

## **PO B.Sc (Biological Science)**

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- PO 2 Students will be able to correctly use biological instrumentation and proper laboratory techniques.
- PO3 Students will be able to recognize the relationship between structure and functions at all levels that is molecular, cellular and organism.
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- PO6 Students will be able to critically evaluate primary literature, in oral and written form and subsequently develop oral and written communication skills.
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## PSO B.Sc. BOTANY (CBZ/ CBBc/ CBBt)

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Students pursuing undergraduate degree programme with Botany as one of the subjects will be competent in the following areas:

PSO 1 Students will have core discipline knowledge.

PSO 2 Students will be able to identify the major groups plants and be able to classify them within a phylogenetic framework. Students will be able to compare and contrast the characteristics of plants, algae, fungi, bryophytes, pteridophytes and the Gymnosperms and differentiate them from each other and from other forms of life.

PSO 3 Students will develop clarity regarding the basic concepts of Botany and will have domain knowledge which will include the following areas:

- ❖ Basics of plant pathology with specific plant diseases
- ❖ Anatomy
- ❖ Morphology
- ❖ Systematics
- ❖ Genetics
- ❖ Physiology & Biochemistry
- ❖ Ecology

PSO 4 Students will develop the ability to discuss and analyze problems using oral and written communication skills.

PSO 5 Students will gain knowledge in problem solving and will develop research ability. This will be facilitated by making observations, collecting data in laboratory and in the field. They will be trained to analyze these results, derive conclusions and report their findings.

## CO B.Sc. BOTANY

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- CO1. Understand general characters, classification, life cycle and economic importance of Prokaryotes (*Mycoplasma*, Bacteria, Virus) and Algae (*Oedogonium*, *Chara*, *Vaucheria* and *Ectocarpus*)
- CO2. Understand general characters, classification, life cycle and economic importance of Fungi (*Albugo*, *Mucor*, *Puccinia*, *Cercospora*), Lichens, Bryophytes (*Riccia*, *Anthoceros*, *Funaria*). Study symptoms, disease control and host pathogen relation of common plant diseases (Citrus Canker. Leaf Curl of Papaya and red rot of Sugarcane) .
- CO3. Understand general characters, classification, life cycle and economic importance of Pteridophytes (*Rhynia*, *Selaginella*, *Equisetum*), Gymnosperms (*Cycas*, *Pinus*, *Cycadeoidea*). To study the concepts of apogamy, apospory, stelar system, heterospory and seed habit in Pteridophytes.
- CO4. Study of Paleobotany with respect to Geological Time Scale, Fossilization theories and types of fossils with special reference to *Glossopteris*. Comprehension of Angiospermic morphology (Root, Stem, Leaf, Inflorescence, Flower and floral parts) and fruits.
- CO5. To study origin of angiosperms, their phylogeny and fossil history with reverence to fossil angiosperm (*Sahnianthus*). Study of Angiospermic taxonomy and nomenclature. Description of angiospermic classifications, systems, modern trends and study of selected families of dicots (*Malvaceae*, *Euphorbiaceae* etc) and monocots (*Poaceae*).
- CO6. Study of structure, ultra structure and functions of Cell and cell organelles. Describe chromosome organization, sex chromosome cell division on plants and plant breeding. Basics of biostatistics and evolution.
- CO7. Comprehension of basic body plan, modular growth, meristematic and permanent tissue system in plants and theories on RAM & SAM. Study of primary, secondary and anomalous growth in root stem and leaf. Description of pollination mechanisms, micro, megasporogenesis and embryogenesis with reference to monocot and dicot embryo development.
- CO8. Study of Mendelian and Non Mendelian Inheritance ratios, linkage, crossing over, structural and numerical aberrations in chromosomes. Structure and replication of DNA, concept of gene, regulation of gene expression, transcription, translations and mutations.
- CO9. Characteristics and chemical properties of some biomolecules, basic enzymology, plant water relations and mineral nutrition. To study basic concepts

of physiological processes like photosynthesis, respiration and nitrogen metabolism.

- CO10. Study of Ecology, branches and significance, climatic, edaphic and physiographic factors. Description of Biogeochemical cycles, components of ecosystems, autecological and synecological studies. Comprehension of principles of phytogeography and climatic regions of India.
- CO11. To study photo morphological principles like phytochromes, circadian rhythms, plant movements and photoperiodism. Study of plant growth regulators and applied aspects of tissue culture and genetic engineering.
- CO12. Description of ecological succession and plant adaptations. To study environmental pollution, causes, control and Natural resource management. Study of economically and ethanobotanically important plants. Understanding of basic principles and applications of microscopy, electrophoresis, spectroscopy and chromatography.
- CO13. Students will acquire knowledge of applications of the studied theory by indulging in the self study modules that cover the applied aspects of the subject.
- CO14. Students will also gain a practical exposure to every topic enumerated

### **Three Years Degree Course – Semester Pattern**

6 Theory periods per week over a semester

6 Practical periods per week over a semester

## Program Outcomes

Bachelor of Science (BSc) with biological sciences offers theoretical as well as practical knowledge about different subject areas of life sciences. These subject areas include Botany, Zoology, Biochemistry, Biotechnology and Chemistry depending on the specialisation a student opts for. This programme course is most beneficial for students who have a strong interest and background in Science. The course is also beneficial for students who wish to pursue multi and inter-disciplinary science careers in future. The curriculum for undergraduates with life sciences will incorporate classical to recent concepts within different areas of core subjects offered for B.Sc. degree. Following are the various programme outcomes:

### Program outcomes:

**PO1.** Students acquiring a B.Sc. degree with life science subjects will be capable of demonstrating comprehensive knowledge and understanding of the core subjects that form a part of the undergraduate programme.

**PO2.** Students will acquire knowledge and understanding of general biology, including a basic knowledge of the biological molecules, types of cellular processes and pathways, structure/function, evolution, chemistry of biomolecules, plants and animals, interaction with the environment and analytical tools.

**PO3.** Students will develop an appreciation for the scope, unity and diversity of life in the biosphere, including the classification of plants, animals, and microbes.

**PO4.** Students will be able to apply analytic thought to the knowledge acquired in the field of life sciences through critical evaluation and analysis based on scientific methods.

**PO5.** Students will develop transferable skills which will enable them to communicate effectively through oral, written and digital modes.

**PO6.** Students will be able to apply technology for the purposes of problem solving and reporting results.

## **Program Specific Objectives: B.Sc. Biochemistry**

PSO1. Completion of the degree course with biochemistry should provide a general awareness of current developments at the forefront in biochemistry and allied subjects. Students will be able to relate various interrelated physiological and metabolic events.

PSO2. Students will acquire an ability to understand fundamental concepts of biology, chemistry and biochemistry. They will be able to apply and integrate basic principles of allied subjects at biological and molecular level of cells.

PSO3. Students will have disciplinary knowledge of:

- Human Physiology and Microbiology.
- Enzymology and Biomolecules.
- Biophysical Techniques and Bioinstrumentation.
- Metabolism and Molecular biology
- Laboratory safety rules and effective utilization of resources.

PSO4. Students will acquire good experimental and quantitative skills encompassing preparation of laboratory reagents, conducting experiments, satisfactory analyses of data and interpretation of results.

PSO5. This course will enable students to think laterally and develop interdisciplinary approach. They will have overall knowledge of the avenues for research and higher academic achievements in the field of biochemistry and allied subjects.

PSO6. After the completion of this course students have the option to go for higher studies i.e. M. Sc and research. Students will be able to persue higher studies in Biochemistry, Botany, Zoology, Chemistry, Biotechnology and Genetics.

PSO7. After completion of higher studies students can aspire to become scientist, Research officers, Academic professionals, Patent attorney, join Banking sectors and MNCs.

## Course Specific Outcomes: Biochemistry

CSO1. Successful completion of semester I and II will provide them the understanding of Biochemistry as a discipline and milestone discoveries in life sciences that led to establishment of Biochemistry as a separate discipline.

CSO2. This course will make them learn the contributions of Louis Pasteur, Edward Jenner and Robert Koch in microbiology and immunology. They will get acquainted with importance of microorganisms as model systems in genetics and biochemistry.

CSO3. Students will get trained in performing routine microbiological practices such as sterilization, media preparation, maintenance of microbial culture, staining and screening microbes for antibiotic resistance etc.

CSO4. Students will have the understanding of human physiology and acquire practical training for qualitative and quantitative analysis of biological samples such as RBC, WBC, hemoglobin, protein, uric acid, creatinine, urea, phosphorus etc.

CSO5. Curriculum of second year i.e. Semester II & IV will make them understand the fundamental properties of elements, their role in formation of biomolecules and in chemical reactions within living organisms.

CSO6. The course will enable them to understand the concepts of biophysical chemistry and fundamental laws relating to photochemistry and photometry, centrifugation and radiometry in analytical determination and characterization of biomolecules.

CSO7. The students will develop competence and hands-on training in basic separation techniques in biochemistry like electrophoresis, chromatography, spectrophotometry and immune techniques, their applications in biological investigations.

CSO8. Study of Enzymology will give them fundamental knowledge on enzymes, their importance in biological reactions, concept of activation energy, role of enzymes in clinical diagnosis. And practical skills to determine enzyme activity, isolation and assay of enzymes.

CSO9. The course will enable to understand the properties of carbohydrates, proteins, lipids, cholesterol, DNA, RNA, glycoproteins and glycolipids and their importance in biological systems.

CSO10. Third year curriculum will provide the learning of basic concepts of bioenergetics, catabolic and anabolic mechanisms of metabolism and mechanism of ATP synthesis under aerobic and anaerobic conditions.

CSO11. Students will gain the understanding of mechanism of signal transduction by steroid and peptide hormones and the role of second messengers in signal transduction.

CSO12. Molecular Biology paper will enable them to understand the role of DNA as genetic material, replication, transcription, genetic code, translation and gene regulation. Techniques in genetic engineering. Acquire practical skills to isolate RNA, DNA, total nucleic acids and total RNA from bacteria, yeast and plant tissues.





# **B.Sc Biotechnology**

## **Course Outcomes**

### **SEMESTER I**

#### **PAPER 1-MICROBIOLOGY**

**Course objectives:** To give students a generalized idea about microbiology its basic aspects so that they can be able to relate them with their upcoming research projects in BSC and can use microbes in their research purposes. Students will gain awareness about the microbes present in the environment and their impact. Course will provide practical knowledge about different types of bacteria, virus and fungi found in environment.

#### **Course Outcomes**

- Students would know about the contribution of microbiologists, the principle and application of various types of microscopic techniques, and different staining protocols
- Study the morphology of bacteria and detailed account of bacterial cell structure
- Classify microorganisms through Bergey's manual and apply basic knowledge of nutrients required by different microorganisms for their growth
- Students would be able to understand characteristics of viruses, classification and life cycles of viruses

#### **PAPER 2-MACROMOLECULES**

**Course objectives:** To make students aware and to give them the basic knowledge of different macromolecules like nucleic acids protein which are the basis of existence of the cell.

#### **Course Outcomes**

- Describe the structure and function of DNA and RNA in the cell
- To differentiate the structure of nucleic acid, types of Nucleic acid and its Forms
- To differentiate between eukaryotic and prokaryotic chromosomal structure
- Describe the structure of proteins, including the significance of amino acid R-groups and their impact on the three-dimensional structure of proteins.
- Students will have knowledge on biomolecules, their importance and Classification, forces stabilizing their structures, write and relate the role of them with day to day life.

#### **PRACTICAL**

**Course outcomes-** Students will be able to quantitatively and qualitatively estimate protein, nucleic acids in any samples by various methods and also will be able to perform the basic staining techniques to identify different organisms and grow them in different media required for their growth under optimal conditions.

### **SEMESTER II**

## **PAPER 1-MICROBIOLOGY AND CELL BIOLOGY**

### **Course objectives:**

The objective of this course is to have a firm foundation in the fundamentals of Cell Biology, deep understanding of advantages and hazards of microbial world and advanced knowledge for growth and control microorganisms. This course will aid students to acquire skills and competency in microbiological laboratory practices applicable to microbiological research or clinical methods, including accurately reporting observations and analysis.

### **Course outcomes:**

- Students develop an understanding of the Cytoskeleton and Cell Membrane & discuss the structure of Microtubules, microfilaments & can differentiate the organisms by its cell structure
- Students can explain various process in cell division.
- Students apply the concept, principle and types of sterilization methods while performing microbiological experiments.
- Students apply the concept and characteristics of antiseptic, disinfectant and their mode of action in day to day life.
- Cultivate various bacteria, yeast, fungi and virus by different methods.
- Students will apply principle, working and applications of instruments viz, laminar air flow, autoclave, hot air oven etc.

## **PAPER 2-CELL CONSTITUENTS AND ENZYMOLOGY**

### **Course objectives:**

The objective of this course is to familiarize students with the Biomolecules, enzymes and related mechanism through which they work. Upon successful completion of this course, the student will learn, the major classes of enzyme and their functions in the cell. The course also provides information pertaining to role of co-enzyme cofactor in enzyme catalyzed reaction, properties of enzymes and regulation of biochemical pathways. Differentiate between equilibrium and steady state kinetics and analyzed simple kinetic data and estimate important parameter ( $K_m$ ,  $V_{max}$ ,  $K_{cat}$  etc).

### **Course outcomes:**

- By acquiring the knowledge of different biomolecules their definition, classification, biological function and chemical and physical properties they can relate these in day to day life
- Students can apply this knowledge of biomolecules in the research of molecular biology.
- Students perform assay of various enzymes according to their properties and can analyse their kinetics data.

**PRACTICAL-** Students will be able to quantitatively and qualitatively estimate protein and sugars can differentiate samples by doing different test. They will be able to give the quality index of fats, can be able to perform assay of different enzymes and measure their activity. Can see the effect of various factors on enzyme activity. They will know different stages of cell division.

## **SEMESTER III**

### **PAPER I –METABOLISM**

**Course objectives:** To acquaint students with the concept of bioenergetics and various metabolic processes taking place inside the human body.

**Course outcomes:**

- Know the concept of bioenergetics, various terminologies related to it and concept of high energy molecules and bonds
- Develop an understanding of various metabolisms in cell
- Know the formation and the breakdown of different biomolecules and the places where it took place
- Various physiological and pathological aspects of by products of metabolic pathways and their regulations and relate with various industrial processes.

### **PAPER II –BIOPHYSICAL TECHNIQUES**

**Course objectives:** The objective is to enrich students' knowledge about various techniques used in biological research and also their implementation in various fields of research.

**Course outcomes:**

- Understand the concept of electromagnetic radiation, absorption spectrum, Beer's law and Lamberts law
- Understand principle, working and applications of various spectrophotometers and AAS, concept of various spectrometries and can handle them.
- Know the concepts of chromatography and concept of partition coefficient and perform various chromatographic techniques
- Explain the relationship between the concentration of H<sup>+</sup> and OH<sup>-</sup> ions in acids and bases
- Students will be able to justify the need for buffers, describe how buffers are prepared, and calculate the amount of buffering agent needed when making a particular buffer

**PRACTICAL**-Students will be able to perform estimation of macromolecules and find out the purity of that macromolecule in a sample. They will be acquainted with various test for marker enzyme, do cell fractionation, titration of acids and bases also they will come across various techniques for the identification and separation of macromolecules.

## **SEMESTER IV**

### **PAPER I-IMMUNOLOGY**

**Course objectives:** The objective of this course is to familiarize students with the Immune system, hypersensitivity and vaccination, Immune Effector Mechanisms, hybridoma technology and various Immunotechniques and immunodiagnosis. The course will provide technical knowledge as to how different diseases are caused and various responses mediated by living cells to combat pathogen attack. The course will provide sound knowledge of how immune system deals with various pathogens, different processes and cell types involved in prevention of disease. Along with this the students will become aware about concept, synthesis and action mechanism of vaccines.

**Course outcomes:**

- Students will be able to explain immune system, properties of immune system, types of immunity, pathways of complement systems
- Know the concept of antigen, antigenic determinants, haptens, factors affecting antigenicity in various diseases.
- Understand immunoglobulin structure, types and functions and can apply the concept of Hypersensitivity and vaccination for different diseases
- Students will be able to perform various immunological techniques.

## **PAPER II-BIOSTATISTICS AND BIOPHYSICAL TECHNIQUES**

**Course objectives:** The objective is to enrich students' knowledge about various techniques used in biological research and also their implementation in various fields of research. At the end of this course students would be able to understand the principle, working, maintenance and calibrations of bioanalytical tools and techniques for industrial and research purpose.

### **Course outcomes:**

- Gain knowledge and apply the concept of electrophoretic mobility, migration of ions in electric field various types of electrophoretic techniques, their procedure, principle and applications
- Understand detection and recovery methods of various macromolecules by electrophoretic methods by knowing their advantages and limitations.
- Students can apply basic concept of biostatistics for various research purpose.
- Have an insight of isotopic tracer technique and centrifugation their uses, different isotopes and their use in radiology, limitations and principle of tracer technique, limitations and application part of it, scintillation counters and can relate them with various tests performed during diagnosis of various disease like cancer.

**PRACTICAL-**Students will be able to perform various basic pathological tests like test for pregnancy, blood test, widal test and also they will be able to learn how electrophoresis can be used for research purpose and to use the technique. They will also know the basic statistical data analysis.

## **SEMESTER V**

### **PAPER I-MOLECULAR BIOLOGY**

**Course objectives:** To acquaint the students with basic and advanced knowledge of molecular biology.

### **Course outcomes:**

- Students will be able to understand molecular Biological processes like DNA replication, transcription and repair systems
- Know how different genes are expressed and regulated in a cell by using operon model.
- Understand use the DNA replication mutants in the study of replication.

### **PAPER II-MOLECULAR BIOLOGY AND r-DNA TECHNOLOGY**

**Course objectives:** To make the students familiar about the translation machinery and concept of r-DNA technology and their application in advanced research.

### **Course outcomes:**

- Explain the concept of genetic code, decoding system, codon-anticodon interactions, selection of initiation codons, initiation, elongation, termination and also regulation of translation

- Students can give the introduction of r-DNA technology, basics of genetic engineering, various enzymes, concept of different vectors and their applications and can apply them further.
- Understand techniques used to probe DNA for specific genes of interest and apply the fundamental steps in a genetic engineering procedure
- Perform selection and screening of transformed cells and can know how to store transformed as well as whole genome of the organisms in compact form in the form of library
- Apply the concept of PCR, its applications, general features of expression vectors-advantages and problems and various applications of r-DNA technology while performing experiments in r-DNA technology.

**PRACTICAL**-Students will know how to isolate nucleic acids, to perform plating techniques and will be able to demonstrate various blotting techniques.

## **SEMESTER VI**

### **PAPER I-APPLICATIONS OF BIOTECHNOLOGY**

**Course objectives:** To give an insight and advanced learning of application of Biotechnology in research development in various field.

**Course outcomes:**

- Students can give examples of how RNA technologies impact research and development in industry and food technology.
- Describe how biotechnology is used to understand and protect the environment, treat sewage and understand the concept of biodegradation, bioremediation and biotransformation, Domestic waste water treatment, Classification of Waste water treatment
- Know about different fermenters, isolation of industrially important microbes and their screening, production of cheese, and study quality assurance in food and pharmaceutical industry, microbial analysis of Microbial production of fermented food viz. cheese, bread etc and can perform these things while they go to any industry further.

- Gain knowledge about industrial awareness on quality control and good practices in manufacturing processes in industry.
- Know causes of food spoilage, Spoilage of fruit, Vegetables, Dairy product basic knowledge of food Preservation –Chemical Method, Physical method and apply them in food industries further.
- Apply the knowledge of Biodegradation, Bioremediation, Phytoremediation, Xenobiotic biodegradation, Herbicide Degradation, Metabolism of Xenobiotic while working in environmental research institutes and also relate these aspects in day to day life.

## **PAPER II-PLANT AND ANIMAL BIOTECHNOLOGY**

**Course objectives:** To make students aware of various tissue culture techniques and their application in biotechnology for commercial purpose and to acquaint students with applications of genetic engineering like transgenic plants, animals. The course will provide complete exposure as how plant and animal cells are isolated, cultured and genetically manipulated in laboratory. Also the course will provide information how cell suspension cultures can be utilized for molecular farming for commercially synthesizing products such as vaccines, hormones, proteins, enzymes, etc

### **Course outcomes:**

- Understand principles of plant and animal culture, media preparation and can explain *in-vitro* fertilization and embryo transfer technology, meristem culture and clonal propagation of plants
- Students will have an insight in applications or recombinant DNA technology in agriculture, production of therapeutic proteins and can describe commercial production of fuels, microbial enzymes and can apply them in research work.
- Explain the microbial degradation of pesticides, Bioremediation& Bio-fertilizers.
- Know how transgenic animals, cryopreservation, apoptosis, animal cloning, cell transformation, DNA microinjection, production of vaccines is done.
- Students can give specific examples of agricultural and horticultural biotechnology applications, including genetically modified organism (GMO) crops, hydroponics, and plant-made pharmaceuticals
- Isolate genomic and plasmid DNA from cells, including the additional steps required for plant cell DNA isolation
- Students can purify proteins of interest from plant samples and perform assay of DNA or protein samples for their concentration and purity
- Students describe the role that *Agrobacterium tumefaciens* plays in producing genetically modified plant crops will know the methods used to produce transgenic plants, and explain the selection processes for identifying transformed plant cells
- Students describe the role of biotechnologies in food production, food processing, and food security

**PRACTICAL-**Students will be able to prepare media for plant and animal tissue culture. They will perform various culture techniques for different part of plant body, will be able to make cell

count using haemocytometer, determine the quality of water and isolate various industrially important enzymes and organisms and also the organisms present in it indicating its quality.



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**Hislop College, Nagpur**  
**PG & Research Department of Chemistry**

**Program Objectives (POs)**

1. Make students employable with the knowledge and competency in various branches of Chemistry
2. Students having good leadership and soft skills with the right attitudes and ethics.
3. Produce Innovative chemists with problem solving skills for sustainability.
4. Chemists who possess interest in research and lifelong learning.

**Program Specific Outcome (PSOs)**

1. Have sound knowledge about the fundamentals and applications of chemical and Scientific theories
2. Apply appropriate techniques for the qualitative and quantitative analysis of Chemicals in laboratories and in industries.
3. Become familiar with the different branches of chemistry like Analytical, Organic, Inorganic, Physical and Polymer Chemistry
4. Develop analytical skills and problem solving skills requiring application of chemical principles.
5. Acquire the ability to synthesise, separate and characterize compounds using laboratory and instrumentation techniques.

**Course outcomes (Cos)**

**Organic Chemistry**

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

1. Predict the major and minor products of a variety of organic reactions with appropriate stereochemistry and regiochemistry.
2. Understand and reproduce accepted mechanisms of organic reactions including all intermediates, arrows, charges, and resonance structures.
3. Understand and interpret spectra (IR, <sup>1</sup>H NMR, <sup>13</sup>C NMR, Mass Spec., and UV-VIS) of organic molecules.
4. Name or draw the structure of an organic molecule using substitutive and/or functional class IUPAC nomenclature.
5. Devise reasonable high-yield synthesis of a target molecule from given organic starting material and to Understand physical properties of organic molecules.

6. Perform a laboratory experiment using conventional equipment, instrumentation, and techniques and understand the principles well enough to interpret the data collected.

### **Physical Chemistry:**

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

1. Acquire a good knowledge on the chemical kinetics, unimolecular and bimolecular reactions, fast reactions, Catalysis, Surface chemical reactions and Photochemistry of atoms and molecules.
2. Explain statistical physics and thermodynamics as logical consequences of the postulates of statistical mechanics;
3. Understand postulates and general principles of quantum mechanics. Approximations based on variational method and time independent perturbation theory. Application to harmonic oscillator, rigid rotor, one-electron and many-electron atoms, and homo-and hetero-nuclear diatomic molecules
4. Know the importance of nuclear chemistry and its applications. Students will measure the rate of nuclear decay of a short-lived isotope to determine a number of statistical and physical properties.

### **Inorganic Chemistry:**

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

1. Understand the background of bonding forces
2. Appreciates the importance of various theories in bonding
3. Learns the chemistry basis of solid state
4. Gains the imagination of 3D structures of silicates and caged compounds
5. Estimates the importance of extractive metallurgy

### **Analytical Chemistry:**

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

1. Describe and compare a range of analytical chemistry methods and explain the underlying theoretical principles.
2. Explain the broad role of chemists in quality control and assessment of experimental measurements and analytical tasks.
3. Employ a variety of analytical and instrumental methods to prepare, separate and quantify samples from various matrices.

4. Apply the scientific process, including statistical treatment of data, in the conduct and reporting of chemical analysis.
5. Work safely and competently in an analytical laboratory setting.
6. Contribute to team and group work for scientific investigation and reporting.

### **Polymer Chemistry:**

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

1. Isolate the key design features of a product which relate directly to the material(s) used in its construction
2. indicate how the properties of polymeric materials can be exploited by a product designer
3. describe the role of rubber-toughening in improving the mechanical properties of polymers
4. identify the repeat units of particular polymers and specify the isomeric structures which can exist for those repeat units
5. estimate the number- and weight-average molecular masses of polymer samples given the degree of polymerisation and mass fraction of chains present.

### **Molecular Spectroscopy:**

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

- have achieved advanced knowledge about the interactions of electromagnetic radiation and matter and their applications in spectroscopy.
- be able to apply formalisms based on molecular symmetry to predict spectroscopic properties.
- be able to analyse and interpret spectroscopic data collected by the methods discussed in the course.
- be able to solve problems related to the structure, purity and concentration of chemicals and to study molecular interactions by choosing suitable spectroscopic methods and interpreting corresponding data.

# Computer Science

## Programme Outcome:

There are two main Outcomes to the B.Sc. Computer Science Programme.

- a) The primary goal of the degree program in Computer Science is to provide students the foundations for the future work and careers in computation-based courses. These foundations support both a successful career path in computing as well as provide appropriate qualifications for further degree work in computation related disciplines.
- b) Our degree emphasizes development of analytical skills, acquisition of knowledge and understanding of systems, languages and tools required for effective computation-based problem solving.
- c) A Computer Science major will provide you with knowledge of programming, operating systems, compiler design and principles of programming language.
- d) To prepare graduates to enter technological fields such as systems programming, technical support, research and teaching.

## Program Specific Outcome:

On completion of the B.Sc Computer Science Programme, the students:

- a) Will have sound knowledge of the Programming languages such as C, C++, Java, VB and SQL. Also they will have knowledge about Information Technology, Operating System, System Analysis and Design and Development.
- b) Can participate in off-campus internships, independent study projects, part-time computer employment, lectures by guest speakers, Society of Computing Students programming and on campus employment as lab assistants, lab supervisors and Helpdesk assistants.
- c) Be in a position to develop industrial and entrepreneur applications.

## Course Outcome

### **SEMESTER I Paper I (C Programming)**

Comprehensive study of the C programming language stresses the strengths of C, which provide students with the means of writing efficient, maintainable, and portable code. The nature of C language is emphasized in the wide variety of examples and applications which helps students to learn and acquire art of computer programming. It serves as a basic foundation, in the journey of programming.

### **SEMESTER I PAPER II (FUNDAMENTALS OF INFORMATION TECHNOLOGY)**

The concepts of Information Technology are need to meet the growing need of student to learn computer and its application in all aspects of life. This is a core subject to help them learn the architecture of device. It covers basic networking concepts.

### **SEMESTER II PAPER I (OBJECT ORIENTED PROGRAMMING USING 'C++')**

The course object-oriented programming language plays important role in computing science and its applications. Object oriented programming is used by software professionals in the development of large software projects. Object oriented programming is the base of the new generation languages and packages.

### **SEMESTER II Paper II (SYSTEM ANALYSIS AND DESIGN)**

This course introduces a range of concepts used in the analysis and design of complex information systems. It helps students to gain practical skills in, modelling systems from the process and object perspectives. It empowers creative and critical thinking in understanding the approaches that can be used when undertaking a holistic analysis and design project.

### **SEMESTER III - PAPER I (DATA STRUCTURES)**

Data Structures is needful in managing the memory usage as well as execution of the algorithms used to solve a specific problem. This course is first step towards success as a Data Manager. It gives students a firm foundation in basic data handling. Students gain a conceptual understanding of the various data structures and their architectures and how its working affect the execution time and efficiency of the algorithm we are using to solve a particular problem.

### **SEMESTER III Paper II(Operating System)**

A comprehensive introduction to understand the underlying principles, techniques and approaches which constitute a coherent body of knowledge in operating systems, helps the students to get acquainted with inherent functionality and processing of program execution. The course helps to understand, how the various elements that underlie operating system interact and provides services for execution of application software.

### **SEMESTER IV Paper I (JAVA PROGRAMMING)**

This course benefits the students for providing object oriented programming approach in project development. It comprises of various features that facilitate the portable code to be executed on any independent platform. It helps to create applet and application which can be executed on web browser and independent system respectively.

### **SEMESTER IV Paper II (Linux Operating System)**

This course benefits students for solving problems in service and administrator activities and managing system information sources in Linux and UNIX-like operating systems independently. Thus opens door for new opportunities in their career.

### **SEMESTER V Paper I(Visual Basic Programming)**

This course benefits students for developing application GUI based. It's a very good front end programming language with which various equipments or database can be made operational. This create better career opportunities.

### **SEMESTER V Paper II-(Database Management Systems)**

The course provides a strong formal foundation in database concepts, technology and practice to the students to groom into well-informed database application developers. The overriding concern is to include just enough concepts and theory to motivate and enrich the practical component, and to include technology component to maximize the relevance of the course to the industry without sacrificing the long-term objectives of providing foundational strength that can withstand the upcoming technological advances

### **SEMESTER VI PAPER I (COMPILER CONSTRUCTION)**

The compilers construction topic provides an essential interface between computer applications and its architectures. Compilers embody a wide range of theoretical techniques which help development of programming concepts. Compiler construction teaches programming and software engineering skills

### **SEMESTER VI PAPER II ( SQL AND PL/SQL)**

Oracle DBAs manage the industry's most advanced information systems and command some of the highest salaries. This course is first step towards success as an Oracle professional, it gives students a firm foundation in basic database administration. Students gain a conceptual understanding of the Oracle database architecture and how its components work and interact with one another. Students also learn how to create and properly manage database in an effective and efficient manner.

### **Program Outcome (PO) of B.Sc**

- PO1:** The Successful graduates can opt for the higher studies programme in Physics, mathematics, Electronics as per the three subjects selected in undergraduate programme apart from B.Ed, MCA and P G diploma.
- PO2:** The graduates can get placements in IT companies, HR services, marketing, startups etc.
- PO3:** The graduates will be in position to think analytically and execute the ideas into practicality.
- PO4:** The graduates will acquire sufficient knowledge and communication skills to present the topics of their interdisciplinary subjects in an effective way.
- PO5:** The graduates will be exposed to ICT technology so that they can use it for their future career.

### **Program Specific Outcomes (PSO) of B.Sc. Electronics**

#### **In this program the students will be able to:**

- PSO1:** The experiments in Electronics that are taught in B.Sc programme have relevance to the day to day life and understand the importance of these experiments which are introduced to them.
- PSO2:** Provide a systematic understanding of basic Electronic circuits and concepts, principles and theories along with their practical applications
- PSO3:** Pursue a postgraduate programme depending upon their Interest in Physics and Electronics for further higher education.
- PSO4:** Find employment in R & D, Scientific and Engineering industries and electronic equipment maintenance.
- PSO5:** Develop expertise in data acquisition using a variety of laboratory instruments and in the analysis and interpretation of such data.

### **Course Outcomes for B.Sc (ELECTRONICS) Programme**

#### **Semester-I**

- CO1: Familiarization with basic circuit elements and passive components
- CO2: Understand DC circuit theorems and their use in circuit analysis
- CO3: Understanding characteristic features of semiconductor devices
- CO4: This Module will enable students to familiarize with elementary electronic Components and Circuits as well as solving network circuits.
- CO5: Familiarization with concepts of digital electronics
- CO6: Learning number systems and their representation

CO7: Understanding basic logic gates, Boolean algebra and k-maps

CO8: Designing and Understanding arithmetic circuits, combinational circuits and sequential circuits.

CO9: This module will help student understand and design basic digital electronic circuits.

### **Semester-II**

CO1: Understanding Applications Based on Basic Semiconductor Devices

CO2: Understanding Basic Concepts of Amplifiers

CO3: Enables Designing Aspects of Basic Amplifier Circuits

CO4: This module gives students hand on experience of active devices and designing aspect of these various applications.

CO5: Enables Designing and Understanding Sequential device

CO6: Application of Sequential Device (counters and Shift Register)

CO7: Understanding of Logic families' enables and Logic Circuits

CO8: Understanding Basic Concept of Memories and memory device.

CO9: This module will enhance students advance digital circuit designing skills.

### **Semester-III**

CO1 : Designing and Understanding Elements of Power supply

CO2 : Acquaintance with various Voltage Regulator Circuits

CO3 : Understanding Multistage Amplifier and its Application (OP-Amp)

CO4 : After completion of this Module student will be able to design Power and supply and different OP-AMP Application.

CO5 : Familiarization with Basic designing aspect of Instrumentation system

CO6 : Understanding Circuit maker Software

CO7 : Designing basic electronic Circuits using Circuit maker Software

CO8 : After Completion of this Module student will be able to design analog and digital circuits using Software thereby enhancing their Virtual Instrumentation skills.



#### **Semester-IV**

- CO1: Familiarization with Basic Concept of Electronic Oscillator Principle and Circuits.
- CO2: Designing Advance Applications of Operational amplifier
- CO3: Familiarization With Converter Circuits and its necessity (D/A and A/D Converters).
- CO4: After the end of this Module student will be able to design advance Analog electronic devices
- CO5: Familiarization with Basic Concept of Transducers
- CO6: Understanding working of Various Transducers
- CO7: Designing basic Instrumentation system using Transducers
- CO8: Familiarization with Basics of Biomedical Instruments and its circuits
- CO9: After completion of this Module students will be able to design small projects with transducers.

#### **Semester-V**

- CO1: Understanding Basic Elements of Electronic Communication
- CO2: Acquaintance with Various Electronic communication system
- CO3: Understanding medium and mode of data transfer in communication system
- CO4: After completion of this Module student will have through knowledge of Modern electronic Communication system
- CO5: Understanding Architecture of Basic Microprocessor
- CO6: Acquaintance with its various Elements like data type, instruction set and registers
- CO7: Programming the microprocessor with advance instruction set
- CO8: After completion of this Module students are enable to write assembly language programming for microprocessor

## **Semester-VI**

CO1: Understanding Basic Concept of C language

CO2: Acquaintance with its various data format and functions

CO3: Understanding and Advance programming skills

CO4: After the completion of this Module students will be able to develop Application using C language.

CO5: Basic Designing Aspect of Microcontroller (Architecture)

CO6: Acquaintance with its various Instruction sets which enhance programming skills

CO7: Understanding Enhanced Architecture for Complex programs

CO8: This module will enhance students programming skills for various microcontrollers application.

## **B.Sc. (Mathematics)**

### **Programme Specific Outcomes**

- Enabling students to develop a positive attitude towards mathematics as an interesting and valuable subject of study.
- A student should get a relational understanding of mathematical concepts and concerned structures, and should be able to follow the patterns involved, mathematical reasoning.
- Ability to analyze a problem, identify and define the computing requirements, which may be appropriate to its solution.
- Formulate and develop mathematical arguments in a logical manner.
- Acquire good knowledge and understanding in advanced areas of mathematics and statistics, chosen by the student from the given courses.
- A student learns properties of inverse Laplace transforms to solve improper integrals.
- Ability to understand the concepts of Matrices and linear equations and make use of linear equations for solving any differential equations.
- Introduction to various other courses like group theory, ring theory, metric spaces, number theory.
- Enhancing students' overall development and to equip them with mathematical modeling abilities, problem solving skills, creative talent and power of communication necessary for various kinds of employment.
- Ability to pursue advanced studies and research in pure and applied mathematical science.

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# Course Outcomes

## **B.Sc. Part I (Semester I)**

**Course Title:-M-1 Algebra and Trigonometry**

**Course Outcomes:-**

- Recognize consistent and inconsistent systems of linear equations by the row echelon form of the augmented matrix, using rank.
- Learn to solve system of linear equation.
- Learn to find eigenvalues and corresponding eigenvectors for a square matrix.
- Introduction to complex analysis.
- Introduction to group and subgroup.
- Learn to employ De Moivre's theorem in a number of applications to solve numerical problems.

## **B.Sc. Part I (Semester I)**

**Course Title: M-2 Calculus**

**Course Outcomes:-**

- Gain Knowledge of fundamental concepts of real numbers.
- Verify the value of the limit of a function at a point using the definition of the limit
- Learn to check function is continuous understand the consequences of the intermediate value theorem for continuous functions.
- Calculate the limit and examine the continuity of a function at a point.
- Understand the Partial differential equations
- Understand definite integrals and applying it in solving problems.

## **B.Sc. Part I (Semester II)**

**Course Title: - M-3 Geometry, Differential and Difference equations**

**Course Outcomes:-**

- Clear understanding of Conic shapes.
- Finding equation in various form of line, circle, ellipse, sphere, cones etc.
- Learn various techniques of getting exact solutions of solvable first order differential equations and linear differential equations of higher order.
- Grasp the concept of a general solution of a linear differential equation of an arbitrary order and also learn a few methods to obtain the general solution of such equations.
- Learn Difference equations.

## **B.Sc. Part I (Semester II)**

**Course Title:-M-4 Vector Calculus and Improper Integrals**

**Course Outcomes:-**

- Learn concepts of Vector differentiation, Gradient, Divergence, Curl etc.
- Inter-relationship amongst the line integral, double and triple integral formulations.
- Understand Surface and volume integrals and its application in solving problems.
- Realize importance of Green, Gauss and Stokes' theorems in other branches of mathematics.
- Understand Improper Integrals, Beta and Gamma functions.

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**B.Sc. Part II (Semester III)****Course Title: M-5    Advanced Calculus, Sequence and Series****Course Outcomes:-**

- Geometrical representation and problem solving on Rolle's theorem and LMVT.
- Finding extreme values of function.
- Understand many properties of the real line  $\mathbb{R}$  and learn to define sequence in terms of functions from  $\mathbb{R}$  to a subset of  $\mathbb{R}$ .
- Recognize bounded, convergent, divergent, Cauchy and monotonic sequences and to calculate their limit superior, limit inferior, and the limit of a bounded sequence.
- Apply the ratio, root, alternating series and limit comparison tests for convergence and absolute convergence of an infinite series of real numbers.

**B.Sc. Part II (Semester III)****Course Title: M-6    Differential equations and Group Homomorphisms****Course Outcomes:-**

- Know about Bessel's and Legendre's functions with their properties.
- Solve ordinary differential equations using Laplace transforms.
- Familiarize with Fourier transforms of functions, relation between Laplace and Fourier transforms.
- Explain the significance of the notions of cosets, normal subgroups, and factor groups.
- Learn about structure preserving maps between groups and their consequences.

**B.Sc. Part II (Semester IV)****Course Title: M-7    Partial Differential Equations and Calculus of Variation****Course Outcomes:-**

- Apply a range of techniques to solve first & second order partial differential equations.
- Model physical phenomena using partial differential equations such as the heat and wave equations.
- Understand problems, methods and techniques of calculus of variations.

**B.Sc. Part II (Semester IV)****Course Title: M-8    Mechanics****Course Outcomes:-**

- Familiarize with subject matter, which has been the single centre, to which were drawn mathematicians, physicists, astronomers, and engineers together.
- Understand necessary conditions for the equilibrium of particles acted upon by various forces and learn the principle of virtual work for a system of coplanar forces acting on a rigid body.
- Deal with the kinematics and kinetics of the rectilinear and planar motions of a particle including the constrained oscillatory motions of particles.
- Learn that a particle moving under a central force describes a plane curve and know the Kepler's laws of the planetary motions, which were deduced by him long before the mathematical theory given by Newton.

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**B.Sc. Part III (Semester V)**

**Course Title: M-9 Analysis**

**Course Outcomes:-**

- Understand Fourier Series, Fourier Sine and Cosine Series.
- Learn Riemann-Stieltjes integral and its properties.
- Understand the significance of differentiability and analyticity of complex functions leading to the Cauchy-Riemann equations.
- Learn concepts of Conformal Mapping.

**B.Sc. Part III (Semester V)**

**Course Title: M-10 Metric Spaces, Complex Integration and Algebra**

**Course Outcomes:-**

- Understand several standard concepts of metric spaces and their properties like openness, closedness, completeness, Bolzano-Weierstrass property, compactness, and connectedness.
- Identify the continuity of a function defined on metric spaces and homeomorphisms.
- Learn the role of Cauchy integral formula in evaluation of contour integrals.
- Learn Taylor and Laurent series expansions of analytic functions, classify the nature of singularity, poles and residues and application of Cauchy Residue theorem.
- Know the fundamental concepts in ring theory such as the concepts of ideals, quotient rings, integral domains, and fields.
- Learn in detail about polynomial rings, fundamental properties of finite field extensions, and classification of finite fields.

**B.Sc. Part III (Semester VI)**

**Course Title: M-11 Abstract Algebra**

**Course Outcomes:-**

- Learn Group and Inner Automorphisms.
- Understand the concepts of vector spaces, subspaces, bases, dimension and their properties.
- Relate matrices and linear transformations, compute eigen values and eigen vectors of linear transformations.
- Learn properties of inner product spaces and determine orthogonality in inner product spaces.
- Realize importance of adjoint of a linear transformation and its canonical form.

**B.Sc. Part III (Semester VI)**

**Course Title: M-12 Special Theory of Relativity**

**Course Outcomes:-**

- Understand the basic elements of Newtonian mechanics including Michelson-Morley experiment and geometrical interpretations of Lorentz transformation equations.
- Learn about length contraction, time dilation and Lorentz contraction factor.
- Understand the role of Tensors in special theory of relativity.
- Understand equations of motion as a part of relativistic mechanics.

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### **Program Outcome (PO) of B.Sc**

- PO1:** The Successful graduates can opt for the higher studies programme in Physics, mathematics, computer science, statistics and chemistry as per the three subjects selected in undergraduate programme apart from B.Ed, MCA and P G diploma.
- PO2:** The graduates can get placements in IT companies, HR services, marketing, startups etc.
- PO3:** The graduates will be in position to think analytically and execute the ideas into practicality.
- PO4:** The graduates will acquire sufficient knowledge and communication skills to present the topics of their interdisciplinary subjects in an effective way.
- PO5:** The graduates will be exposed to ICT technology so that they can use it for their future career.

### **Program Specific Outcomes (PSO) of B.Sc. Physics**

#### **In this program the students will be able to:**

- PSO1:** The experiments in Physics that are taught in B.Sc programme have relevance to the day to day life and understand the importance of these experiments which are introduced to them.
- PSO2:** Provide a systematic understanding of core physical concepts, principles and theories along with their applications
- PSO3:** Pursue a postgraduate programme depending upon their Interest in Physics and Electronics for further higher education.
- PSO4:** Find employment in R & D, Scientific and Engineering industries and electronic equipment maintenance.
- PSO5:** Develop expertise in data acquisition using a variety of laboratory instruments and in the analysis and interpretation of such data.

### **Course Outcomes for B.Sc (Physics) Programme**

#### **Semester-I**

- CO1:** The students will be able to learn application in daily life like the cantilever in construction of buildings, bridges and diving boards of swimming pools.
- CO2:** Students learn about static charges and the principles governing the production, the theories behind them.
- CO3:** Students also learn about different capacitors, dielectric and insulating materials and their uses like running of ceiling fans, electrical motors.
- CO4:** Students learn novel concepts in transformer making, have critical thinking about design and fabrication of transformers for potential uses in laboratory.
- CO5:** The transformers used in amplifying the A.C. voltage and theory behind them is learnt by the students. The theories behind the A.C. current flow, the use of complex numbers for the calculation of complex A.C circuits are learnt.

## **Semester-II**

- CO1: The students will be able to learn the concepts of Astrophysics and Astronomy and visualize the motion of planets, evolution of universe and latest developments in the field of astronomy and astrophysics.
- CO2: Principles governing basic concepts of Super Conductivity are learnt.
- CO3: Students learn basic properties of magnets and their application in accessories using the concept of magnetism.
- CO4: The phenomenon of electromagnetism is introduced to the students and how contactless current measuring devices are made using the principles of electromagnetism.
- CO5: Students learn about the electrical devices which use the concepts of magnetism for their operation.

## **Semester-III**

- CO1 : The students will be able to learn details about human ear, the limits of audibility, musical instruments, different tones and harmonics.
- CO2: How Physics helps the people to design new instruments for melodious music is a part of this topic.
- CO3: It helps the students to get factual and physics backed information related to Transducers and their characteristics (Crystal microphone, Moving coil loud speaker).
- CO4: Recording and reproduction of sound (Magnetic tape, Cine film, Compact disc) and acoustics of a building, music hall and cinema theatre.
- CO5: The students will be able to learn details and applications on interferometers, newton's rings, gratings used in spectroscopy, blue colour of sky, how light affects us due to atmosphere.
- CO6: Detailed study of Electromagnetic waves, how the electromagnetic waves propagate and have relevance in transmission through different media with different refractive indices.

## **Semester-IV**

- CO1: The students will be able to get exposed to different Crystals systems, the structure of Crystals and diamond.
- CO2: Lasers applications, basics of how lasers are manufactured. Different types of Lasers and their uses for human, industries and hospitals
- CO3 : Students also learn about Light emitting diode, Solar Cell, Photovoltaic cell, Bipolar transistor- Construction and working, transistor characteristics in CE and CB Mode.
- CO4: Students learn about field effect transistors like MOSFET, JFET and their applications in IC fabrication.
- CO5: The basics of Molecular spectra are studied so that the students can explore the application part in research field.
- CO6: Application of Magnetic Resonance Imaging (MRI) using concepts of Nuclear Magnetic Resonance (NMR) are learnt.



## **Semester-V**

- CO1: Student will be able to describe the atomic spectra of one and two valence electron atoms and explain the change in behavior of atoms in external applied electric and magnetic field and learn free electron gas model to explain, thermal conductivity, electrical conductivity, optical behaviour in solids.
- CO2: Students get acquainted with all the three statistics to distinguish between different types of particles like bosons, fermions and classical particles among energy levels.
- CO3: The student will be able to apply Schrodinger Wave equation to solve the problems in wave mechanics.
- CO4: The students will get an insight into many aspects of Nano Science and Technology and their applications in Materials Science.

## **Semester-VI**

- CO1: The students will learn concepts of Relativity which deals objects and heavenly objects.
- CO2: The students will learn about different radiations from radioactive elements and their reactions with matter.
- CO3: The student will get exposure to medical equipments like ECG, EEG, ERG, Sonography etc. which are used to analyse the vibrational changes in human body.
- CO4: The student learns different types of Amplifiers, OP-AMP technology, Oscillators and Communication technology.
- CO5: The students learns about basics of digital electronics which are the basics of computer hardware.

**Department of Statistics**  
**Programme Specific Outcomes: (PSO)**

| <b>Programme offered with<br/>Statistics as one of the Subjects<br/>at UG level</b> | <b>Course name</b>   | <b>Course outcome</b>   |
|---|----------------------|---|
| B. Sc. with Physics, <b>Statistics &amp;</b> Mathematics                            | <b>B. Sc. (PSM)</b>  | <ul style="list-style-type: none"> <li>• Course will help the students to join M. B.A. courses by passing state eligibility test (SET) or qualifying competitive examinations of reputed universities</li> <li>• Course will be helpful to pursue the career of an actuary by passing the Actuarial Common Entrance Test (ACET).</li> <li>• Course is good to pursue the career as Data Analytics, Data Scientist in corporate world</li> <li>• The course will help the students to do PG in Biostatistics to pursue their career in clinical research</li> <li>• Student can prepare for qualifying Indian Statistical service examination</li> </ul> |
| B. Sc. with <b>Statistics</b> Computer Science, Mathematics                         | <b>B. Sc. (SCSM)</b> | <ul style="list-style-type: none"> <li>• Course will help the students to join M. C.A. courses by passing eligibility test / qualifying competitive examinations of reputed universities</li> <li>• Course will be helpful to pursue the career of an actuary by passing the Actuarial Common Entrance Test (ACET).</li> <li>• Course is good to pursue the career as Data Analytics, Data Scientist in corporate world</li> <li>• The course will help the students to do PG in Biostatistics to pursue their career in clinical research</li> <li>• Student can prepare for qualifying Indian Statistical service examination</li> </ul>              |

### Course specific Outcomes (CO) of the subject Statistics

| Class             | Paper    | Name of Paper            | Course Outcomes (CO)  |
|-------------------|----------|--------------------------|---|
| B. Sc. Semester-I | Paper-I  | Probability Theory       | <ul style="list-style-type: none"> <li>➤ Students will understand the importance of collecting the data accurately by using appropriate data collection methods suitable to the characteristic under study.</li> <li>➤ Development of conceptual understanding of scales of measurement, qualitative and quantitative data and categorical analysis.</li> <li>➤ Statistical techniques taught in Semester-I class will help the students-                             <ul style="list-style-type: none"> <li>✓ to draft the questionnaire for personal interview or mail questionnaire method of data collection.</li> <li>✓ to decide the appropriate method of data collection for collecting the data accurately.</li> <li>✓ To understand the structure of data and need for qualitative and quantitative classification</li> <li>✓ To draw and understand diagrammatic and graphic representation of data</li> <li>✓ In understanding of concept of probability, &amp; its applications</li> <li>✓ In preparation for Statistics Olympiads and other related reputed competitive examinations</li> </ul> </li> </ul> |
|                   | Paper-II | Descriptive Statistics-I |   |

| Class               | Paper    | Name of Paper  | Course Outcomes (CO)  |
|---------------------|----------|--|---|
| B. Sc. Semester-II  | Paper-I  | Probability Distributions                                  | Concept of probability modeling will be developed by studying discrete and continuous probability distributions         |
|                     | Paper-II | Descriptive Statistics-II                                  | Students will be able to understand the concept of Descriptive Statistics of quantitative data and its techniques       |
| B. Sc. Semester-III | Paper-I  | Statistical methods  | Concept of random sample, Sampling distributions and their applications will be developed.                              |
|                     | Paper-II | Economic Statistics  | Students will be able to understand the Applications of Statistics in Economics   |
| B. Sc. Semester-IV  | Paper-I  | Statistical Inference                                      | Students will be able to do data analysis using data sets by techniques of statistical inference                        |
|                     | Paper-II | Applied Statistics   | Students will be able to understand the Applications of Statistics in Demography and Psychological Statistics           |
| B. Sc. Semester-V   | Paper-I  | Statistical Quality Control and Linear Programming Problem | Concepts will be developed regarding quality control techniques used in industries and Applications of LPP              |
|                     | Paper-II | Sampling Techniques  | Students will be able to know appropriate sampling method with respect to the objective and nature of study and data.   |
| B. Sc. Semester-VI  | Paper-I  | Operations Research  | Students will be able to learn Project management techniques, transportation and assignment techniques                  |
|                     | Paper-II | Experimental Designs                                       | Students will be to use ANOVA technique, designing of an experiment to carry ANOVA in simple and factorial experiments. |

**Department of Zoology**  
**Undergraduate Programme**  
**Course outcomes: Subject Zoology**

CO 1: A working knowledge of using principles of nomenclature and identification keys for Animal Kingdom.

CO 2: A practical ability to morphologically separate Animal species and describe its anatomy and histological characters.

CO 3: Able to understand the origin and evolutionary relationship of different phylum

CO 4: Able to explain the economical importance of both useful and harmful fauna by which socioeconomic status of our nation can be raised.

CO 5: Able to describe the fundamental concepts and principles of environmental science in major areas such as atmospheric and soil science, hydrobiology, biodiversity and pollution ecology and understand the major ecological issues, policies and laws, crucial for solving environmental problems.

CO 6: Able to recognize the experimental nature of cell and molecular biology, with ability to discuss specialized topics viz., the function and the composition of the various cell organelles, cell division, cancer, study of genetics, recombinational principles and genetic disorders in human being.

CO 7: Able to describe interaction between the immune system and pathogens, how the immune system works building on their previous knowledge from biochemistry, genetics, cell biology and microbiology. Able to compare and contrast humoral versus cell-mediated immune responses, distinguish and characterize antibody isotypes, development, and functions and understand the role of cytokines in immunity and immune cell activation.

CO 8: Able to describe physiology of different organo-systems and developmental biology of both non chordates and chordates.

CO 9: Able to learn about Computational and Statistical methods in biology, especially genetics and genomics.

CO10: Able to explain various important disciplines of biotechnology, such as cell biology, molecular genetics, biophysical methods, genomics and proteomics, immune technology, transgenic animals and environmental biology.

### **Program specific outcomes**

#### **Chemistry Botany Zoology / Chemistry Biochemistry Zoology / Chemistry**

#### **Biotechnology and Zoology**

PSO 1: To understand the animal kingdom, its origin and evolutionary relationship of different phylum and to analyse its relationship with plant and microbes.

PSO 2: To understand and establish scientific principles and concepts for understanding our interaction with the natural environment and address all major environmental issues that confront our society.

PSO 3: To understand Cell and molecular biology with essential concepts and applications of molecular biology, pharmacy, biotechnology, microbiology and other related disciplines.

PSO4: To correlate Animal Physiology and Developmental biology to related subjects such as Biochemistry, Cell Biology, Histology and Anatomy.

PSO 5: To understand bioalgorithms, bio-databases, molecular phylogeny and biosimulation and also its applications in protein modeling.

PSO 6: To perform procedures as per laboratory standards in the area of Taxonomy, Physiology, Ecology, Cell biology, Genetics, Applied Zoology, Clinical Science, microtechnique, Entomology, Aquaculture, Biotechnology and Immunology.