

## **COURSE OUTCOMES**

### **Departments of Mathematics**

#### **Outcomes**

#### **B. Sc. I : SEM – I (CBCS)**

##### **Paper-I (Differential and Integral Calculus)**

- It is used in almost all branches of engineering.
- It deals with calculus of several variables.
- It is a science that deals with rate of change.
- Understanding the concept of differentiation.
- Understanding the concept of Integration.
- Applications of differentiation include measuring velocity, acceleration, etc.
- Applications of Integration include estimating areas, volumes,
- To understand the importance of Taylors series.
- To learn mean value theorem of integral calculus.
- To learn how to solve improper integrals.
- To find area by double integration
- To learn how to change the order of integration.

##### **Paper-II (Differential Calculus and Trigonometry)**

- It is used in almost all branches of engineering.
- Understanding the concept of limit.
- To learn Chain rule of differential calculus.
- To learn Euler's theorem of differential calculus.
- Understanding the concept of slope.
- Understanding the concept of asymptotes.
- Understanding the concept of complex number.
- To learn De Moivre's theorem in trigonometry.

#### **B. Sc. I: SEM- II (CBCS)**

##### **Paper-I (Ordinary Differential Equations and Difference Equations)**

- To understand the necessity of differential equations.
- To learn about forming differential equations from physical situations.
- To know various types of differential equations.
- To practice methods of solution for various types of differential equations.
- It is useful for methods of momentum and energy transfer.
- It is used in all branches of engineering.

- To learn about the simultaneous differential equations.
- It is widely used in Civil engineering, Mechanical engineering, etc.
- To understand definition and properties of Wronskian.
- To understand definition and properties of difference equations.

## Paper-II (Partial Differential Equation)

- To understand the importance of partial differential equations.
- It is used in solving many problems of engineering and physics.
- To study about linear partial differential equations.
- To know various types of partial differential equations.
- To understand the Charpit's method of partial differential equations.
- To learn about the Homogeneous and Non-Homogeneous partial differential equations.

## B. Sc. II: SEM-III (CBCS)

### Paper-I (Real Analysis)

- To understand the concept of real sequence.
- To study continuous functions on metric spaces.
- To learn connected metric spaces.
- To understand complete metric spaces.
- To study compact metric spaces
- To understand the concept of Riemann integral.
- To learn the Fundamental Theorem of Integral Calculus.

### Paper-II (Set Theory and Laplace Transform)

- Discuss the development of the axiomatic view of set theory in the early 20th century,
- Identify the axioms of a system of set theory, for example the Zermelo-Fraenkel axioms, including the Axiom of Choice,
- Define cardinality, discuss and prove Cantor's Theorem and discuss the status of the Continuum Hypothesis,
- Explain basic concepts and prove basic facts about ordinals and well-ordered sets,
- Use transfinite induction to prove a selection of theorems relating to ordinals and cardinals, and
- Define the set theoretic universe  $V$  and discuss its structure.
- To learn properties of Laplace transforms.
- To learn properties of inverse Laplace transforms.
- To understand how to solve ordinary differential equations and partial differential equations from Laplace Technique.

## B. Sc. II SEM-IV

### Paper-I (Algebra)

- Algebra is science of operations.
- It is widely used in Computer science and I.T.
- To understand the concept of groups.
- To learn homomorphism and isomorphism.
- To learn group codes and how to uncode.
- To learn normal subgroups.

### Paper-II (Elementary Number Theory)

- To understand the concept of Division Algorithm
- To learn the Prime Numbers.
- To understand the concept of the Fundamental Theorem of Arithmetic.
- To learn the Fermat Numbers.
- To understand the concept of Congruence.
- To understand the properties of Congruence.
- To learn the Euler's Theorem.

## B. Sc. III SEM V

### Paper-I (Linear Algebra)

- It is a branch of Algebra.
- It is used in Computer Science, Electrical engineering, etc.
- To learn the importance of analytic function.
- To understand theorems on Cauchy Riemann equation.
- To learn about vector spaces.
- To understand theorems on basis and dimension.
- To know about eigen values and eigen vectors.
- To study linear transformations.
- To learn about the inner product space.

### Paper-II (Matrices and Theory of Equations)

- Solve systems of linear equations using multiple methods, including Gaussian elimination and matrix inversion.
- Carry out matrix operations, including inverses and determinants.
- Demonstrate understanding of the concepts of vector space and subspace.
- Demonstrate understanding of linear independence, span, and basis.
- Determine eigenvalues and eigenvectors and solve eigenvalue problems.
- Apply principles of matrix algebra to linear transformations.
- Demonstrate understanding of inner products and associated norms.

## B. Sc. III SEM-VI

### Paper-I (Numerical Methods)

- Articulate the tradeoffs between easy computation and accuracy.
- Execute basic commands and scripts in a mathematical programming language.
- Demonstrate proficiency in the use of input/output commands including: command line, file, and graphical.
- Create changes in program flow using control structures.
- Modularize program construction and increase code-reuse using functions.
- Design programs using a top-down design methodology.
- Select appropriate numerical methods to apply to various types of problems in engineering and science in consideration of the mathematical operations involved, accuracy requirements, and available computational resources.

### Paper-II (Complex Analysis and Vector Calculus)

- To learn properties of complex numbers.
- To understand the use of complex numbers in the field of Calculus.
- To gain knowledge of singularities and residues.
- To apply the knowledge of residues in complex integration
- To understand Cauchy Riemann Equation.
- To learn the Mobius Transformation.
- Find parametrizations of curves, and compute line integrals directly.
- Use antiderivatives or Cauchy's integral theorem or formula to compute line Integrals.
- Use the residue theorem to compute several kinds of real integrals.

## **Department of Physics**

### **COURSE OUTCOME**

The Board of Studies in Physics (UG) recognizes that curriculum, course content and assessment of scholastic achievement play complementary roles in shaping education. The committee is of the view that assessment should support and encourage the broad instructional goals such as basic knowledge of the discipline of Physics including phenomenology, theories and techniques, concepts and general principles. This should also support the ability to ask physical questions and to obtain solutions to physical questions by use of qualitative and quantitative reasoning and by experimental investigation. The important student attributes including appreciation of the physical world and the discipline of Physics, curiosity, creativity and reasoned skepticism and understanding links of Physics to other disciplines and to societal issues should give encouragement. With this in mind, we aim to provide a firm foundation in every aspect of Physics and to explain a broad spectrum of modern trends in physics and to develop experimental, computational and mathematics skills of students.

The programme also aims to develop the following abilities:

1. Read, understand and interpret physical information – verbal, mathematical and graphical.
  2. Impart skills required to gather information from resources and use them.
  3. To give need based education in physics of the highest quality at the undergraduate level.
  4. Offer courses to the choice of the students.
  5. Perform experiments and interpret the results of observation, including making an
- B. Sc. Programme in Physics, an assessment of experimental uncertainties.
6. Provide an intellectually stimulating environment to develop skills and enthusiasms of students to the best of their potential.
  7. Use Information Communication Technology to gather knowledge at will.
  8. Attract outstanding students from all backgrounds.

Objectives: The syllabi are framed in such a way that it bridges the gap between the plus two and post graduate levels of Physics by providing a more complete and logical framework in almost all areas of basic Physics.

By the end of the first year (2nd semester), the students should have attained a common level in basic mechanics, a secure foundation in mathematics, Chemistry (otherwise specified), Languages and other relevant subjects to complement the core for their future courses and

developed their experimental and data analysis skills through experiments at laboratories.

By the end of the second year (4th semester), the students should have been introduced to powerful tools for tackling a wide range of topics in Optics, Laser, Fiber optics, semiconductor devices and circuits. Along with Languages, they should have been familiar with additional relevant techniques in mathematics, Chemistry or Electronics/Computer application and developed their experimental and data analysis skills through a wide range of experiments through practical at laboratories.

By the end of the third year (6th semester), the students should have developed their understanding of core Physics by covering a range of topics in almost all areas of physics including Classical and Quantum Mechanics, Electricity and Electrodynamics, Relativity and spectroscopy, Thermal and Statistical Physics, Nuclear and Particle physics, Solid State Physics, Digital Electronics etc. along with one choice based courses, Open course and had experience of independent work such as projects; seminars etc. and thereby developing their experimental skills through a series of experiments which also illustrate major themes of the lecture courses.

## **SEMESTER I**

### **PH1BO1U-METHODOLOGY PERSPECTIVES OF PHYSICS**

This course will be an introduction to the pursuit of Physics, its history and methodology. The course also aims at emphasizing the importance of measurement, measuring instruments, sources of errors and estimation of errors which is central to physics. Developmental stages of physics and biography of scientist's especially Indian scientists develop scientific appreciation and scientific interest among students.

## **SEMESTER II**

### **PH2BOIU-MECHANICS AND PROPERTIES OF MATTER**

This course would empower the student to acquire engineering skills and practical knowledge, which help the students in their everyday life. The properties of solids especially knowledge of elasticity help the students to identify the materials suitable for the construction of buildings, houses etc.

Properties of fluids especially knowledge of viscosity and surface tension help the students in their daily life and agriculture. This syllabus will cater the basic requirements for their higher studies. This course will provide a theoretical basis for doing experiments in related areas.

## **SEMESTER III**

### **PH3BOIU –ELECTRONICS**

We are living in a wonder world of Electronics. The knowledge of basic principles and applications of Electronics is most necessary for a physics student. Students will get the ability to identify almost all electronic components and their working principles. Practical in this course will definitely enable the students to service or repair basic electronic equipment's like radio, television, electronic chokes, lamps etc. This course is intended to provide theoretical and practical knowledge about electronics.

## **SEMESTER IV**

### **PH4BO1U-ELECTRICITY AND ELECTRODYNAMICS**

Electricity and Electrodynamics have the key role in the development of modern technological world. Without electric power and communication facilities, life on earth stands still. A course in electricity and electrodynamics is thus an essential component of physics programme at graduate level. This course is expected to provide a sound foundation in Electricity and Electrodynamics.

Students should familiarize with electrical circuits, electrical connections, and storage devices their working etc. which will be quite useful in their daily life. Theoretical and practical knowledge about signal generating circuits enable the students to identify different communication techniques which will be useful in their daily life and higher studies

### **PH5BOIU-CLASSICAL AND QUANTUM MECHANICS**

This course is a prelude to advanced theoretical studies in Condensed Matter Physics, Spectroscopy, Astrophysics Electrodynamics and nuclear physics. It is conceptually rich and technically difficult. Special techniques are developed for attacking more realistic problems.

### **PH5BO2U-PHYSICAL OPTICS AND PHOTONICS**

This course aims to provide necessary foundation in optics and photonics which prepare the students for an intensive study of advanced topics at a later stage. Covering the very important and fascinating areas of interference diffraction and polarization with many experiments associated with it.

## **PH5B03U – THERMAL AND STATISTICAL PHYSICS**

This course is to develop a working knowledge of Thermal and statistical mechanics and to use this knowledge to explore various applications related to topics in material science and the physics of condensed matter.

## **PH5B04U – DIGITAL ELECTONICS**

This course is expected to provide necessary back ground for applications of electronics in mathematical computation. Students will familiarize with logic circuits and their applications which enable them to design logic circuits of their own.

## **PH5D01.1U- Open course**

### **AMATEUR ASTRONOMY**

This course is intended mainly for the students of other disciplines. So a secondary level knowledge of mathematics and physics is enough to study this course. But an inquisitive mind and curiosity are essential from the part of a student. Students from other discipline can identify stars, constellations and galaxies. They are also familiarizing with different types of telescopes, construction and working. This will enable the students to select good telescopes and cameras.

## **SEMESTER VI**

### **PH6B01U - COMPUTATIONAL PHYSICS**

This course is intended to give an insight to computer hardware and computer applications. Students will familiarize with microprocessors which are the back bone of computers. C programming enables the students to develop computer programme which can solve mathematical equations which will be useful for research and job

.

### **PH6B02U – NUCLEAR AND PARTICLE PHYSICS**

This course is intended to explore the interior of nucleus and interaction between nucleons. Students will get good theoretical basis of nuclear fission, which is the basis of atom bomb and nuclear fusion, basis of hydrogen bomb and energy production in stars. Students also familiarize with fundamental particles of nature and how these particles are interacting with each other and matter.



### **PH6B03U -- CONDENSED MATTER PHYSICS**

This course is intended to provide an introduction to the physics of Condensed Matter. This study attempts to explain various types of phenomena like electro-magnetic properties, super-conductivity and super fluidity. Material science is a very wide branch where extensive research is going on. Thermal, electrical, optical and magnetic properties of matter provide a strong foundation in that direction

### **PH6B04U - RELATIVITY AND SPECTROSCOPY**

This course is intended to introduce principles of spectroscopy and special theory of relativity. Spectroscopic studies were central to the development of Quantum mechanics and study of atoms and molecules. Theory of relativity provides intellectual food for students interested in theoretical studies.

### **PH6B05.1U – ASTRONOMY AND ASTROPHYSICS**

A good introduction to the basics of astronomy and astrophysics will be given in the course. Students from can identify stars, constellations and galaxies. They are also familiarizing with different types of telescopes, construction and working. This will enable the students to select good telescopes and cameras. It is expected that some of the students will opt for this specialization for their post graduation.

The Outcomes of UG Course, B. Sc. in Physics At the completion of B. Sc. in Physics students are able to: Demonstrate a rigorous understanding of the core theories & principles of physics, which includes mechanics, electromagnetism, thermodynamics, & quantum mechanics. Learn the Concepts as Quantum Mechanics, Relativity, introduced at degree level in order to understand nature at atomic levels. Provide knowledge about material properties and its application for developing technology to ease the problems related to the society. Understand the set of physical laws, describing the motion of bodies, under the influence of system of forces.

Understand the relationship between particles & atom, as well as their creation & decay. Relate the structure of atoms & subatomic particles understand physical properties of molecule the chemical bonds between atom as well as molecular dynamics. Analyze the applications of mathematics to the problems in physics & develop suitable mathematical

method for such application & for formulation of physical theories. Learn the structure of solid materials & their different physical properties along with metallurgy, cryogenics, electronics, & material science. Understand the fundamental theory of nature at small scale & levels of atom & sub-atomic particles.

## **Learning Outcomes for the BS program in Physics**

### Physics B.Sc. students will

- ***Content:*** demonstrate conversance with many topics in each of Classical & Relativistic Mechanics, Quantum Mechanics, Electromagnetism/Optics, Thermodynamics/Statistical Mechanics, and Mathematical Physics, as defined by the commonly-used undergraduate textbooks that we use, e.g. Taylor, Griffiths, and McIntyre. Not all topics in each subfield will be mastered or even addressed, but enough will be presented that students will be able to self-teach those not covered.
- ***Multiple representations of scientific information:*** demonstrate the ability to translate a physical description to a mathematical equation, and conversely, explain the physical meaning of the mathematics, represent key aspects of physics through graphs and diagrams, and use geometric arguments in problem-solving.
- ***Organized knowledge:*** be able to describe the big ideas in physics and articulate how these central concepts recur in physics – oscillations & waves, eigenstates, conservation laws, energy, symmetry, and discrete-to-continuous descriptions.
- ***Communication:*** demonstrate the ability to justify and explain their thinking and/or approach, both written and oral. Demonstrate the ability to present clear, logical and succinct arguments, including prose and mathematical language. Write and speak using professional norms, and demonstrate an ability to collaborate effectively.
- ***Problem-solving strategy:*** demonstrate the ability to organize and carry out long, complex physics problems, articulate expectations for, and justify reasonableness of solutions, state strategy/model and assumptions, and demonstrate an awareness of what constitutes sufficient evidence or proof.
- ***Intellectual maturity:*** demonstrate the ability to be aware of what they don't understand, as evidenced by asking sophisticated, specific questions; articulating where they experience difficulty; and taking actions to move beyond that difficulty.

- **Research:** make measurements on physical systems understanding the limitations of the measurements and the limitations of models used to interpret the measurements, computationally model the behavior of physical systems, and understand the limitations of the algorithm and the machine. Complete an experimental, computational or theoretical research project under the guidance of faculty and report on this project in writing and orally to an audience of peers and faculty.

## B.Sc. Physics

A) Students will be able to demonstrate their understanding of the foundations in physics (classical mechanics, computational physics, electricity and magnetism, modern physics, waves and optics, and quantum mechanics) by demonstrating competence in the major through appropriate homework assignments and examinations, particularly in their upper-level physics courses. Homework assignments within this learning outcome refer specifically to more traditional forms of mathematical and problem solving activities common to all physics classes (including lower-level introductory classes).

B) Students will be able to competently solve appropriate problems in upper level physics courses using increasingly important computational and mathematical tools, such as Mathematica. Specific courses include but are not limited to

- Phys 351 (Waves and Optics)
- Phys 360 (Astrophysics)
- Phys 370 (Modern Physics)
- Phys 380 (Mathematical and Computational Physics)
- Phys 396 (Special Topics in Physics)
- Phys 430 (Classical Mechanics)
- Phys 440 (Experimental Physics)
- Phys 450 (Electricity and Magnetism)
- Phys 460 (Statistical Mechanics)
- Physics 470 (Introduction to Quantum Mechanics)
- Phys 480 (Capstone Seminar)
- Phys 490 (Independent Study Projects in Physics)

C) Students will be able to demonstrate competency in experimental design and scientific data collection and analysis.

D) Students will be able to demonstrate competency in their understanding of scientific information, both orally and in writing.

E) Upon taking the foundational courses in physics (classical mechanics, computational physics, electricity and magnetism, modern physics, waves and optics, and quantum mechanics) students will be able to integrate competently the knowledge and skills acquired in the major and have adequate preparation to succeed in post-undergraduate studies or a professional career.

## **Student Learning Outcomes**

### **Learning outcomes for the physics undergraduate program**

- Students will demonstrate an understanding of core knowledge in physics, including the major premises of classical mechanics, E&M and Modern Physics.
- Students will demonstrate written and oral communication skills in communicating physics-related topics.
- Students will design and conduct an experiment (or series of experiments) demonstrating their understanding of the scientific method and processes. Students will demonstrate an understanding of the analytical methods required to interpret and analyze results and draw conclusions as supported by their data.
- Students will demonstrate proficiency in the acquisition of data using a variety of laboratory instruments and in the analysis and interpretation of such data.
- Students will utilize a wide range of printed and electronic resources and information technologies to support their research on physical systems and present those results in the context of the current understanding of physical phenomena.
- Students will demonstrate understanding of the applications of numerical techniques for modelling physical systems for which analytical methods are inappropriate or of limited utility.
- Students will demonstrate a thorough understanding of the analytical approach to modelling of physical phenomena.
- Students will demonstrate an understanding of the impact of physics and science on society.

## **Learning Outcomes**

### **Graduates with a major in physics will be able to:**

- Demonstrate a rigorous understanding of the core theories and principles of physics, which include mechanics, electromagnetism, thermodynamics, and quantum mechanics.
- Apply critical reasoning skills to model and solve physics related problems.
- Demonstrate proficiency in the collection, analysis and interpretation of data.
- Communicate scientific information in oral, written, and graphical formats.

# Department of Chemistry

## COURSE OUTCOMES

### SEM-I

#### **PAPER-I (Inorganic chemistry)**

##### **Unit-I**

- To know the basic concept of atomic structure, atomic orbital and shape of orbitals.
- Explain the discrete energy levels in which electrons orbit the nucleus of an atom.
- To learn the distribution of electron based no. of principles such as Aufbau, hunds rule etc
- To understand the fundamentals of the chemistry of the main group elements
- To study the relation of atomic structure to the periodic table of the elements

##### **Unit-II**

- To learn how to bond formed, strength of bond, energy of bond.
- To know the how the repulsion of bond occurs.
- To understand how to diatomic molecules are combined.
- How the predict geometries of simple molecules.

##### **Unit-III**

- To learn the entire concept of s-block and p-block of the periodic table and get to know the elements inside, Learn all about the s-block elements, including some of their distinguishing properties.
- To understand the application of s-block and p-block elements in biosystem.

##### **Unit –IV**

- To understand acid-base titration with different kinds of indicator.
- How the inert gases are different than other elements.

#### **Paper- II (organic chemistry)**

##### **Unit-I**

- To understand the Inductive effect, electromeric effect and the cleavage of bonds.
- Explain the types of reactions with suitable example.
- To learn the structure, shape of organic molecules like  $sp$ ,  $sp^2$ ,  $sp^3$  and reactivity of intermediates of carbocation, carbanions and free radical
- To study the strength of organic acids and bases.

## Unit-II

- To understand the basic concept of structural chain, position, functional group of isomerism and their types.
- To study the Wedge formula, Newman, sawhorse and Fischer representations repulsion.
- To understand how to chirality of two carbon atoms are combined and how to distinguish geometrical and optical isomerism.
- To understand theory and erythroisomerism, CIP rules, E/Z nomenclature.
- To study racemisation, resolution inversion, retention of configuration.

## Unit-III

- To understand how to prepare the alkane by wurtz reaction, Kolbe reaction and decarboxylation of carboxylic acid.
- To study the uses of alkane in day to day life for example L.P.G cylinder, C.N.G, octane number and Octane number.
- To study the uses of Baeyer's strain theory and strain less theory.
- Learn all about the manufacture procedure of alkene, including some of their distinguishing properties.
- To study the role of ozonolysis in biosystem.
- To understand how to identify alkynes from alkane and alkenes.

## Unit –IV

- To understand the preparation of phenol by decarboxylation, from acetylene and benzene sulphonic acid.
- To study the structure and orbital diagram of benzene and learn all about the aromaticity and Huckel's rule.
- How the activating groups are different than deactivating groups and direct influence in the light of modern electronic theory

## PRACTICAL OUTCOME FROM B.SC. 1<sup>ST</sup> YEAR

### PAPER-I (Inorganic chemistry)

- Student will be learning how to prepare a solution and the use of an analytical balance for mass measurement
- The use of graduated cylinders, graduated pipettes, and volumetric flask for volumetric measurement
- To learn the gravimetric and volumetric analysis.
- To understand the estimation of different types of elements.
- To learn determination of total hardness of water and how to distinguish the soft water and hard water this is useful for many purposes.

### Paper- II (organic chemistry)

- Student will be learning how to detect elements from unknown organic compound.
- Student will be learning qualitative organic analysis of organic compound possessing functional groups.

- The use of thermometers and temperature probes.
- To learn chromatographic method for separation of organic mixture.

## **COURSE OUTCOMES FOR B.Sc. 1ST YEAR**

### **SEM-II**

#### **PAPER-I (Organic chemistry)**

##### **Unit- I**

- To understand the types of nucleophilic substitution reaction like  $SN^1$  and  $SN^2$ .
- Students will be able to learn elimination reaction of alkyl halide with E1 and E2 reaction and how substitution reactions differentiate from elimination reaction.
- Students will be able to learn reactivity and relative strength of C-halogen bond in aryl halides.

##### **Unit- II**

- To understand the difference between the preparation of  $1^0$ ,  $2^0$  and  $3^0$  alcohols.
- The application of diols in day to day life.
- To learn preparation of phenol from different types of reactions.
- To study the comparative acidic strength of alcohols and phenols.
- To understand the synthesis and reactions of ethers and how the ethers are very useful in our life.

##### **Unit-III**

- To understand the nomenclature, structure and reactivity of carbonyl group.
- To learn the preparation of aldehyde and ketone from different types of methods
- Students will be able to learn Rosenmund reduction, Reimer-Tiemann reaction and Friedel-Craft's acylation.
- To understand the useful Aldol condensation and Benzoin condensation.
- To learn how Wolff-Kishner reduction and Meerwein-Ponndorf-Verley reduction are important.

##### **Unit-IV**

- Students will be able to learn nomenclature, structure and bonding in carboxylic acid.
- To understand the importance of carboxylic acid in biosystem and it is also related to the subject of Botany.
- To learn the most important Hell-Volhard-Zelinsky reaction.
- To study the concepts of dicarboxylic acid, its methods of formation such as effect of heat and work and how they are related or differentiated from carboxylic acid.
- Students will be able to learn the derivatives of carboxylic acid and their physical properties.

## **PAPER-II (Physical chemistry)**

### **UNIT –I**

- To understand mathematical Concepts.
- Students will be able to learn electrolytes, ionization of acid and bases
- Students will be able to acquire knowledge about solubility of product of sparingly soluble salts.

### **Unit- II**

- To acquire concepts in thermodynamics, different thermodynamic quantities such as heat and work and how they are measured, related or transformed from one to the other
- To know how to apply mathematical tools to calculate thermodynamic properties
- To know the basic thermodynamics laws.
- To understand the thermochemistry, to calculate the bond energy from thermodynamically data.

### **Unit-III**

- To understand the explain gas behaviour using kinetic molecular theory and study of molecular velocity
- To learn gas laws governing the physical and chemical behaviour of gases.

### **Unit-IV**

- To understand viscosity, surface tension and determination its method.
- To learn the determination of crystal structure of solid compound, symmetry of compound interfacial angles.

## **PRACTICAL OUTCOMES FOR B.Sc. 1ST YEAR**

### **SEM-II**

## **PAPER-I (Organic chemistry)**

- To learn the purification of organic compound by crystallization method.
- Students reported the melting point of sample before and after crystallization.
- Preparation of organic compound and determination of melting point by using thermometers and temperature probes.
- To study the different types of organic preparation with mechanism of various reaction, recrystallization and determination of melting point and calculation of quantitative yields.



## **PAPER-II (Physical chemistry)**

- To understand heatcapacity, enthalpy of neutralization, enthalpy of ionization, enthalpy of hydration of solution by performing practical
- To understand change in enthalpy
- To learn the use of PH meter for finding PH of different solutions like fruit juice, shampoo, soap, etc.
- the preparation of buffer solutions at a required pH, given a choice of solutions of acid/conjugate base pairs
- To understand how to determine relative viscosity of unknown liquids by using instrument Ostwald viscometer.
- To understand how to determine surface tension of liquids by using instrument stalagmometer.

## **COURSE OUTCOMES FOR B.Sc. 2nd YEAR**

### **SEM-III**

## **PAPER-I (Inorganic chemistry)**

### **Unit- I**

- To understand the Ionic solids, to calculate the lattice energy from given data.
- Students will be able to learn the most important Born-Haber cycle.
- To understand the types and properties of metallic bonding.
- Students will be able to learn free electron theory, valance bond theory and band theory.
- To understand the nature of conductor, insulators and semiconductors and how to use in electronic appliances.
- To study the basic concepts of hydrogen bonding with respect to their viscosity, solubility, melting point and boiling point.

### **Unit- II**

- Students will be able to learn first transition series elements with reference to their electronic configuration, atomic and ionic radii.
- To understand the different properties of first transition series elements this is obtained in our nature and known how to use this series that begins with scandium, titanium and ends with zinc.
- Students will be able to learn second and third transition series elements.
- To study the comparative treatment of second and third transition elements in respect of oxidation state, magnetic behaviour and stereo chemistry

### **Unit-III**

- Students will be able to learn errors in chemical analysis and to study how to differentiate random and systematic errors.
- To understand the Mean, median and standard deviation and significant figure and try to solve the related numerical problems which is very useful for mathematics and statistics and also useful for collecting and analysing numerical data.
- To learn theory of volumetric analysis

- To understand types and theory of acid-base titration with different kinds of indicator.
- To study how to use of redox titration and complexometric titration.

## **Unit-IV**

- To understand the classification and general characteristics reaction in non-aqueous solvent
- Students will be able to learn chemical fertilizers and how to use for farmers for producing food without affecting the environment as well as the surrounding ecosystem.
- To learn the advantages that fertilizers are very important for plant growth because it contains nitrogen, potassium and disadvantages that excess of fertilizers are harmful for crop production.
- To learn the manures, compost and how to use of chemical fertilizers.
- To understand the importance of raw materials and general composition of Portland cement
- Students will be able to learn the manufacturing process of cement like dry and wet process which is very useful binding materials in construction.
- To study the composition and characteristics of constitutional compounds, mortars, concrete and curing and to learn how its strength increases over time and it holds up well against weather conditions and is easy to maintain.

## **PAPER-II (Physical chemistry)**

### **Unit-I**

- To understand concepts in thermodynamics, different thermodynamic quantities such as heat and work and how they are measured, related or transformed from one to the other
- How to apply the mathematical tools to calculate thermodynamic properties?
- To know about thermodynamics laws.
- To understand the thermochemistry and to calculate the bond energy from thermodynamically data.

### **Unit-II**

- To understand second law of thermodynamics and why need of second laws of thermodynamic
- To gain Concept of entropy and how entropy as criteria of spontaneity and equilibrium
- To learn Helmholtz free energy and Gibbs free energy and their properties.
- To learn Van't Hoff equation has been widely utilized to explore the changes in state functions in a thermodynamic system.

### **Unit-III**

- To learn concept phase rules, phase, component and degree of freedom and application of phase rule to two phase equilibria.
- To understand Raoult's law of ideal solution
- To understand Henry's law and Nernst distribution law.

## **Unit –IV**

- To learn the determination of crystal structure of solid compound, symmetry of compound, interfacial angles, laws of rationality of indices.
- To understand crystal system and x – ray diffraction.

## **PRACTICAL OUTCOMES FOR B.Sc. 2nd YEAR**

### **SEM-III**

#### **PAPER-I (Inorganic chemistry)**

- Student will be learning how to prepare a solution and the use of an analytical balance for mass measurement
- To learn how to titrations, occur.

#### **PAPER-I (Physical chemistry)**

- To understand heat of solution, heat of ionization and critical solution of partially miscible liquids
- To learn the construction of phase diagrams of three component system.
- To know the molecular state of benzoic acid.

## **COURSE OUTCOMES FOR B.Sc. 2nd YEAR**

### **SEM-IV**

#### **PAPER-I (Inorganic chemistry)**

##### **Unit –I**

- To understand position of lanthanides and actinides in periodic table.
- To gain the concept of lanthanides and actinides elements and their characteristics.
- To learn how to identifies the periodic trends in physical and chemical properties of elements.
- To know the reactivity of elements and explain reasons for the anomalous behaviour.

##### **Unit- II**

- To understand coordination compound, warner's coordination theory and experimental verification.
- To learn effective atomic number rule, chelates and their application.
- To learn isomerism in coordination compound.

##### **Unit-III**

- To understand gravimetric analysis and different steps involve in gravimetric analysis.
- To know concept of hard acid and soft acid and bases.
- To learn green chemistry and its goals.

## **Unit-IV**

- To know the terms, oxidation, reduction, oxidizing agent and reducing agent.
- To understand redox stability in water
- To learn metallurgy and various steps in metallurgy
- To understand hydrometallurgy and pyro metallurgy.

## **PAPER-II (Organic chemistry)**

### **Unit-I**

- To understand the principle of UV spectroscopy.
- To know the difference type of excitation.
- To learn the basic principle of IR spectroscopy.
- Application of UV and IR spectroscopy.

### **Unit-II**

- Students will be able to understand to nomenclature, structure and bonding of carboxylic acid.
- To learn the reactivity of carboxylic acid.
- To understand the various preparation and chemical reaction of carboxylic acid and its derivatives.

### **Unit-III**

- Students will be able to understand to nomenclature, structure and bonding of Nitro compounds.
- To understand mechanism of nucleophilic substitution in nitro alkane.
- To learn about amino compound.
- To understand chemical reaction of amino compounds.

## **UNIT-IV**

- To understand the Quantitative analysis of C, N, S, H.
- Students should learn about active methylene compound (preparation and synthesis).
- To know about various organometallic compound and their reactivity and chemical reaction.

## **PRACTICAL OUTCOMES FOR B.Sc. 2nd YEAR**

### **SEM-IV**

## **PAPER-I (Inorganic chemistry)**

- Student will be learn how to prepare a solution and the use of an analytical balance for mass measurement.
- How to Use of graduated cylinders, graduated pipettes, and volumetric flask for volumetric measurement.
- To understand the gravimetric analysis.

## **PAPER-I (Organic chemistry)**

- Student will be learning identification of organic compound through element test, functional group test etc.
- To use of thermometers and determine Melting Point and Boiling Point of organic compound.

### **COURSE OUTCOME FROM B.Sc. 3rd YEAR**

#### **SEM V**

## **Paper- I (Organic chemistry)**

### **Unit-I**

- To understand magnetic properties of nucleus
- To gain the concept of principle of NMR.
- To know what is mean by nuclear shielding and deseilding, chemical shift, spin-spin coupling.
- To know how to elucidate the structure of organic molecule using NMR data.

### **Unit-II**

- To understand the molecular orbital diagram of heterocyclic compounds like furan, pyrrol, pyridine.
- To know electrophilic and nucleophilic substitution reaction on heterocyclic compound.
- To learn about different types of reagent like sulphur ylides, LDA etc.

### **Unit-III**

- To understand the classification and ring size determination of various carbohydrate.
- To learn about the amino acid, peptide and protein.
- To understand what is mean by fats, oil and detergent.

### **Unit –IV**

- To learn how the colour imparted on fabrics by dye.
- To understand the basic terms like auxochrome, chromophore, Otto witts theory.
- To discuss the definition, basic terminology and types of drugs.

## **Paper- II (Physical chemistry)**

### **Unit-I**

- To know the terms conductance, type of electrodes and electrolytes, conductivity, specific conductance, equivalence and molar conductance.
- To learn about kohltrausch law and conductometric titration.
- To understand the Arrhenius theory and Debye-Huckel theory

## **Unit-II**

- To understand the difference types of cell and its e.m.f and measurement.
- To learn how to determine the thermodynamics quantities.
- To learn about types of process and laws of electrolysis.
- To understand difference types of reversible electrodes.
- To learn about Nernst equation and its application.
- To know about salt bridge and its application in titration.
- To learn the concept of various types of potentiometric titration

## **Unit-III**

- To understand concept of quantum mechanics and classical mechanics with examples.
- To know what is DE-Broglie's hypothesis and Heisenberg uncertainty principle.
- To learn about Schrodinger wave equation and different operators.
- To learn about the application of particle in one dimensional box.

## **Unit –IV**

- To understand the various methods of concentration of solution
- To know about basic terminology-osmosis, lowering vapour pressure, osmotic pressure.
- To learn about quantum no. and its type and application.
- discuss different types of magnetic properties

## **PRACTICAL OUTCOME FROM B.SC. 3RD YEAR**

### **SEM-V**

#### **PAPER-I (Organic chemistry)**

- Students should understand about separation and identification of organic compound in given binary mixture.
- To learn about how the glucose, amide, can be estimated.
- To know the preparation pf drugs like aspirin and paracetamol

#### **Paper- II (Physical chemistry)**

- To determine strength of various acid by conductometric titration.
- how the FAS titrated by potentiometrically;
- To determine the saponification value of oil.

## **COURSE OUTCOME FROM B.SC. 3rd YEAR**

### **SEM –VI**

#### **PAPER-I (Inorganic Chemistry)**

#### **Unit-I**

- Valency bond theory, Crystal field theory: Splitting of d- orbital in octahedral, tetrahedral and square planar complexes.

- Crystal Field stabilisation energy of octahedral and tetrahedral complexes (Numerical).
- John Teller Effect, Selection Rules.
- Hole Formalism principle, electronic spectrum of  $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$  and  $[\text{Cu}(\text{H}_2\text{O})_6]^{2+}$  complex ion.

## **Unit-II**

- Method of determining of Magnetic Susceptibility by Gouy's method.
- Magnetic properties of Octahedral and Tetrahedral complexes with respect to CFT.
- Thermodynamic and Kinetic stability of metal complexes,
- Factors affecting the stability of complexes.
- Determination of composition of Fe(III)-SSA Complex by Mole ratio and Job's method.

## **Unit-III**

- Principle of photometry: Beer-Lamberts Law, and Its deviation.
- Types of colorimeter and spectrophotometer with simple schematic diagrams.
- Application of colorimeter and spectrophotometer in quantitative analysis.
- Chromatography: Classification, principle, technique and applications of paper chromatography.
- Ion- Exchange: Type of ion exchange resins, Applications in separation of binary mixture.
- CO-6: Solvent Extraction: Principle and classification, application in chemistry.

## **Unit-IV**

- Definition Nomenclature and Classification of Organometallic compounds.
- A brief account of metal ethylenic complex and Homogeneous Hydrogenation (Wilkinson's catalyst reaction).
- Metallo porphyrins structure and role of Hemoglobins and Myoglobin
- Biological role of  $\text{Na}^+$  and  $\text{K}^+$  and  $\text{Ca}^+$  metal ions
- Introduction of soil and its types, Chemical analysis of soil.

## **SEM-VI**

### **Paper II: Physical Chemistry**

#### **Unit-I**

- Schrodinger wave equation for hydrogen atom.
- Total wave function for hydrogen atom in terms of radial and angular wave functions.
- Concept of orbital and radial probability distribution curves for 1s, 2s, 2p, 3p and 3d orbitals.
- Criteria for forming M.O. from A. O. LCAO-MO method for  $\text{H}_2^+$  molecule.
- Introduction to M.O. Theory for  $\text{H}_2$  molecule. Introduction to Valency bond theory for  $\text{H}_2$  molecule.

## **Unit-II**

- Introduction of radiation with matter, Beer-Lamberts law of photochemistry. Jablonski diagram depicting various processes.
- Phosphorescence, chemiluminescence, quantum yield, determination of quantum yield of reactions.
- Photosynthesis of HBr from  $H_2$  and  $Br_2$  and photosynthesis, Photosensitized reactions.
- Electrical dipole moment, Determination dipole moment.
- Application of dipole moment to (i) % ionic character (ii) Shape of molecules. (iii) Study geometrical isomers and (iv) substituted benzene molecules.

## **Unit-III:**

- To know about basic principle, techniques, and application of chromatography.
- Ion-exchange, its type and application in binary mixture.
- To learn about extraction of solvent and its application in chemistry.
- To gain detail information about various fertilizer.
- To know about various methods of soil analysis.

## **Unit-IV**

- Adsorption chemisorption's, application of adsorption.
- Langmuir's theory of adsorption, adsorption chromatography.
- Types of colloidal system, its allocations, lyophilic and lyophobic sol, particle size range.
- Electrical properties: electrophoresis and electro osmosis, surfactant definition, types.

## **PRACTICAL OUTCOME FROM B.SC. 3RD YEAR SEM-VI**

### **Paper-I(Inorganic chemistry)**

- To understand the preparation of various complexes like potassium trioxalato ferrate, copper tetraamine complex.
- To perform jobs method and mole ratio methods to determine composition of Fe-SSA complex.
- To determine  $R_f$  value by paper chromatography.

### **Paper-II(Physical chemistry)**

- To verify the Beer-Lambert law for determination of concentration of  $KMnO_4$ .
- To determine molecular mass of non-volatile solute by Rast method.



# Department of Electronics

## Course Outcomes

### Objectives:

1. To enrich the understanding of fundamentals of semiconductor devices and circuits.
2. To have an awareness of digital electronics and programming language skill.

Students are able to

- Identify the electronics component and testing of components.
- Measure the AC, DC voltage and current.
- Design the low power regulated power supply and other small circuit.
- Troubleshoot the small electronics circuit.
- Implement the logic and logic circuit.
- Understand the assembler software and Assembly language programming skill.
- Programming in high level language (C Programming)

**This course meets with industrial requirement. Student can repair and maintenance the electrical and electronics equipment's.**

## Outcomes

### B.Sc. I Sem I (CBCS)

#### Paper I (Network Analysis & Digital Fundamentals)

- Students learn the networking concept. Due to this student know the type of circuit and how can it be implemented practically e.g. domestic wiring, series of LED etc.
- Students are able to connect the batteries in series and parallel form and also to circuit.
- They are able to measure the voltages and current in the circuit.
- Students learn the basic concept of number system & it type. They are able to know how it can be useful and implemented in digital electronics.
- Students learn the basic concept of digital electronics – they are able to understand the concept of logic and how it can be implemented in digital circuit.

#### Paper II (Semiconductor Diodes and Analog Electronics)

- Students learn the basic of semiconductor material and semiconductor components e.g. pn junction diode.

- Student learns the working of different diode and its utilization in the circuit.
- They are able to make simple dc power supply which can normally use for electronic gadgets.
- Students will be able to understand the Basic concept and working of transistor and it uses in the circuit.
- Students can analyze the amplifier parameter so that they can chose the audio amplifier or other amplifier as per their requirements.

## **B.Sc. I Sem II (CBCS)**

### **Paper I (Unipolar Device and Linear Integrated Circuit)**

Student will be able to understand

- The basic concept and working of unipolar semiconductor component and its application.
- Differentiate between BJT and FET.
- Classification amplifier i.e. power amplifier, voltage amplifier and where it is used.
- Need of Coupling of amplifier and how to couple one amplifier to other amplifier.
- Type of amplifiers and its frequency response, its application available in the market.
- Feedback concept in the circuits and type of feedback. Effect of feedback in the amplifier circuit.
- Basic concept of oscillator circuit, different type of oscillator circuits and use of oscillator in different application.
- Operational amplifier and its applications. Students can easily design own amplifier as per requirement.

### **Paper II (Digital Integrated Circuit)**

Student will be able to understand

- Logic analysis and design of combinational circuit. Student can implement the combinational digital circuit as per requirement.
- Basic concept of clock, timer circuit and flip flop and determine its application.
- The use of counter in the various applications.
- Various Shift register, digital to analogue converter and analogue to digital converter. Need and Application of these circuits in electronic equipment.

## **B.Sc. II SEM III**

### **Paper I (Amplifier)**

Student will be able to understand

- Basic concepts and analysis of amplifier, and its parameter. The can measure the various parameter of amplifier so that they can determine the gain, power and frequency response of amplifier.
- Classification of amplifier – student can identify the class of amplifier e.g. voltage amplifier, power amplifier etc.
- Frequency response and distortion of amplifier- student can determine the quality of amplifier.
- Operation amplifier and its parameter- students can differentiate the transistorized amplifier and operational amplifier with respect to its parameter.
- Operational amplifier Application – students can design the circuit using operational amplifier as per requirement.

### **Paper II (Digital Electronics – I)**

Student will be able to understand

- Logic analysis and design of combinational circuit. Student can implement the combinational digital circuit as per requirement.
- Basic concept of clock, timer circuit and flip flop and determine its application.
- The use of counter in the various applications.
- Various Shift register, digital to analog converter and analog to digital converter. Students can determine the need and Application of these circuits in electronic equipment.

## **B. Sc. II SEM IV**

### **Paper I (Power Amplifier, Oscillator and Power Supplies)**

Student will be able to understand

- Basic of power transistor and its uses in the circuit.
- The difference between voltage and power amplifier and it application.
- Different type of amplifier and they can determine the particular amplifier with respect to application.
- Basic concept of oscillation, Need of oscillator circuit in various electronic equipment.

- Different type of oscillator circuit and its application. Also they know the maximum frequency limit of oscillator circuit.
- Unregulated DC power supply and its disadvantages – student know the reason that why unregulated DC power supply is not used in the electronic and electrical equipment.
- Regulated DC power supply and its advantages – it is most preferred in all electrical and electronics equipment.
- Three terminal regulator IC – they are able to design regulated power supply for low power electronics equipment's.

## **Paper II (Digital Electronics – II)**

Student will be able to understand

- The concept of shift register and its application – they know that how serial data is converted into parallel form and vice versa.
- Classification of memory – student can determine the memory for a particular application.
- Memory organization and operation – they can expand the memory size with respect to word length and word size.
- Concept of semiconductor memory and its operation.
- Need of analogue to digital converter and digital to analogue converter in the electronics and instrumentation field.
- Type of Analog to digital converter and digital to analog converter – student can chose the converter as per requirement.

## **B.Sc. III SEM V**

### **Paper I (Microprocessor, Interfacing and PPI Devices)**

Student will be able to understand

- Basics of microprocessor – students know the operation of microprocessor at primary level.
- Feature of 8085 microprocessor.
- Instruction set and assembly language programming – students can develop programming skill in assembly language.
- Concept of interfacing and interfacing device – students are able to interface the device with microprocessor and program for it.

## **Paper II (C-Programming – I)**

On completion of the course, students are able to:

- Develop their programming skills.
- Be familiar with programming environment with C Program structure.
- Declaration of variables and constants.
- Understand operators, expressions and preprocessors.
- Understand arrays , it's declaration and uses.

## **B.Sc. III SEM VI**

### **Paper I (Microprocessor, Interfacing and Microcontroller)**

Students are able to understand

- Interfacing of peripheral device.
- Measurement of electrical quantity using microprocessor.
- Feature of 8086 microprocessor.
- Handling of assembler software.
- Assembly language Programming skill.
- Concept of Microcontroller and feature of 8051 microcontroller.
- Programming skill of microcontroller 8051.

### **Paper II (C-Programming – II)**

On completion of the course, students are able to:

- Design programs using Functions, Pointers, Structures and Unions in C language.
- Write a program using File Handling.
- Writing programs for drawing different graphical shapes.
- Develop programs using C to meet real world needs at primary level. This course provides platform to enhance student's basic skills required for advanced programming.

# **DEPARTMENT OF ZOOLOGY**

## **COURSE OUTCOMES ( With non CBCS & CBCS) B.Sc. Sem –I**

### **Paper I - ANIMAL DIVERSITY – INVERTEBRATES**

- Describe general taxonomic rules on animal classification
- Classify Protista up to phylum using examples from parasitic adaptation
- Classify Phylum Porifera to Echinodermata with taxonomic keys
- Describe Phylum Nematoda and give examples of pathogenic Nematodes

### **Paper II - ENVIRONMENTAL BIOLOGY**

- Know the biotic and abiotic components of ecosystem.
- Food chain & food web in ecosystem.
- Understand diversity among various groups of animal kingdom.
- Understand Animal community & ecological adaptation in animals.
- Scope , importance and management of biodiversity

### **Paper II Cell Biology (CBCS) From 2017**

- Students gain knowledge of different biomolecules and biochemical processes of cells  
Gather basic concepts of Cell Biology along with various cellular functions
- Develop deeper understanding of what life is and how it functions at cellular level.
- Describe cellular membrane structure and function, fine structure and function of cell organelles.
- Perform a variety of molecular and cellular biology techniques
- Ability to observe chromosomal arrangements during cell division

## **B.Sc. Sem. - II**

### **Paper I- Life And Diversity of Animals Arthropoda to Protochordata**

- Understand the evolution, history of phylum.
- Understand about the Non Chordate animals.
- Understand the taxonomy and structures of Arthropoda
- To study the external as well as internal characters of non chordates.
- To study the distinguishing characters of non chordates.
- Understand the economical importance of Molluscs
- Understand the various internal systems like Digestive system, nervous system.
- Understand the economical importance of Molluscan shells.

## **Paper II- CELL BIOLOGY**

- Students gain knowledge of different biomolecules and biochemical processes of cells
- Gather basic concepts of Cell Biology along with various cellular functions
- Develop deeper understanding of what life is and how it functions at cellular level.
- Describe cellular membrane structure and function, fine structure and function of cell organelles.
- Perform a variety of molecular and cellular biology techniques
- Ability to observe chromosomal arrangements during cell division

## **Paper II- GENETICS AND EVOLUTION (CBCS) FROM 2017**

- Described the fundamental molecular principles of genetics
- Understood the structure and function of DNA & RNA
- Understood about the transmission, distribution, arrangement, and alteration of genetic information and how it functions and is maintained in populations
- Described the basics of genetic mapping.
- To understand Origin of life with respect to prokaryotic and eukaryotic cells.
- Understand the evidences of organic evolution by anatomical embryological list, paleontological, physiological, genetics and molecular biology evidences.
- Understand theories of organic evolution, isolation, and speciation.
- Understand geological time scale, methods and classification of animal distribution and factors affecting animal distribution.

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

### **Paper- I- LIFE AND DIVERSITY OF CHORDATES**

- .Describe the diversity in form, structure and habits of vertebrates
- Explain general characteristics and classification of different classes of Vertebrates
- Understand various systems such as Digestive , Nervous , Circulatory , Respiratory, reproductive Systems

### **Paper II – DEVELOPMENTAL BIOLOGY**

- Understood and mastered on the basic concepts of developmental biology.
- Understood how fertilization, cleavage and gastrulating occur.
- Understood the basic concepts of organogenesis.
- Understood about the basic concepts of growth, regeneration and ageing
- Described the test tube baby and placentation in mammals.

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

### **Paper I- ANIMAL BEHAVIOUR AND EVOLUTION**

- To introduce animal behavior taking an integrative approach that addresses animal behavior from ethological, ecological and evolutionary aspects
- Review the basic concepts of behavior as a science.
- The course explain the basic concepts of animal behavior using two approaches ethology and behavioral ecology. It gives a thorough idea about biological rhythm and instinct behavior.
- Enable the students to understand the evolution of universe and life.
- Understanding on the process and theories in evolutionary biology.
- Develop an interest in the debates and discussion taking place in the field of evolutionary biology

### **Paper II- GENETICS AND GENETIC ENGINEERING**

- Understood the inheritance of mendelian traits.
- Understood the theories of classical genetics and blood group inheritance in man.
- Described the genetic variation through linkage and crossing over, chromosomal aberrations and sex determination.
- Understood the genetic defects and inborn errors of metabolism and genetic counseling and role of inbreeding and outbreeding.

## **B.Sc. Sem.- V**

### **Paper I- GENERAL MAMMALIAN PHYSIOLOGY- I**

- Understand the structure and function of carbohydrate, amino acids, proteins, and lipids.
- Understand the concept Enzymes and also Vitamins and minerals.
- Understand the Principle role of Vitamins in metabolism and Deficiency diseases.
- Understand the Digestion and Excretion process, by studying the Organs of it.
- Understand respiratory system, physiology of respiration and its disorders.
- Understand blood and circulatory systems .

### **Paper II- APPLIED ZOOLOGY I (AQUACULTURE AND ECONOMIC ENTOMOLOGY)**

- Identify various methodology and perspectives of applied branches of zoology
- Student understand aquaculture and practices and its management , construction of fish farm .Culture of prawn etc.



- Learn the basic principles involved in the culture and breeding of common edible and ornamental fishes and the art of aquarium keeping.
- Student understood various harmful insect pests and their control measures.
- Students will have comprehensive idea about sericulture, apiculture, lac culture

## **B.Sc. Sem.- VI**

### **Paper I- GENERAL MAMMALIAN PHYSIOLOGY- II**

- Student understood about nervous system , neuronal signaling .
- Understood muscular physiology and excretory systems and their functions .
- Student understood, identify and have comprehensive idea about all endocrine glands their structure, functions , hormones and their signaling.
- Students will have knowledge about male and female reproductive systems its structure and their functions.

### **PAPER - II : APPLIED ZOOLOGY –II**

**( BIOTECHNIQUES, MICROTECHNIQUES, IMMUNOLOGY, BIOINFORMATICS AND BIOSTATISTICS)**

- Student understood about various biotechniques such as Sterilization ,autoclaves , centrifugation ,electrophoresis chromatography
- Students will have the knowledge about various tissue techniques related to histological studies.
- Distinguish Innate immunity and Acquired Immunity
- Understand the importance of Immune system CO2.Apply the knowledge to collect various Biological data
- Understand the importance of Bio molecules
- Familiar with various Applications of Bioinformatics
- Came to know the data collection, tabulation and presentation.
  - Described the mean, median, mode and SD.
  - Understood the Analysis of Variance.
  - Described Student ‘t’ test and probability
  - Understood the Correlation and Regression.

# DEPARTMENT OF BOTANY

## COURSE OUTCOMES

### B.Sc. I SEM I (CBCS)

#### Plant Diversity- I (Micro-organisms, Algae, Fungi and Plant Pathology)

##### UNIT I

- Students learn general characteristics of life.
- Students learn general characteristics & nature of viruses, understand structure of T4 and TMV , and lean economic importance.
- Students understand structure Mycoplasma, pathogenicity
- Students learn Bacteria, Classification of on the basis of Gram Staining Bacteria, and economic importance.
- Students understand General character, ultrastructure and reproduction of *Nostoc*

##### UNIT II

- Students understand concept of plant kingdom.
- Students learn General characters, Classification (G.M. Smith, 1955) and Economic importance of algae
- Students learn Life history of – Chlorophyceae e. g. Oedogonium
- Students learn Life history of – Charophyceae e. g. Chara
- Students learn Life history of- Xanthophyceae e. g. Vaucheria
- Students learn life history of -Phaeophyceae e. g. Ectocarpus .
- Students learn life history of – Rhodophyceae e. g. Batrachospermum

##### UNIT III

- Students understand general characteristics Classification (G. C. Ainsworth, 1971) and economic importance.
- Students learn Life history of- Mastigomycotina e. g. Albugo.
- Students learn Life history of- Zygomycotina e. g. Mucor.
- Students learn Life history of- Ascomycotina e. g. Penicillium.
- Students learn Life history of- Basidiomycotina e. g. Puccinia
- Students learn Life history of - Deuteromycotina e. g. Cercospora

##### UNIT IV

- Students understand general characteristics, Types (Crustose, Foliose, Fruticose) and economic importance.
- Students understand Plant Pathology,
- Students understand viral Disease: Mosaic of Tobacco (TMV)
- Students understand Red rot of Sugarcane (*Colletotrichum fulcatum*).
- Students understand Brown spot of rice (*Helminthosporium oryzae*)
- Students understand loose smut of wheat (*Ustilago hordei*)
- Students understand bacterial disease: Bacterial Blight of Cotton (*Xanthomonas campestris*)

## **Plant Diversity- II**

### **(Bryophyta, Pteridophyta, Gymnosperm and Paleobotany)**

#### **UNIT I**

- Understand general characteristics, Classification (G. M. Smith) and Economic importance of Bryophytes.
- Learn life history of Hepaticopsida e. g. Riccia
- Learn life history of Anthocerotopsida e. g. Anthoceros
- Learn life history of Life Bryopsida e. g. Funaria

#### **UNIT II**

- Students fascinate by gaining the knowledge the Pteridophyta, General characteristics, classification (G. M. Smith) and Economic importance
- Understand telome theory and Types of stele.
- Learn External Morphology and Reproduction of Psilophyta e. g. Rhynia, Lycophyta e. g. Selaginella, Arthophyta e. g. Equisetum, and Filicophyta e. g. Marsilea.
- Students get idea about Concept of Heterospory and seed habit telome theory and Types of stele.

#### **UNIT – III**

- Students learn general characteristic Gymnosperm, classification (Sporne, 1965) and Economic importance.
- Students understand external Morphology and Reproduction of Cycadales e. g. (Cycas) and Coniferales (Pinus).

#### **UNIT – IV**

- Students fascinate by gaining the knowledge Paleobotany and Geological time scale.
- Understand the process of fossilization (Replacement theory, Infiltration theory)
- Learn types of fossils (Impression, Compression and Petrification)
- Students learn Fossil gymnosperm Glossopteris (Pteridospermatophyta) and Cycadeoidea (Cycadopsida).

### **B. Sc. BOTANY CBCS (Semester II)**

#### **Paper – I (Morphology and Anatomy of Angiosperms)**

#### **UNIT – I**

- Learn vegetative morphology of Angiosperm, Mode of living Autotrophic
- And Heterotrophic
- Understand habit erect forms, weak forms.
- Learn about normal root, modified root and its types.
- Learn about stem and its modification.
- Learn leaf, its parts and lamina (shape, margin, apex, base, surface, texture, venation).
- Learn types of leaves, its modification and phyllotaxy.

## **UNIT – II**

- Understand definition and types Inflorescence
- Understand flower is a modified shoot and types of flower.
- Learn Parts of flower perianth, Calyx, Corolla, Androecium, Gynoecium.
- Understand and acquired skill to write Floral formula and Floral diagram
- Learn about fruit and its types.

## **UNIT – III**

- Understand terminology of Meristems and classification (based on origin and position)
- Learn Newman Theory of Root apical Meristem
- Learn Tunica-Carpus Theory of Shoot apical Meristem
- Learn tissue and its types
- Understand the arrangement of vascular Bundle and types.
- Learns structure and function Xylem, Phloem, Cambium, Periderm.

## **UNIT – IV**

- Learn comparative study the primary structure of Dicot root (Sunflower) and monocot root (Maize).
- Learn comparative study the primary structure of Dicot stem (Sunflower) and monocot root (Maize).
- Learn comparative study the primary structure of Dicot leaf (Sunflower) and monocot root (Maize).
- Understand secondary growth in Dicot stem e. g. Moringa
- Understand anomalous secondary growth in stem Bignonia, Boerhaavia
- Dracaena
- Learn anomalous secondary structure in root Beta vulgaris (Beet).

## **Paper – II (Taxonomy & Diversity of Angiosperms)**

### **UNIT – I**

- Learn origin of Angiosperms according to Bennettitalic theory
- Learn primitive angiosperm – Magnolia.
- Fascinated by gaining the knowledge of fossil Angiosperms (Flower Saharianthus and fruit – Enigmocarpon).
- Students enjoyed Botanical nomenclature (principles, rules, taxonomic ranks, typification).
- Created interest by History of Theophrastus and Linnaeus taxonomic work.

### **UNIT – II**

- Learn classification of Angiosperms and types of classification (Artificial, Natural and Phyllogenetic).
- Learn System proposed by Bentham and Hooker and its Merits & Demerits.
- Understand skill of Herbarium Techniques.

### **UNIT – III**

- Learn diversity of flowering plants dicot families (Ranunculaceae, Malvaceae, Fabaceae (Pappilionaceae), Aesalpiniaceae, Mimosaceae, Solanaceae).

### **UNIT – IV**

- Learn diversity of Dicot families (Lamiaceae, Apocynaceae, Asclepiadaceae, Asteraceae, Euphorbiaceae).
- Diversity of flowering plants Monocot families Liliaceae, Poaceae, Orchidaceae.

## **B. Sc. BOTANY CBCS (Semester III)**

### **Paper – I**

### **(Reproductive Biology of Angiosperms, Plant Growth and Development)**

#### **UNIT – I**

- Students learn structure of Stamen, Microsporogenesis and Male gametophyte.
- Understand the Structure of Pistil, Megasporogenesis and Polygonum type female gametophyte.
- Learn the types of Embryo sac (Mono, bi and tetrasporic).
- Learning the structure and types of Ovules.
- Gain knowledge about Pollination types, contrivances of self and cross pollinations, also attractions and rewards.

#### **UNIT – II**

- Students will learn the information about Double fertilization and Triple fusion
- Get knowledge about Seed; Endosperm and its types; Embryo and its types.
- Information about Development of Dicot embryo (Onagrad type).
- Learn the Significance of seed: Ecological adaptations.
- Learn Seed dormancy; Suspended animation; causes and role of dormancy.
- Learn various methods to break seed dormancy and seed dispersal strategies.

#### **UNIT – III**

- Students understand about growth and development and phases of growth.
- Students get idea about plant regulators like Auxin, Cytokinin, Gibberelin, Absciscic acid and Ethylene
- Understand Plant Movements.

#### **UNIT – IV**

- Students learn the process of Photoperiodism.
- Learn about Physiology of flowering and process of Vernalization.
- Learn about phytochromes.
- Get idea about senescence and abscission.

## **Paper – II**

### **(Plant Biochemistry and Physiology)**

#### **UNIT – I**

- Learn the definition, structure and classification of Carbohydrates.
- Learn structure of Aldoses and Ketoses, monosaccharides (glucose), disaccharides (sucrose), polysaccharides (cellulose and starch).
- Learn the definition and classification of lipids, fatty acids, oils and waxes, phospholipids, sphingolipids, sterols.
- Understand structure of Protein, classification amino acids and peptide bond.

#### **UNIT – II**

- Students understand terminology of Enzymology and about mechanism action.
- Students understand nitrogen Metabolism.
- Acquire knowledge of properties of water, process of diffusion, osmosis and plasmolysis.
- Understand the Ascent of sap, Root pressure theory,
- Understand the process of transpiration. Types of Stomata and their mechanism, guttation.
- Learn about Phloem transport: Bulk flow theory (Munch hypothesis).
- Understand the theories of absorption of solute in plants.
- Learn active absorption, passive absorption.

#### **UNIT – IV:**

- Learn the process of Photosynthesis, photosynthetic pigments, cyclic and Non-cyclic photophosphorylation.
- Learn C<sub>3</sub>, C<sub>4</sub> and CAM pathway,
- Terminology respiration, its types, structure of ATP, respiratory substrates and respiratory quotient (R. Q.)
- Understand glycolysis, citric acid cycle, ETS, oxidative phosphorylation, factors affecting respiration.

## **B.Sc. Semester – IV (CBCS)**

### **Paper – I (Cell Biology, Genetics and Biotechnology)**

#### **UNIT – I**

- Students learn about all cell Biology and plant cell organelles (Cell wall, Plasma Membrane; General structure of Nucleus, Mitochondria, Plastids, Endoplasmic Reticulum, Golgi Complex, Vacuole, Lysosome, Peroxisome, Glyoxisome).
- Students learn Mitosis, Meiosis with respect plant cells.
- Learn about structure and replication of DNA.
- Students get knowledge about Plant Tissue culture .

#### **UNIT – II:**

- Students learn Mendel History and his Laws of inheritance (Dominance, Segregation and Independent Assortment).
- Understand Allelic and Non-allelic interaction of genes with reference to plants.
- Understand cytoplasmic inheritance.

### **UNIT – III:**

- Learn linkage and its types.
- Understand crossing over.
- Learn Variation in Chromosome number, Polyploidy and Aneuploidy
- Learn chromosome abnormality (Deletion and Deficiency, Duplication, Inversion and Translocation).
- Understand terminology Mutation and its types.

### **UNIT – IV**

- Learn various techniques of Genetic Engineering.
- Tools and techniques of Recombinant DNA technology.
- Learn process of Protein synthesis-transcription and translation.
- Understand the Jumping genes in Maize.
- Learn Regulation of gene action in Prokaryotes.

## **Paper – II (Plant Ecology)**

### **UNIT – I:**

- Students acquire knowledge of their environment.
- Learn Ecology, branches of ecology and significance.
- Learn climatic Factors and edaphic factors.
- Learn interactions between plants and animals, community and soil organisms.

### **UNIT – II:**

- Students understand structure and function of Ecosystem.
- Learn Biotic and Abiotic components, food chains, food web, ecological pyramid.
- Learn Biogeochemical Cycles (Water, Carbon, Nitrogen).
- Learn Environmental Pollution (Air, Water) and its control.

### **UNIT – III:**

- Learn terminology of Autecology and Synecology; understand community dynamics.

### **UNIT – IV:**

- Understand Plant Succession, climax.
- Fascinate about Phytogeography and also concept of continental drift
- Get idea about Phytogeographical studies of Chandrapur and Gadchiroli districts.
- Western Himalaya, Eastern Himalaya, Indus plane, Gangatic plane, Central India, Western coast, Deccan, Assam.

## **B. Sc.Semester V(CBCS)**

### **Discipline Specific Elective-I (DSE-I)**

#### **Paper-I (Genetics and Plant Breeding – I)**

##### **UNIT - I**

- Students learn History and terminology of genetics; Mendel's laws of Inheritance.
- Learn Non-Mendelian Inheritance.
- Understand Multipleallelism and Pleotropism.

##### **UNIT - II**

- Students get idea about Cytoplasmic Inheritance; Leaf variegation in *Mirabilis jalapa*; Mutations in mitochondrial DNA disease in humans; Maternal inheritance.
- Learn Chromosome theory of inheritance.
- Understand construction the Genetic maps with two point and three point test cross.
- Understand the Sex determination and sex-linked inheritance in *Drosophila*, humans and plants.
- Acquire information about Klinefelter and Turner's syndrome, Barr bodies, Lyon's hypothesis.

##### **UNIT - III**

- Students get information about important achievements of plant Breeding.
- Learn about crop improvement and modes of reproduction in crop plants.

##### **UNIT - IV**

- Students learn about plant genetic resources, acclimatization.
- Understand procedure, purpose, achievements and merits demerits of Plant breeding.
- Students get idea about process of Hybridization.
- Learn various techniques such as Emasculation methods, bagging, tagging, pollination, harvesting and storing of F1 seeds, selfing.
- Learn their advantage and limitations.

### **Discipline Specific Elective-I (DSE-I)**

#### **Paper-II (Genetics and Plant Breeding – II)**

##### **UNIT - I**

- Students learn structure and modern concept of Gene organization.
- Learn various types of RNA and their function –
- Understand the Salient features, Exceptions, Wobble-hypothesis in genetic code.
- Students get idea about method of replication of DNA in Eukaryotes.



- Learn about Gene pool, Gene frequency, Hardy-Weinberg Law.
- Fascinate study of Pedigree analysis Concept, symbols and sign.
- Learn Autosomal dominant, autosomal recessive, X-linked and Y- linked.

## **UNIT - II**

- Understand morphology and Structure of Chromosome.
- Understand Karyotype variations such as changes in chromosome number, structural alterations centromere position.
- Learn Lampbrush, Polytene and B- chromosomes.
- Learn Chromosome mapping, Chromosome banding technique.

## **UNIT - III**

- Students learn History, Genetic basis of inbreeding depression and heterosis, applications.
- Understand the Concept, mechanism and examples of quantitative inheritance.
- Get idea about Germplasm conservation- In situ seed banks, plant banks, shoot tip banks, cell and organ banks, and DNA banks.

## **UNIT - IV**

- Students learn about Plant breeding and methods of crop improvement – polyploidy breeding, mutational breeding and application of mutation breeding, limitations and achievements).
- Learn detailed concept hybridization and importance,
- Students understand the Role of biotechnology in crop improvement.
- Students acquire information about Genetic transformation of plants, Transgenic techniques, Bacteria and gene transfer in plants, Insect resistance,
- Understand the virus resistance, Disease resistance, Pest resistant plants (BT-cotton).
- Learn various herbicide resistance, disease and stress resistant plants.
- Learn transgenic crops with improved quality traits.

## **B.Sc. Semester VI**

**(credit with semester effect from: 2014-15)**

### **Paper – I (Plant Physiology, Growth and development)**

#### **UNIT I**

- Learn the process of Photosynthesis, photosynthetic pigments, cyclic and Non-cyclic photophosphorylation.
- Learn C3, C4 and CAM pathway.

#### **UNIT- II**

- Terminology respiration, its types, structure of ATP, respiratory substrates and respiratory quotient (R. Q.)

- Understand glycolysis, citric acid cycle, ETS, oxidative phosphorylation, factors affecting respiration

### **UNIT- III**

- Students understand about growth and development and phases of growth.
- Students get idea about plant regulators like Auxin, Cytokinin, Gibberelin, Absciscic acid and Ethylene
- Understand Plant Movements.

### **UNIT – IV**

- Students learn the process of Photoperiodism.
- Learn about Physiology of flowering and process of Vernalization.
- Learn about phytochromes.
- Get idea about senescence and abscission.

## **B.Sc. Semester VI**

### **Paper – II (Ethnobotany and Applied Botany)**

#### **UNIT-I**

- Learn details of Ethnobotany.
- Understand the methods in research and conservation of Ethnic societies of India.

#### **UNIT-II**

- Fascinate by gaining the knowledge of Ethno botanical plants.
- Students acquire knowledge about medicinal plants and narcotics.
- Understand the importance of ethnobotany.

#### **UNIT-III**

- Students acquire knowledge about Applied Botany.
- Students learn about introduction, and useful plants for Agroforestry such as Eucalyptus, Teak, Bamboo, Terminaliatomentosa
- Understand biofertilizer and various techniques of Culture of Blue-Green algaeg. Spirulina
- Learn Composting, Vermicomposting and its application.

#### **UNIT IV**

- Fascinate about study of Floriculture and its application.
- Understand Mushroom culture and its application.
- Students learn apiculture and its application.

# **Department of Computer Science**

## **Course Outcomes**

### **Programme: B.Sc. Sem-I**

#### **Course: Information & Communication technology**

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

1. Understand the concepts and need of primary and secondary memory.
2. Explain input and output devices.
3. Understand the meaning and basic components of a computer system
4. Understand the role of CPU.
5. Understanding Windows OS.
6. Understanding the concept of Network, Internet and Open source technologies.

### **Programme: B.Sc. Sem-I & Sem-II**

#### **Course (B.Sc. Sem-I) : Programming techniques & Introduction to C**

#### **Course (B.Sc. Sem-II) : Structured Programming with C**

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

1. Understanding the language evaluation.
2. Understand programming structures like sequence selection and iteration.
3. Draw algorithm and flowchart for any problem to solve them programmatically.
4. Understand basic concepts of programming in C.
5. Understand arrays, strings, functions, structures, unions and pointers.
6. Understand the sequential access and random access programmatically.
7. Understanding the concept of file management.

### **Programme: B.Sc. Sem-I**

#### **Course: Operating System & LINUX**

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

1. Understanding OS concept and its type.
2. Understanding the OS structure.
3. Understand the basic set of commands and utilities in Linux
4. Understand the anatomy of Linux operating system.
5. Perform backup and to create compress file and decompress them.
6. Perform operation on process.
7. Developing the shell script programs.

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

### **Course: Data base Management & System Analysis**

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

1. Understanding the basic terminology of DBMS.
2. Understand concept of various data model.
3. Perform normalization of database and its dependencies.
4. Gather data to analyze and specify requirements of a system.
5. Design system components and environment.
6. Creating various types of documentation related to project.

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

### **Course: Object Oriented Programming with C++**

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

1. Understand key structured programming, constructs declaration sequence, selection, repetition evaluating expression.
2. Understand C++ functions and the concepts related to good modular designs.
3. Understand pointers and reference parameters; understand the creation of class, object, operator overloading and Inheritance.
4. Handle files programmatically creating dynamic objects.
5. Understand virtual functions, need and pure virtual functions.
6. Understand mechanism of inline function, constructors, destructors, operator overloading and exception handling.

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

### **Course: Algorithm & Data Structure**

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

1. Developing the logic of the program using algorithm.
2. Understanding the basic concept of data structure.
3. Determine appropriate data structure as applied to specified problem definition.
4. Understanding the various searching and sorting methods.
5. Understand the concept of linear and non-linear data structure type.

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

### **Course: Visual Basic & Introduction To .NET**

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

1. Write, compile and execute applications using various controls like text box, command button.
2. Write, compile and execute applications using database connectivity like ADO, DAO.
3. Create database using MS-Access and visual Data managers.
4. Developing small application project.
5. Developing programming using .NET.

## **Programme: B.Sc. Sem-V**

### **Course: Data base Programming with ORACLE**

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

1. Understanding the concept of DBMS & RDBMS.
2. Perform queries related to DDL, DML, DCL and TCL.
3. Understanding cursors and triggers.
4. Understanding various SQL Functions.
5. Developing PL/SQL Programming.

## **Programme: B.Sc. Sem-V**

### **Course: System Analysis & Project Management**

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

1. Gather data to analyze and specify requirements of a system.
2. Design system components and environment.
3. Develop data flow diagram and decision tables.
4. Work as an effective team member on assigned projects.

## **Programme: B.Sc. Sem-VI**

### **Course: E-Commerce & HTML**

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

1. Understand basic internet terms.
2. Create effective HTML pages.
3. Developing framing concepts.
4. Understanding basic terms of E-Commerce.
5. Developing forms.
6. Create websites.

## **Programme : B.Sc. Sem-VI**

### **Course: Java Programming**

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

1. Understand model of Java Programming language.
2. Evaluate user requirement for software functioning.
3. Solve given problems using Java programming.
4. Create GUI applications
5. Create web applications.

# **DEPARTMENT OF MICROBIOLOGY**

## **COURSE OUTCOMES (CBCS)**

### **B.Sc. Sem -I**

**After completion of this semester students will be able to -**

#### **Paper I - FUNDAMENTALS OF MICROBIOLOGY**

- Understand the basic fundamentals of microbial world.
- Know interesting history behind the reveal of unknown microbial world to humans.
- Know about the scope of Microbiology, its branches and its impact on future research.
- Study structure of Bacterial cell and other important classes of microorganisms like Viruses, Archaeobacteria and Fungi in detail.
- Understand the Microbial Taxonomy in detail.

#### **Paper II - MICROBIAL TECHNIQUES**

- Understand various techniques in Microbiology to make invisible microorganisms visible which helps in their observation and study.
- Understand the concept, principle, construction, working and applications of various types of Microscopy.
- Gain the knowledge of stains and staining techniques used in Microbiology.
- Know various laboratory methods used for the cultivation of microorganisms.
- Know about the sterilization and disinfection techniques.

### **B.Sc. Sem - II**

#### **Paper I - GENERAL BIOCHEMISTRY**

- Understand the fundamentals of Chemical Microbiology.
- Know about biochemical principles in Microbiology.
- Gain the complete knowledge of Amino acids and Proteins.
- Develop deeper understanding of biomolecules like Carbohydrates and Lipids.
- Understand the biochemistry of microbial Nucleic acid.

#### **Paper II- APPLIED MICROBIOLOGY**

- Understand and aware of the fundamentals of National Mission on environmental cleanliness, health and hygiene.
- Become aware of beneficial and harmful effects of microorganisms in air by studying Air Microbiology.
- Develop deeper understanding about pure and polluted water.
- Understand various experimental techniques used for the bacteriological analysis of water.
- Gain the knowledge of mechanism of disinfection of water body by Chlorination.
- Understand the problem of Sewage.
- Get knowledge about the different sewage treatment methods.
- Become aware of harmful and beneficial effects of microorganisms in milk.

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

### **Paper I - MICROBIAL PHYSIOLOGY AND METABOLISM**

- Understand the fundamentals of bacterial physiology.
- Know the concept of bacterial growth and various methods used for the measurement of bacterial growth.
- Develop deeper knowledge of Enzymology.
- Understand the fundamentals of metabolic pathways in microorganisms.

### **Paper II – FOOD, SOIL MICROBIOLOGY AND MICROBIAL ECOLOGY**

- Understand the fundamentals of Food Microbiology.
- Develop deeper understanding about Microbiology of Soil.
- Gain knowledge about various Microbial Associations found in nature.
- Understand the Biological Nitrogen Fixation by soil microbes in detail.
- Gain the knowledge of importance of microorganisms in Environmental Biotechnology.

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

### **Paper I - INDUSTRIAL MICROBIOLOGY**

- Understand the fundamentals of industrial process and mechanism behind the product formation.
- Properly understand the design of typical fermentation plant.
- Know importance of specific microorganisms in fermentation production processes.
- Understand Industrial production process in a stepwise manner.
- Gain knowledge about the large scale production of important fermentation products having great economic value.

### **Paper II - MOLECULAR GENETICS AND MOLECULAR BIOLOGY**

- Understand the fundamentals of microbial genetics.
- Developed deeper understanding about the fundamentals of DNA and RNA.
- Properly understand the process of Protein Synthesis.

## **B.Sc. Sem - V**

### **Paper I - MEDICAL MICROBIOLOGY**

- Study microbes that infect humans, types of diseases they cause, their diagnosis, and prevention and treatment methods.
- Developed knowledge about the Host-Parasite relationship in infectious diseases.
- Understand the fundamental knowledge of dynamics of disease transmission and their control.
- Developed deeper understanding about the different microbial mechanisms responsible for their pathogenicity.

## **Paper II - BIOINSTRUMENTATION**

- Understand the fundamental knowledge of Bioinstruments and Analytical techniques.
- Develop deeper understanding about the different analytical techniques used for identification and separation of components in biological mixtures.
- Properly understand the principle and working of some important analytical techniques like Spectrophotometry, Chromatography, Electrophoresis, Blotting, Centrifugation and Radioactivity.

## **B.Sc. Sem - VI**

### **Paper I - RECOMBINANT DNA TECHNOLOGY**

- Properly understand the fundamental knowledge of Genetic Engineering.
- Developed deeper knowledge about the complex yet much more useful technique in recent times i.e. Recombinant DNA Technology.
- Gain knowledge of latest advanced techniques used in Molecular Biology.
- Get to know the wide area of applications of genetic engineering in Medical, Agriculture and Medicine field.

### **PAPER II - IMMUNOLOGY**

- Understand the fundamental knowledge of Immune System.
- Understand the concept of Antigen and Antibody.
- Properly understand the principle behind Antigen-Antibody reactions in Serology.
- Become aware of infectious diseases.
- Understand the reason behind serious diseases like Hypersensitivity and Autoimmune disorders in humans.