tissues, organs of animals belonging to these phyla.

**Environmental Biology**

**Course Outcomes (COs):** • Students will be able to describe and explain atmosphere, hydrosphere, lithosphere and energy resources.

- Students could describe, elucidate different types and components of ecosystems. They could identify, describe and explain different biotic components and could explain and analyze their role in ecosystem.
- Students will describe, explain and be aware about the significance and need of biodiversity conservation. They also understand, describe and explain legislations passed to conserve the biodiversity and acquainted themselves to nearby National Parks and Wildlife Sanctuaries.
- They will elucidate and differentiate causes of different types and hazards of pollution.
- Students will estimate the different physico-chemical parameters of water to analyze.

**B.Sc. Sem. I VSC course: Vermicomposting**

Course outcomes: After completion of this course, student will –

- Get acquainted with hand on training of vermicomposting.
- Get acquainted with hand on training of vermiwash.
- Able to understand and learn about the vermicompost marketing.
- Able to do internship in any commercial vermicompost or vermiwash unit.

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## **B.Sc. SEMESTER – I BVE1T01: ENVIRONMENTAL SCIENCE**

**COURSE OUTCOMES:** At the end of the course, students shall be able to:

- Explain the basics of Environmental Science and Atmospheric Science along-with the components of Environment
- Explicate the importance of Environmental Education.
- Elucidate the fundamentals of atmospheric science including formation, depletion and effects of ozone layer and acid rain on environment.
- Describe the various physical and chemical characteristics and properties of Water and Soil
- Understand the Ecology and its allied branches
- Comprehend about Population and Community Ecology
- Study the changes in Population by understanding the concept of Population ecology.

### **Indian Knowledge System (IKS) SEM1: VEDIC MATHEMATICS (BIK1T0 1)**

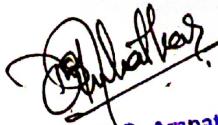
Course Outcomes: This course will enable the students to

1. Improve speed and accuracy in numerical calculations
2. Acquire IQ skills and high-end technical knowledge
3. gain test taking skills & creativity of calculations

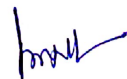
### **B.Sc. Sem. I (Zoology) - SEC Course: Bee Keeping (BVS1P02) Credit: 2**

**Course outcomes:** After completion of course, students will

- Able to identify queen, drones and workers of honey bee.
- Able to handle artificial bee hive.
- Understand the economic importance of honey bee.
- Identify and recognized enemies of honey bee.
- Able to do internship in commercial bee keeping unit.

  
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**General Elective (GE)/ Open Elective (OE) for FYUGP GE/OE for B.Sc. I Human anatomy and Physiology (BGO1T01) Credit: 2**

**Course outcomes:** After completion of the course, students will able to-

- Learn, describe and explain structure and histology of human digestive system.
- Learn, describe and explain structure and physiology of excretion and muscles.
- Learn, describe and explain structure and physiology of respiration and circulation.
- Learn, describe and explain structure and physiology of nervous system.

**GE/OE for B.Sc. I Indian Birds (BGO1T01) Credit: 2 Course outcomes:** After completion of the course, students will able to-

- Understand, describe and explain importance of birds.
- Learn how to record and study the birds.
- Identify and recognized certain Indian birds.

**GE/OE for B.Sc. I Reproductive Biology (BGO1T02) Credit: 2 Course outcomes:**


After completion of the course, students will able to-

- Understand, describe and explain the male reproductive system.
- Understand, describe and explain the female reproductive system.
- Understand, describe and explain menstrual cycle.
- Understand, describe and explain spermatogenesis, oogenesis and fertilization.

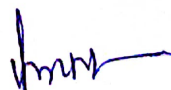
**GE/OE for B.Sc. I Attractive Insects BGO1T02 Credit: 2 Course outcomes:**

After completion of the course, students will able to-

- Understand, describe and explain the general characters of insects.
- Understand, describe and explain suborders of Odonata.
- Identify, recognized, describe and explain certain damselflies.
- Understand, describe and explain ecological significance of dragonflies.
- Identify, recognized, describe and explain certain dragonflies.
- Identify, recognized, describe and explain certain butterflies.

  
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- Identify, recognized, describe and explain certain beetles.

## B.Sc. Sem. II

### Life and Diversity of Animals – Non-Chordates: Life and Diversity of Animals (Arthropoda to Hemichordata)


#### Course Outcomes (COs):

1. Students will learn, identify, explain and analyze the taxonomic position of animals belonging to phylum Arthropoda to Hemichordata
2. They could describe, explain and analyze phylogeny to understand the course of evolution in animals from phylum Arthropoda to Hemichordata
3. They will able to describe, explain and differentiate various morphological, anatomical structures and functions of animals of phyla from Arthropoda to Hemichordata.
4. Students will able to understand, describe, explain and differentiate the larval forms and development of the invertebrates from phylum Arthropoda to Hemichordata
5. Students will able to describe, explain and analyze the ecological and economic importance of invertebrates.
6. Students will understand, able to describe, explain and analyze the ecological role of invertebrates in the biodiversity.

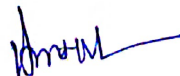
### DSC: BZO1T04 Cell Biology

#### Course Outcomes (COs):

- Students will able to describe, sketch, analyze, and explain the structure and function of the cell organelles.
- Students could describe, sketch, analyze, and explain the structure and function of nucleus and chromatin structure, its location.
- Students will able to describe, sketch, analyze, and explain the basic principle of life. They could also demonstrate and explain how a cell divides leading to the growth of an organism.
- Students could describe, sketch, analyze, and explain how a cell communicates with its neighbouring cells.
- Students will able to describe, sketch, analyze, and explain the abnormality in structural and functional aspects of cells.

  
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- Students will be able to handle and use microscopes and oculometer to elucidate and measure and explain the minor details of tissues.
- Students will be able to demonstrate osmosis. They could also demonstrate and explain mitochondria, salivary gland chromosome and Barr body in cells.

### **B.Sc. Sem. II VSC course: Culture of Indian Major Carps BVS1P03**

**Course outcomes:** After completion of this course, student will–

- Able to sketch, describe, Identify and classify the Indian major carps.
- Design the layout of the various types of ponds for the rearing of various stages of IMC.
- Get acquainted with hands on training of various breeding techniques.
- Get acquainted with hands on training of rearing of fry to fingerlings.
- Able to understand the different types of crafts and gears used in fish harvesting (Catching).
- Get hands on training of handling of various gear, crafts used in fish harvesting (Catching).
- Able to do internship and work in any commercial breeding centre.

### **Indian Knowledge System (IKS) SEM2: INDIAN ASTRONOMY**

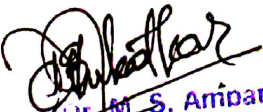
**Course Outcomes:** This course will enable the students to understand that

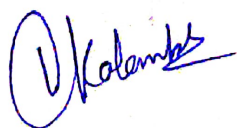
1. It is possible to create a map of the intellectual growth of a culture using astronomy as a probe.
2. The growth of Indian astronomy occurs in distinct stages analogous to phase transitions of the evolution of cultures
3. Indian Astronomy therefore provides an excellent window to the past dramatic transitions.

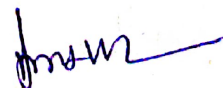
### **B.Sc. Sem. II SEC Course Name: Lac culture (BVS2P04) Credit: 2**

**Course outcomes:** After completion of the course, students will be able to–

- Identify, recognized, describe and explain male and female Lac insect and different stages of its life cycle.
- Identify, recognized, describe and explain various host plants of Lac insect.
- Handle different tools and materials involved in Lac culture.

  
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- Separate Lac from sticks; dry and wash the crude Lac.
- Process the crude lac to Shellac.
- To do internship and work in commercial Lac cultivation unit.

**GE/OE for B.Sc. II Industrial Entomology BGO2T03 Credit: 2 Course outcomes:**


After completion of the course, students will able to-

- Understand, describe and explain the Mulberry sericulture
- Understand, describe and explain Tasar sericulture.
- Understand, describe and explain Eri sericulture
- Understand, describe and explain lac culture.
- Understand, describe and explain agricultural and medical pests.
- Understand, describe and explain apiculture.

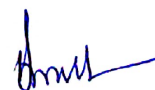
**GE/OE for B.Sc. II Fish Farming BGO2T04 Credit: 2 Course outcomes:**

After completion of the course, students will able to-

- Understand, describe and explain suitable aquaculture fish on specific criteria.
- Understand, describe and explain construction and management of fish pond.
- Understand, describe and explain breeding techniques.
- Comprehend the status of freshwater resources.
- Evaluate economically important freshwater biological resources for their commercial utilization.
- Adjudge different types of rearing process and steps along with procedure involve in preparation and management of nursery and rearing pond of fish culture.
- Understand, describe and explain the marketing of fish.
- Understand, describe and explain various diseases in fishes.

  
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## **Programme Specific Outcomes (PSOs) of Postgraduate Programme for Zoology:**

### **Program Outcomes (POs)**

PO 1- M.Sc. program produces post-graduates who have great readiness in playing active role either in government or non-government organization by designing processes/strategies that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO 2-Students developed analytical and creative thinking from the conducive research environments and interacting with scholars/ faculties that will help in identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.

PO 3- To use research-based knowledge and research methods including review research literature, accession of primary literature, identify relevant works for a particular topic, design of experiments, analysis, evaluation and interpretation of scientific data, and synthesis of the information to provide valid conclusions in real situations.

PO 4- To empower students to create, select, and apply appropriate techniques, resources, and ICT tools for understanding of the science.

PO 5- Apply ethical principles and commit to professional ethics and responsibilities and norms of the work/research practice. Also, to promote learning and research aptitude and attitude to serve the society.

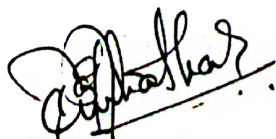
PO 6- Students are encouraged to develop an analytical mind as they ask questions, take part in topic-based quiz and debates, and are made aware of recent study and research on relevant topics.

PO 7- To enhance the ability of writing research project activities, problem-solving, to design and carry research project.

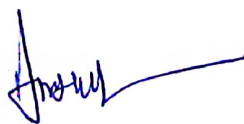
PO 8- M.Sc. program produces post-graduates who have great confidence which allows them to have a positive and realistic perception of themselves and their abilities in the scientific and social environment.

PO 9- Students acquiring skill-based education will make them self-employable and can generate employment.

PO 10- Students are encouraged to develop analytical and critical thinking minds which will help to develop scientific temperament in the community.



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### Program Specific Outcomes (PSOs)

PSO 1-Students will acquire techniques and skills to implement the knowledge in the design and execution of research in different branches of Zoology. This will help in careers related to teaching, research in Zoology; as well as in having innovative ideas and necessary training to initiate unique start-ups and entrepreneurship in the realm of life sciences.

PSO 2- To learn and apply the ethics in animal handling, during laboratory practices and experimentation.

PSO 3- In addition to the curriculum, the students will also gain skill-based learning, practical knowledge to facilitate experiments in the subject Zoology.

PSO 4- Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings. Demonstrate knowledge and understanding of Zoology and management principles and apply these to one's own work, as a member and leader in a team.

PSO 5- To acquired knowledge across a broad range of Zoology including recent trends which will help to solve the scientific problem logically in the context of biological process. Thus, leading to self-directed learning and evaluation.

PSO 6- Perform laboratory procedures as per standard protocols in various areas of Zoology including Animal Diversity, Cell Biology, Genetics, Molecular Biology, Physiology, Developmental Biology, Comparative Endocrinology, Immunology, Mammalian Reproductive Physiology, Fish and Fisheries and Entomology.

PSO 7- Understand the applications of zoological science in Apiculture, Sericulture, Lac culture, Fish and Fisheries, Mammalian Reproductive Physiology and Animal Physiology.

PSO 8- Develop knowledge and understanding of living organisms at several levels of Zoological and Biological organization from molecular level, through cells and ultimately the whole organisms and its impact on ecosystems.


PSO 9- To develop interest and elective modules by selecting specialization in various aspects and understanding the methods of zoological research.

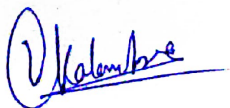
PSO 10- The M. Sc. Program will lead the students to impart a scientific temperament which will help them to add new scientific knowledge/information in the field of Zoology research.

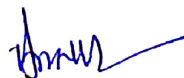
### **M.Sc. Zoology Semester-I**

#### **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

  
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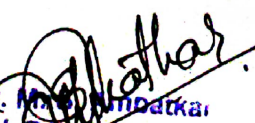
invertebrate phyla. Assess and evaluate a taxonomic status of primitive members of arthropods and molluscs. Describe and analyze the sea star's body plan, elucidate the origins and evolutionary significance of echinoderm larval forms, comprehend the mechanism of movements based on fluid filled cavities in invertebrates and identify and classify minor invertebrate specimen. Perform the whole mount preparations of given invertebrate material.

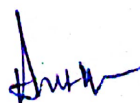
### **MZO1T02- Cell Biology and Genetics Course Outcomes (COs)**

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 extra chromosomal 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.

### **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 ultrastructure 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.

  
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### **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 related to biology and metagenomics research. 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 apply central tendency, dispersion, skewness, and kurtosis measures in the research work. They also learn measures of relationship tests of hypothesis testing of significance and know about statistical softwares. Students will also be able to learn and acquainted with IPR and Patent registration.

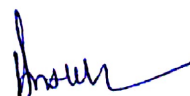
### **M.Sc. Zoology Semester II**

#### **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 be able to identify, demonstrate, explain and compare the histological structure and functions of internal organs of vertebrates.

  
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### **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.


### **Brain and Muscle Physiology Course Outcomes (COs)**

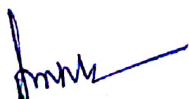
Students will be able to differentiate and classify the various morphological differentiation and analysis of the mammalian brain, brain stem and cerebellum. Elaborate on the physiology and mechanism of learning, memory and sleep. Classify and illustrate the ultrastructure of neurons and synapses, functional 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.

## **M.Sc. Zoology Semester-III**

### **MZO3T09 - 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,

  
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Vidya Vikas A





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 immunotechniques such as RIA and ELISA.

### **MZO3T10 - 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, bird's diversity, techniques of bird counting, bird breeding population and breeding group maps, bird hotspots, bird sanctuaries and role of birds in ecosystem.

### **MZO3T11- Comparative Endocrinology Course Outcomes (COs)**

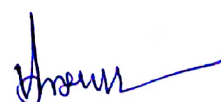
Students will be able to identify, classify, differentiate, describe and explain different types of cells and organs of neuroendocrine system of invertebrates. Illustrate the role of hormones in the regulation of various physiological processes in invertebrates such as metamorphosis, reproduction and colour change mechanisms. Describe, explain, and differentiate the hypothalamo-hypophysial system, structure, hormones, functions and feedback mechanisms of pituitary, thyroid, parathyroid, pancreas, gastro-intestinal tract and adrenal gland. Comprehend the role of hormones in pharmaceuticals, including contraception, sex hormones, cancer, immune system and immune regulating hormones (IRH). Raise awareness about the significance of pharmaceutical applications. Students could demonstrate compare the preparation of histological slides of endocrine glands.

### **MZO3RP01, Research Project (RP) Minor Work Course Outcomes (COs)**

After completion of minor research project, the student will able to search research articles online and offline. Draft scientific write up and submit in the form of report. They will 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.



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## M.Sc. Zoology Semester-IV

### MZO4T13 –Biotechniques, Biostatistics, Toxicology and Bioinformatics Course Outcomes (COs)

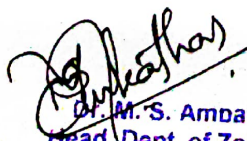
Students will be able to elaborate, discuss and describe sterilization, animal cells, tissue culture, primary culture, cell lines, cell quantification, and growth kinetics and cryopreservation technique. Describe, demonstrate and explain the principle and working mechanism of sedimentation, centrifugation, 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.

### MZO4T14- Radiation and Chronobiology Course Outcomes (COs)

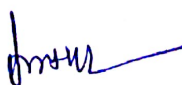
The students will be able to define and explain the scope and significance of radiobiological scope in human welfare. Identify ionizing radiation, linear energy transfer, radiation dose and units and conceptualize the radiation types. Describe, explain and analyze application of radiology and gainful 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.

### MZO4T15 -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<sub>2</sub> and CO<sub>2</sub>) 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, andropause 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 be able to demonstrate the effects of various factors on the dissolved oxygen of water.

## **MZO4RP02, Research Project (RP) Major Work Course Outcomes (COs)**

After completion of major research project student will be able to select proper problem (Title). Plan and develop experimental design for projects. Select and learn to use the proper methods and materials for his/her research work. Analyse and interpret the results. Draft the scientific writeup and submit in the form of thesis. Learn and write bibliography by various styles.

  
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## **POST GRADUATE DEPARTMENT OF COMPUTER SCIENCE**

### **PROGRAMME OUTCOMES**

#### **SEMESTER-I**

##### **1. PO1: Analytical and Critical Thinking**

- Develop the ability to analyze, understand, and solve complex computational problems using theoretical and applied methods.
- Employ critical thinking to evaluate different approaches to problem-solving in computer science.

##### **2. PO2: Advanced Knowledge of Core Areas**

- Acquire advanced knowledge in key areas of computer science, including algorithms, data structures, database management, programming languages, operating systems, and software engineering.
- Understand contemporary issues and emerging technologies in computer science, such as AI, machine learning, cybersecurity, and data science.

##### **3. PO3: Problem-Solving Skills**

- Develop problem-solving abilities to design, implement, and test computer systems, software, and applications.
- Apply mathematical and logical techniques to solve complex computational problems efficiently.

#### **4. PO4: Research and Development**

- Cultivate research skills to undertake independent investigations in computer science, addressing real-world problems through novel solutions.
- Develop the ability to design and conduct experiments and analyze results with precision.

#### **5. PO5: Communication Skills**

- Develop effective written and verbal communication skills to present technical concepts clearly and concisely.
- Ability to communicate and collaborate effectively with peers, faculty, and industry professionals.

#### **6. PO6: Professionalism and Ethics**

- Understand and adhere to professional, ethical, and social responsibilities in computing, including data privacy, security, and intellectual property rights.
- Demonstrate the ability to work in an ethical and socially responsible manner within multidisciplinary teams.

#### **7. PO7: Software Development Skills**

- Develop advanced software development skills, including the use of modern programming languages, frameworks, and development tools.
- Learn how to manage software projects, design user-centric applications, and apply best practices in software engineering.

#### **8. PO8: Teamwork and Collaboration**

- Demonstrate the ability to work effectively as part of a team in the development of computer systems and software.
- Cultivate leadership skills and manage projects with a collaborative approach.

## **9. PO9: Lifelong Learning**

- Develop the capacity for lifelong learning to stay current with advancements in the field of computer science.
- Engage in continuous professional development through courses, workshops, and self-learning.

## **10. PO10: Global and Societal Impact**

- Appreciate the global impact of computer science on society and contribute to the betterment of society through technology and innovation.
- Understand how computing innovations affect economic, environmental, and social domains.

## **SEMESTER-II**

### **1. PSO1: Expertise in Advanced Algorithms and Data Structures**

- Develop advanced proficiency in algorithms and data structures, including graph algorithms, dynamic programming, and advanced tree structures.

### **2. PSO2: Competence in Object-Oriented Programming (OOP)**

- Apply object-oriented principles to design, implement, and optimize complex software systems.

### **3. PSO3: Proficiency in Database Design and Management**

- Gain practical experience in Database Management Systems (DBMS), including advanced SQL techniques, normalization, and database tuning.

### **4. PSO4: Network Security and Cryptography**

- Understand and apply principles of network security, including cryptographic algorithms, secure protocols, and ethical hacking techniques.



## **5. PSO5: Machine Learning and Data Science Applications**

- Apply machine learning algorithms and data science techniques to solve real-world problems, using programming languages and libraries such as Python and TensorFlow.

## **6. PSO6: Software Engineering and Development Tools**

- Master software engineering techniques, including requirements gathering, design, testing, and deployment, using industry-standard tools like Git, Jira, and Docker.

## **SEMESTER-III**

### **1. PSO1: Expertise in Artificial Intelligence and Machine Learning**

- Gain hands-on experience in implementing AI and machine learning algorithms for real-world problems. Learn about reinforcement learning, natural language processing (NLP), and deep learning.

### **2. PSO2: Proficiency in Advanced Data Management and Analytics**

- Learn advanced techniques for managing large datasets, including data warehousing, ETL (Extract, Transform, Load) processes, and big data analytics. Develop expertise in SQL, NoSQL, and data mining techniques.

### **3. PSO3: Advanced Cloud Computing and Distributed Systems**

- Develop proficiency in cloud platforms and technologies, including cloud storage, serverless computing, and microservices architecture. Understand distributed systems and their design for scalability and fault tolerance.

### **4. PSO4: Research and Innovation in Emerging Technologies**

- Engage in research in fields such as blockchain, IoT (Internet of Things), cybersecurity, and AI ethics. Contribute to innovative solutions that push the boundaries of existing knowledge.

## **5. PSO5: Professional Development and Industry Readiness**

- Learn to manage and lead complex projects, gain experience working in teams, and develop communication skills to present **technical** findings in a clear and concise manner. This prepares students for leadership roles in the industry.

## **SEMESTER-IV**

### **1. PSO1: Expertise in Advanced AI and Machine Learning Techniques**

- Students will master advanced machine learning algorithms, deep learning techniques, and reinforcement learning to design and implement intelligent systems for real-world applications.

### **2. PSO2: Advanced Data Science and Big Data Analytics**

- Students will become proficient in handling large-scale datasets, performing data mining, and applying predictive analytics using modern tools like Hadoop, Spark, and Python for real-world problem-solving.

### **3. PSO3: Blockchain Technology and Distributed Systems**

- Students will understand blockchain architecture, cryptography, and distributed ledger systems, applying them to develop secure applications such as smart contracts, cryptocurrency systems, and decentralized applications (dApps).

### **4. PSO4: Cybersecurity Solutions and Ethical Hacking**

- Students will acquire advanced knowledge of network security, cryptography, and ethical hacking techniques to protect systems from vulnerabilities and threats.

## **5. PSO5: Cloud Computing, IoT, and Distributed Systems**

- Students will apply concepts of cloud computing, microservices, and IoT to design scalable systems and applications, utilizing platforms like AWS, Google Cloud, and Azure.

## **6. PSO6: Software Engineering and Agile Practices**

- Students will apply Agile methodologies, DevOps, and continuous integration/continuous deployment (CI/CD) practices to manage and develop complex software systems.



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**POST GRADUATE DEPARTMENT OF COMPUTER SCIENCE**  
**COURSES OUTCOMES**

**SEMESTER-I**

**MCS1T01**

**Paper I : ARTIFICIAL INTELLIGENCE**

**COURSE OUTCOMES:**

- Evaluate Artificial Intelligent (AI) methods and describe and their foundations.
- Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation and learning.
- Demonstrate knowledge of reasoning and knowledge representation for solving real world problems.
- Analyze and illustrate how search algorithms and planning play vital role in problem solving.

**SEMESTER-I**

**MCS1T02**

**Paper II : COMPILER CONSTRUCTION**

**COURSE OUTCOMES:**

- Demonstrate the knowledge of Lexical Analysis
- Derive an appropriate model of code generation.

## **SEMESTER-I**

### **Elective 1 : MCS1T03**

#### **Paper III : COMPUTER ARCHITECTURE AND ORGANIZATION**

##### **COURSE OUTCOMES:**

- Provide fundamentals on machine instructions and addressing modes.
- Comprehend the various algorithms for computer arithmetic.
- Analyse the performance of various memory modules in memory hierarchy.
- Compare and contrast the features of I/O devices and parallel processors. Outline the evaluation of memory organization.
- Analyse the performance of Arithmetic logic unit, memory and CPU.

## **SEMESTER-I**

### **Elective 1 : MCS1T03**

#### **Paper III : DISCRETE MATHEMATICAL STRUCTURE**

##### **COURSE OUTCOMES:**

- Observe the various types of sets, functions and relations.
- Understand the concepts of group theory.
- Understand the concepts of combinatorics.
- Understand the concepts of graph theory, and its applications.
- Learning logic and Boolean algebra. Using these concepts to solve the problems

## **SEMESTER-I**

### **MCS1T04**

#### **Paper IV : RESEARCH METHODOLOGY**

##### **COURSE OUTCOMES:**

- The basic concept of research and its methodologies, Identify appropriate research topics. Select and define appropriate research problem and parameters.
- Prepare a project (to undertake a project)

- Organize and conduct research in a more appropriate manner, writing research report and thesis.

## **SEMESTER-II**

### **MCS2T05**

#### **Paper I : CLOUD COMPUTING**

##### **COURSE OUTCOMES:**

- Analyze the trade-offs between deploying applications in the cloud and over the local Infrastructure.
- Compare the advantages and disadvantages of various cloud computing platforms.
- Program data intensive parallel applications in the cloud.
- Analyze the performance, scalability, and availability, of the underlying cloud technologies and software.
- Identify security and privacy issues in cloud computing.

## **SEMESTER-II**

### **MCS2T06**

#### **Paper II : MACHINE LEARNING**

##### **COURSE OUTCOMES:**

- Understand the concepts of various machine learning strategies.
- Handle computational data and learn ANN learning models.
- Solve real world applications by selecting suitable learning model.
- Boost the performance of the model by combining results from different approaches.

## **SEMESTER-II**

### **Elective 2 : MCS2T07**

#### **Paper III : R PROGRAMMING**

##### **COURSE OUTCOMES:**

- Develop an R script and execute it.
- Install, load and deploy the required packages, and build new packages for sharing and reusability 3. Extract data from different sources using API and use it for data analysis.
- Visualize and summarize the data
- Design application with database connectivity, for data analysis

## **SEMESTER-II**

### **Elective 2 : MCS2T07**

#### **Paper III : NEURAL NETWORK**

##### **COURSE OUTCOMES:**

- Ability to understand the concepts of Neural Networks.
- Ability to select the learning Networks in modeling real world systems

## **SEMESTER-III**

### **MCS3T08**

#### **Paper I : ADVANCED SOFTWARE ENGINEERING**

##### **COURSE OUTCOMES:**

On successful completion of this subject students should be able to:

- To demonstrate an understanding of advanced knowledge of the practice of software Engineering, design, validation, test and deployment.
- Use modern engineering principles, processes, and technologies to solve difficult engineering issues and tasks.
- Demonstrate leadership and the ability to participate in team work in an environment with different disciplines of engineering, science and business.
- Identify the proper ethical, financial, and environmental effects of their work.

### **SEMESTER-III**

#### **MCS3T09**

#### **Paper II : NETWORK SECURITY**

##### **COURSE OUTCOMES:**

On successful completion of this subject students should be able to:

- Classify the symmetric encryption techniques
- Illustrate various Public key cryptographic techniques
- Evaluate the authentication and hash algorithms.
- Basic concepts of system level security

### **SEMESTER-III**

#### **MCS3T010**

#### **Paper III : DIGITAL IMAGE PROCESSING**

##### **COURSE OUTCOMES:**

On successful completion of this subject students should be able to :

- Know and understand the basics and fundamentals of digital image processing, digitization, sampling, quantization, and 2D-transforms.
- Operate on images using the techniques of smoothing, sharpening and enhancement. Understand the restoration concepts and filtering techniques.

### **SEMESTER-III**

#### **Elective 3 : MCS3T11**

#### **Paper IV : COMPUTER GRAPHICS**

##### **COURSE OUTCOMES:**

On successful completion of this subject students should be able to :

- Students can animate scenes entertainment.
- Will be able to work in computer aided design for content presentation.
- Better analogy data with pictorial representation.



## **SEMESTER-III**

### **Elective 3 : MCS3T11**

#### **Paper IV : INTERNET OF THINGS (IOT)**

##### **COURSE OUTCOMES:**

On successful completion of this subject students should be able to :

- Able to understand the application areas of IOT
- Able to realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks
- Able to understand building blocks of Internet of Things and characteristics.

## **SEMESTER-IV**

### **MCS4T12**

#### **Paper I : BIG DATA ANALYTICS**

##### **COURSE OUTCOMES:**

On successful completion of this subject students should be able to :

- Classify and categorize different types of Data Analytics
- Frame Business Architecture
- Understand the use of Information and Communication Technology
- Differentiate Between Traditional data Analysis and Big Data Analytics
- Evaluate different Enterprise Technologies and Big Data Business Intelligence

## **SEMESTER-IV**

### **MCS4T13**

#### **Paper II : COMPUTER VISION**

##### **COURSE OUTCOMES:**

On successful completion of this subject students should be able to :

- Implement fundamental image processing techniques required for computer vision
- Develop computer vision applications.

## **SEMESTER-IV**

### **MCS4T14**

#### **Paper III : DEEP LEARNING**

##### **COURSE OUTCOMES:**

On successful completion of this subject students should be able to :

- Solve various deep learning problems
- Apply autoencoders for unsupervised learning problems
- Implement Convolutional Neural Networks to image classification problem
- Apply recurrent neural network to sequence Learning Problem.

## **SEMESTER-IV**

### **Elective 4 : MCS4T15**

#### **Paper IV : DESIGN AND ANALYSIS OF ALGORITHM**

##### **COURSE OUTCOMES:**

On successful completion of this subject students should be able to :

- Produce thorough proofs of an algorithm's soundness.
- Demonstrate about important algorithms and data structures.
- Use key analytical techniques and concepts for algorithmic design.
- Combine effective algorithms in typical engineering design scenarios.

## **SEMESTER-IV**

### **Elective 4 : MCS4T15**

#### **Paper IV : CYBER FORENSICS**

##### **COURSE OUTCOMES:**

On successful completion of this subject students should be able to :

- To learn investigation tools and techniques, analysis of data to identify evidence.
- To analyze the technical Aspects & Legal Aspects related to cyber crime.