



## *Programme Specific Outcome*

**On Successful completion of CBBT, students will be able to:**

- PSO1. Demonstrate technical skills required for synthesis and structural characterization of organic & inorganic compounds to cater to the requirement of industries.
- PSO2. Understand the hazards associated with carrying out chemical experiments in terms of chemical toxicity, chemical stability and chemical reactivity for environmental sustainability.
- PSO3. Analyze the relationship between plants, animals and microbes towards conservation of the biosphere.
- PSO4. Design and develop solutions from medicinal plants for various health problems, disorders and diseases prevailing in the society.
- PSO5. Understand the importance of Recombinant DNA technology, cloning Cell culture and other techniques in solving critical industrial and environment related issues

## ***Course Outcome***

**On Successful completion of CBBT, students will be able to:**

### **Semester I**

#### **CHEMISTRY**

##### ***I Sem CHE.T1-1***

- CO1.1 Students will gain an understanding of the application of mathematical tools to calculate thermodynamic and kinetic properties
- CO1.2 Students will be able to explain the principle involved in the process of liquefaction of gases which are used for scientific, industrial and commercial purposes.
- CO1.3 Define and distinguish the various types of errors encountered in qualitative experimental measurements and apply their skills in minimizing the error.
- CO1.4 Deep knowledge on the modern periodic table and periodic properties which stands as the backbone in understanding Chemistry
- CO1.5 Predict chemical and physical properties of molecules and materials, which is useful to many fields of science and engineering.
- CO1.6 Inculcates the better understanding of the organic chemistry and to have qualities of chemist

##### ***Practicals***

##### ***CHE.P1-1***

- Develop skills on calibration of Glass wares, preparation of solutions of varied concentrations
- Estimate the concentration of solutions by volumetric analysis.

#### **BOTANY**

##### ***BOT.T1-1***

- CO1.1 Enumeration of the microbial world.
- CO1.2 Provide insight on plants-microbes interaction.
- CO1.3 Thorough knowledge on the diversity of morphology and reproduction of few selected forms of Viruses, Bacteria, Cyanobacteria and Phycology.
- CO1.4 Elucidate the importance of Bacteria, Cyanobacteria and algae in the field of industries, agriculture and medicines.

CO1.5 Inculcating a complete knowledge on microbes and algae towards sustainability.

### ***Practicals***

#### ***BOT.P1-1***

- Handling Microscope.
- Principle, working and applications of instruments viz, Autoclave, Incubator, Inoculation loop, LAF and Hot air oven.
- Identification and staining technique of Bacteria, Cyanobacteria and Algae.
- Submission of a report based on visit to a neighbouring waterbody and study of phytoplanktons in the water sample.

## **BIOTECHNOLOGY**

### ***BIT.T1-1***

#### ***PART A: CELL BIOLOGY***

- CO1.1 Students will understand basic knowledge of cell theory, overview of plant and animal cell and detailed note on plasma membrane which will acquaint students the basics of Cell Biology.
- CO1.2 Thorough knowledge on structure and functions of membrane bound organelles, which will acquaint students the basics of Cell Biology.
- CO1.3 Emphasize on structure of Chromosome with deeper understanding on Karyotype and Chromosome banding techniques, significant in Cytogenetics lab.
- CO1.4 (A) Students will understand the mechanism of Cell division, Cell senescence and Cell death and get familiarize at molecular level.
- CO1.4 (B) An insight on Cancer biology and significance of oncogenes and tumor suppressor genes with examples.
- CO1.5 An understanding on Cell-cell interactions and introduction of Cell signaling concept at B.Sc level to facilitate students with research inclined outcome.

#### ***PART B: GENETICS***

- CO1.1 An insight on types of inheritance with broader scope on understanding Mendelian genetics with solved problems.
- CO1.2 Students will understand types of Gene interactions and familiarize them to solve real-life problems on Mendelian inheritance.
- CO1.3 To understand types of Sex Determination which will help students in Applied Genetics.
- CO1.4 An insight on Linkage and Crossing Over mechanism with understanding on Chromosome mapping technique and applications.
- CO1.5 (A) Students will familiarize with Chromosomal aberrations and understand types of Mutations with significance of mutation breeding in plants.
- CO1.5 (B) An insight on concept of Human Genetics with inheritance patterns and chromosomal anomalies in humans and construction of Pedigree chart will be acquainted.

CO1.5(C) Students will acquaint on types of Transposable elements with mechanism of transposition in maize and drosophila which form basis for molecular genetics.

***BIT.P1-1: BIOTECHNOLOGY-I***  
**(CELL BIOLOGY AND GENETICS)**

- Measurement of cell size, isolation of organelles, Karyotype analysis, squash preparation for cell division, construction of pedigree analysis.
- To solve real-life problems associated with genetic disorders and relate to natural examples.

**Semester II**

**CHEMISTRY**

***II Sem CHE.T2-2***

- CO2.1 Gain the knowledge on implementing the basic techniques to monitor the properties of liquids and solutions which are valuable methods to control the quality of incoming and final products in many industrial areas.
- CO2.2 Photo means light. Exposure of light on different chemicals produce colour of chemicals and also can carry out chemical conversion. This course discussed the theoretical basics of photochemistry.
- CO2.3 Chemical bonding theory (covalent, ionic, metallic) explains how atoms are held together in these different types of structure. This theoretical chemical bonding knowledge, backed up with experimental evidence, helps scientists to design and engineer new materials with desirable properties for specific uses.
- CO2.4 Students will be acquainted with the knowledge on application of zeolites in the water treatment processes.
- CO2.5 Students will be able to compare the properties of noble gases and design their applications in relevant fields such as metallurgical processes, photography, medical imaging systems, radiotherapy etc.
- CO2.6 Impart technical knowledge about chromatographic techniques and their applications for separation of inorganic and organic compounds.
- CO2.7 Recognize and distinguish between aromatic and anti-aromatic compounds by their structures.
- CO2.8 Illustrate the mechanism involved in SN2 reactions, SN1 reactions, E1 reactions and E2 reactions of alkyl halides.

### *Practicals*

#### **CHE.P2-2**

Determine physical properties such as density, viscosity and surface tension of given liquids

Determine the molar masses of electrolytes, non electrolytes and transition temperature of salt hydrates.

### **BOTANY**

#### ***BOT.T2-2***

CO2.1 Determining the scope, variation in structure, reproduction and application of fungi.

CO2.2 Know the prevention and control measures of plant diseases and its effect on crop plants.

CO2.3 Understand the morphology, reproduction, life cycle and importance of Bryophytes.

CO2.4 Familiarizing with the internal structure of vascular plants.

CO2.5 Application of wood in various industries.

### *Practicals*

#### ***BOT.P2-2***

- Free hand Sectioning and learning of the internal anatomy of plant parts.
- Identification of Fungi, Plant Diseases and Bryophytes.
- Preparing herbaria for plant pathology specimens.
- Report submission on Mushroom cultivation.

### **BIOTECHNOLOGY**

#### ***BIT.T2-2***

##### ***PART A: GENERAL MICROBIOLOGY***

CO2.1: An outlook on the important discoveries that led to the development of Microbiology and its current scope, Major scientists in the history of microbiology and their contributions.

CO2.2: Acquaint students with the construction, working principle and applications of different types of microscopes used in Microbiological study.

CO2.3: An overview on the different life forms, their characteristics features and their significance

CO2.4 (A): An insight into the growth characteristics, different modes of reproduction and genetic recombination in bacteria.

CO2.4 (B): An outlook on the need of culture media and its uses, microbial growth requirements and the different methods of obtaining pure cultures.

CO2.4(C): An understanding on the different aseptic techniques used in microbial culture practices and sterilization purposes.

CO2.5: Familiarize students with some of the important pathogens, their disease process, diagnosis, treatment and preventive measures.

### ***PART B-BIOSTATISTICS***

CO2.1: An insight into the organization of data obtained in a sample study in tabular or graphical format making it convenient for researchers to understand the outcome of the study

CO2.2: It helps in understanding how data from a sample study is distributed from its lowest to highest values and the point at which they are centrally placed.

CO2.3: It helps in understanding the variation of data from its central values

CO2.4: Familiarize on the use of hypothesis testing to obtain a correct conclusion of the data obtained from population studies.

CO2.5: Helps students to use statistical tools to analyse the data and to predict the possible outcome of occurrence of an event

### **BIOTECHNOLOGY- II (GENERAL MICROBIOLOGY)**

- Microbiological instruments, maintenance of glass wares and safety measures taken in a laboratory when working with live cultures
- Techniques used for isolation and characterization of microorganisms
- Significant laboratory tests performed for identification of microorganisms.

## **Semester III**

### **CHEMISTRY III Sem CHE.T3-3**

CO3.1 Apply the first and second laws of Thermodynamics to various gas processes and cycles

CO3.2 Understand temperature dependence of equilibrium constant; Van't Hoff reaction isochore, Van't Hoff reaction isotherm

CO3.3 Determine the rate, extent of chemical reactions and explain the concept of activation energy, its relation to the variation of reaction rate with temperature

CO3.4 Define and explain surface and interfacial phenomena.

CO3.5 Describe the properties and applications of the biodegradable and non- biodegradable polymers and discuss their consequences for the environment.

CO3.6 Demonstrate an integrative approach to environmental issues with a focus on sustainability

CO3.7 Interpret the reactions and properties of alcohols and phenols.

CO3.8 Explain and rationalize the synthesis, structure and reactivity of organometallic compounds

### *Practicals*

#### **CHE.P3-3**

- Skilled with fundamental practical knowledge in the synthesis and purification of organic compounds on lab scale.
- Separation of a mixture of two organic compounds by thin layer chromatography and column chromatography.

## **BOTANY**

### ***BOT.T3-3***

CO3.1 Equipped with the knowledge of first evolved vascular plants and to understand the structural and reproductive diversities.

CO3.2 Identification of new traits to differentiate Pteridophytes and Gymnosperms.

CO3.3 Knowledge of ecological, edaphic and biotic factors regulating different ecosystems and their components.

CO3.4 Elucidate the importance of biodiversity and its conservation, and geographical distribution of plants in India and Karnataka.

### *Practicals*

#### ***BOT.P3-3***

- Identification of Tracheophytes.
- Estimation of Chloride and Oxygen content in water.
- Enumerate various parameters of Edaphic Factor.
- Identifying plants with ecological adaptations.

- Report submission on case study/ survey with reference to topics related environment.

## **BIOTECHNOLOGY**

### ***BIT.T3-3: BIOTECHNOLOGY- III (BIOCHEMISTRY AND BIOPHYSICS)***

- CO3.1: Students are given an insight on the basic building blocks of cells – amino acids and proteins, their structural organization and biological significance. An understanding of a class of proteins which functions as catalyst in biological system, their mechanism of action and structural composition
- CO3.2: Helps students understand the significance of energy and structural component of the cell- monosaccharide and their properties. A deeper understanding of the different types of carbohydrates and their biological significance.
- CO3.3: An overview on the structure of fatty acids, their types and biological significance.
- CO3.4: A deeper understanding of the functions of various organ in the human body and the routine tests needed to check their normal functioning.
- CO3.5: An insight into the various food sources and their dietary significance. An understanding of the need to take the right nutrient sources for maintenance of proper biological functions and disorders associated with their deficiency.
- CO3.6: An outlook on the concept and applications of Biophysics
- CO3.7: A detailed understanding of the relevance of pH and buffers both in biological system and in experimental studies and the method of preparing buffers.
- CO3.8: An understanding of different analytical instruments and techniques employed in laboratories and industries for analysis, separation and purification of biomolecules.
- CO3.9: An insight into the working principle of instruments based on use of different light ranges in molecular analysis.
- CO3.10: A basic understanding on the principle of radioactivity and their applications

### ***Practicals***

#### ***BIT.P3-3: BIOTECHNOLOGY- III (BIOCHEMISTRY AND BIOPHYSICS)***

- Preparation of different concentration of solutions
- Accurate pipetting of solutions useful for quantitative estimation of biomolecules
- Basic steps involved in quantitative estimations like preparation of standard table and determination of unknown concentration from the standard constructed.
- Separation techniques like chromatography and centrifugation techniques
- Protein purification methods and their quantification
- Enzymology studies

- Conducting diagnostic tests used for organ function, blood sugar and lipid profile in an individual.

## **Semester IV**

### **CHEMISTRY**

#### ***CHE.T4-4***

- CO4.1 Interpret phase diagrams for binary mixtures, identifying the phases and components present in each region.
- CO4.2 Describe the principles concerning solid state structures and specific crystal structures by applying basic crystallographic concepts
- CO4.3 Analyze BOD and COD of waste water and describe steps involved in sewage treatment
- CO4.4 Acquainted with the basic knowledge of radiation and nuclear chemistry; requirements, methods of preparation, uses of radioelements
- CO4.5 Interpret the reactions and properties of ethers and epoxides.
- CO4.6 Illustrate the reactions and preparations of aldehydes and ketones.
- CO4.7 Design reactions of carboxylic acids and their derivatives.
- CO4.8 Understand the fundamentals including thermodynamics and phase relations in the production of *ferroalloys*.

#### ***Practicals***

#### ***CHE.P4-4***

- Analyze the mixture of two inorganic salts quantitatively
- Able to conduct practical experiments on solvent extraction and separation of metal ions by paper chromatography.

### **BOTANY**

#### ***BOT.T4-4***

- CO4.1 Knowledge on development and organization of reproductive organs in angiosperms.
- CO4.2 Enumeration of pollen morphology, identification, classification and its application.
- CO4.3 Understanding the process of inter-relationship of anther and ovule with respect to fertilization and post fertilisation changes.
- CO4.4 Familiarise with physiological process of water and nutrient transport.
- CO4.5 Understanding of stress physiology in plants with reference to selected physical factors.

### ***Practicals***

#### ***BOT.P4-4***

- Identification of various stages of development in anther and ovule.
- Understanding the plant vascular tissues water relations.
- Learn the importance of mineral nutrients in the growth of plants.
- Preparation and submission of permanent slides from pollen grains and section of ovules.

## **BIOTECHNOLOGY**

### ***BIT.T4-4: BIOTECHNOLOGY- IV***

#### ***(MOLECULAR BIOLOGY AND GENETIC ENGINEERING)***

- CO4.1: Understand basics of DNA and RNA and familiarize with basics in Molecular biology.
- CO4.2: Acquaint students with different forms of DNA and problems on DNA topology and Eukaryotic gene structure.
- CO4.3: explain mechanism DNA replication and DNA repair mechanism in prokaryotes and eukaryotes.
- CO4.4: An insight on Transcription in prokaryotes and eukaryotes and eukaryotic Post-transcriptional modification which will help students to familiarize with Molecular biology.
- CO4.5: Describe mechanism of Translation in prokaryotes and eukaryotes and eukaryotic Post-translational modification with special mention on Genetic code.
- CO4.6: Understand the mechanism of gene regulation in prokaryotes and eukaryotes.
- CO4.7: Familiarize students with basics of Genetic engineering tools with focus on different vectors, enzymes and construction of recombinant DNA molecule.
- CO4.8: Impart knowledge on methods of isolation of vector and foreign DNA and overview of applications and technique of Genomic and cDNA library.
- CO4.9: Describe Transformation and Screening techniques and its applications
- CO4.10: Understand technique and applications of Genetic engineering techniques with current biotechnology industry updates.

### ***Practicals***

#### ***BIT.P4-4: BIOTECHNOLOGY***

#### ***(MOLECULAR BIOLOGY AND GENETIC ENGINEERING)***

- Familiarize with model making of different types of DNA and quantification of nucleic acids.
- In-depth knowledge on isolation of nucleic acids from various sources (plant and animal) and solving problem on DNA topology
- Hands on experience on routine molecular techniques such as Transformation, PCR, Agarose gel electrophoresis and SDS-PAGE electrophoresis.

## Semester V

### **CHEMISTRY**

#### ***CHE.T5-5***

- CO5.1 Explain the criteria for chirality and discuss axial, planar and helical chirality
- CO5.2 Interpret the reactions and properties of amines and recognise the main differences between aliphatic and aromatic amines.
- CO5.3 The fundamental theoretical understanding of heterocyclic chemistry of synthesis, particular properties and reactions for the most important heterocyclic compounds and their structure.
- CO5.4 Understand the different classes of carbohydrates and important terms related to carbohydrates and structure elucidation of glucose and structures of important disaccharides.
- CO5.5 Elucidate citral and zingiberene and some important terpenes structure and their uses.
- CO5.6 Define general Characteristics and elucidate the structure of nicotine and some important terpenes structure and their uses.
- CO5.7 To interpret UV-Visible spectroscopy, basic principles of UV-Visible spectroscopy, relevant terms of UV-Visible spectroscopy and graphical representation of simple organic compounds.
- CO5.8 To interpret IR spectroscopy, basic principles of IR spectroscopy, examine infrared spectroscopy and molecular structure determination by the simple molecules
- CO5.9 Develop an understanding of the significance of the number, positions, intensities and splitting of signals in nuclear magnetic resonance spectra.
- CO5.10 Appreciable knowledge on Synthesis and usefulness of different dyes and drugs.

#### ***CHE.T5-6***

- CO6.1 Evaluate fundamentals of electrochemistry, conductivity measurements and titration curves
- CO6.2 Construct an electrochemical cell diagram, including identifying the anode, cathode, direction of electron flow, sign of the electrodes, direction of ion flow in salt bridge, from a redox reaction.
- CO6.3 Describe types of electrolyte and degree of ionization, represent ionization of weak acids and bases, degree of hydrolysis and hydrolysis constant. Elucidate solubility product of sparingly soluble salts and applications of solubility product.
- CO6.4 Emphasized on the importance HPLC plays in research and quality control in the pharmaceutical and biotechnology industries, and educate students on the various applications of HPLC.

- CO6.5 Explain the fundamentals of molecular spectroscopy, principles of Rotational spectroscopy and calculate bond lengths and atomic mass from rotational spectra of diatomic molecules, Isotope effect on rotational spectra
- CO6.6 Explain the principles of Vibrational spectroscopy, an harmonic nature of vibrations , Stereo chemical effects on the absorption pattern
- CO6.7 Examine the Raman spectra and molecular structure determination of the simple molecules.
- CO6.8 Knowledgeable of current electroanalytical techniques and Capable of identifying the most appropriate electroanalytical technique for a specific analysis

### ***Practicals***

#### ***CHE.P5-5***

- Analyze the organic compounds through functional group determination qualitatively.
- Isolate the caffeine and lycopene from tea leaves and tomatoes respectively.

#### ***CHE.P5-6***

- Apply the physical chemistry principles in the determination of physical constants and have hands on experience in handling the instruments associated with it.
- Interpret the experimental results, draw conclusions, and communicate effectively through oral and written reports

## **BOTANY**

#### ***BOT.T5-5***

- CO5.1 Study different types of classification to understand the evolution.
- CO5.2 Understanding the functionality of various Herbaria and Botanical gardens.
- CO5.3 Acquire knowledge on taxonomic study through molecular, numerical and chemical evidences.
- CO5.4 Identification of selected families of Polypetalae, Gamopetalae, Monochlamydeae and Monocotyledons based on Bentham and Hookers system of classification.
- CO5.5 Correlating the diversity and richness of the flowering plants of the country with their economic importance.

#### ***BOT.T6-6***

CO6.1 Deep understanding of the process of Nitrogen metabolism, Photosynthesis and Respiration in plants.

CO6.2 Comprehend the assimilation of different biochemicals.

CO6.3 Knowledge on plant growth and applications of Phytohormones.

CO6.4 Understand the process of defence mechanism displayed in Plants.

CO6.5 Knowledge on Sensory photobiology and Movements exhibited by plants.

### ***Practical***

#### ***BOT.P5-5***

- Students learn Herbarium techniques and assign flowering plants to family level.
- Economic importance of plants and various parts modified as food storage organs in plants.
- Submission of herbarium sheets of angiosperms and Economic Botany Chart.

#### ***BOT.P6-6***

- Identification and estimation of different phytochemicals from plant sources.
- Determination of various by-products evolved during different metabolic activities of plants.
- Separation of photosynthetic pigments using Paper chromatography.
- Submission of Mini Project report.

## **BIOTECHNOLOGY**

### **BIT.T5-5 BIOTECHNOLOGY**

#### ***PART- A: GENETIC ENGINEERING***

CO1.1 Students will familiarize with basic tools used in genetic engineering.

CO1.2 Understand various methods of isolation of vector and foreign DNA and overview of applications and technique of Genomic and cDNA library.

CO1.3 Students gain knowledge about various Transformation and Screening techniques and its applications.

CO1.4 Impart understanding on various technique and applications of Genetic engineering significant in biotechnology industry.

CO1.5 Familiarize with applications of Genetic engineering in human health with suitable examples.

## ***PART - B: ENVIRONMENTAL BIOTECHNOLOGY***

- CO1.1 Focused on awareness related to environment in particular with fuel crisis.
- CO1.2 An insight on conventional and modern fuels with suitable examples.
- CO1.3 Students will familiarize with production of bio fertilizers with commercial examples.
- CO1.4 Students will gain knowledge on Bioleaching with illustrations.
- CO1.5 An overview on Biopesticide and its applications
- CO1.6 Gain knowledge on Bioremediation with underlying mechanism and suitable applications.
- CO1.7 Understand the concept of waste management with emphasis on SWM and current methods against waste management.

### ***Practical***

#### **BIT.P5-5 BIOTECHNOLOGY**

##### ***(GENETIC ENGINEERING AND ENVIRONMENTAL BIOTECHNOLOGY)***

- Hands on experience on routine molecular techniques such as PCR, Agarose gel electrophoresis and SDS-PAGE electrophoresis.
- Routine Quality analysis of water- MPN, Total hardness and BOD determination
- Isolation of beneficial microorganisms (Rhizobium and VAM) as Biofertilizer

#### **BIT.T5-6 BIOTECHNOLOGY**

##### ***PART- A: IMMUNOLOGY***

- CO1.1 Insight about the history, scope of immunology and different types of immunity.
- CO1.2 An overview of different organs, cells of immune system and their functions.
- CO1.3 Students gain in depth knowledge about antigen, antibody and production of monoclonal antibodies.
- CO1.4 Introduce about Complement system, their properties and their functions.
- CO1.5 An overview about the autoimmune disorders, hypersensitivity with suitable examples.
- CO1.6 Impart deeper understanding on techniques based on Antigen-antibody interactions which is significant in diagnostic labs
- CO1.7 An overview of different types of vaccines and immunization which will generate awareness among students.

##### ***PART - B: ANIMAL BIOTECHNOLOGY***

- CO1.1 Students familiarize with animal cell culture requirements and media preparation.
- CO1.2 An outlook on basics of cell culture techniques.
- CO1.3 Students will study about Transfection technique with suitable commercial examples.

CO1.4 An overview about the applications of animal biotechnology significant in animal husbandry.

*Practical*

**BIT.P5-6 BIOTECHNOLOGY**

**(IMMUNOLOGY AND ANIMAL BIOTECHNOLOGY)**

- Hands on experience on laboratory procedure used in diagnostic labs for detection of immunological disorders and disease identification
- Isolation and culturing method in animal cell culture laboratory.

**Semester VI**

**CHEMISTRY**

***CHE.T6-7***

CO7.1 Identify the principles, structure and reactivity of selected coordination complexes and Interpret their electronic spectra and magnetic properties.

CO7.2 Develop an appreciation for the scope, diversity, and application of organometallic chemistry

CO7.3 Determine the shaping and the selection based on the use of various field of refractory materials.

CO7.4 Knowledge on the types, properties and applications of abrasives, glass, cement and ceramics.

CO7.5 Describe the extraction separation process, understand the equipment for extraction and apply the principles of extraction.

CO7.6 Understand the synthesis of nanomaterials by determining appropriate solution method, explain types of conducting polymers, superconductivity, nanomaterials and their applications

***CHE.T6-8***

CO8.1 Gain knowledge on significance with an historical account of the development of biochemistry highlighting landmarks and achievements. Describe elemental and biochemical composition of living organisms, major functions of cell organelles and role of water in biological systems.

CO8.2 Acquainted with the chemistry of carbohydrates, significance and determining the calorific value.

CO8.3 Classification, structure and biological importance of Lipids. Properties and biological importance of triglycerides and phosphoglycerides. Detailed structure of cell membrane.

CO8.4 Describe the classification and structural organisation of proteins, ionic properties and reactions of amino acids.

CO8.5 ATP and other high energy compounds. Stepwise process of biological oxidation.

CO8.6 Components of nucleic acids. Polynucleotide structure of DNA. Biological roles of DNA & RNA. Central dogma of molecular biology, Replication, transcription and translation.

CO8.7 Describe the characteristic features, classification, kinetics, and inhibition of enzymes

CO8.8 Discuss the characteristic features and classification of hormones. Role of insulin and glucagon in homeostasis

CO8.9 Describe the metabolism of Carbohydrates, lipids and proteins

CO8.10 Principle and applications of Paper chromatography and TLC, Adsorption

Chromatography. Electrophoresis– SDS-PAGE, UV-visible spectrophotometry, and Reverse osmosis.

### ***Practicals***

#### ***CHE.P6-7***

- Estimate the metal ions present in the given solution titrimetrically and gravimetrically
- Preparation and analysis of metal complexes.

#### ***CHE.P7-8***

- Use of apparatus such as colorimeter, pH meter to obtain reproducible data from biochemical experiments.
- Preparation of buffers for different biochemical experiments.
- Implement protocols to analyse clinically significant metabolites such as glucose, creatinine, inorganic phosphate, cholesterol.
- Demonstrate knowledge and understanding of biochemical techniques for separation of molecules such as paper chromatography, TLC.

## **BOTANY**

#### ***BOT.T7-7***

CO7.1 Understanding the Chromosomal Biology and significance of Cell division.

CO7.2 Familiarising Plant Genetics and Sex determination.

CO7.3 Gaining knowledge on plant breeding and its importance in Polyploidy.

CO7.4 Evolutionary concepts and its significance in achieving plant hybrids.

#### ***BOT.T8-8***

CO8.1 Understanding about the genomic organization and DNA replication.

CO8.2 Learning the steps involved in Biosynthesis of proteins and their regulation in Prokaryotic and Eukaryotic cells.

CO8.3 Elucidate the fundamentals of Recombinant DNA Technology.

CO8.4 Knowledge on Genetic Engineering and its significance.

CO8.5 Principles and basic protocols for Plant Tissue Culture.

CO8.6 Applications of Biotechnology in Plant and Human welfare.

### ***Practicals***

#### ***BOT.P7-7***

- Preparation and Identification of different stages of cell divisions.
- Solving Genetic Problems to understand the factors governing the alleles.
- Learning various vegetative plant propagation techniques.
- Submission of prepared permanent slides of different stages of cell divisions.

#### ***BOT.P8-8***

- Estimation of RNA.
- Extraction of DNA from plant sample.
- Micropropagation.
- Submission of a Report on Industrial visit.

## **BIOTECHNOLOGY**

### ***BIT.T6-7***

#### ***BIOTECHNOLOGY-VII (PLANT BIOTECHNOLOGY)***

CO1.1 Familiarize with Plant tissue culture techniques, different types of media and growth hormones significant in plant tissue culture lab.

CO1.2 Understand technique of Micropropagation with various case study and applications in different field of agriculture, horticulture and forestry.

CO1.3 Gain knowledge about Organ culture techniques and their applications.

CO1.4 Impart understanding on technique and applications of Somatic hybridization with special mention on Cybridization.

CO1.5 An insight on different methods of *invitro* production of plant secondary metabolites with applications.

CO1.6 Understand the mechanism of transgenic plant production and their applications.

CO1.7 Familiarize about Intellectual Property Right (IPR) and their significance.

CO1.8 Understand types of stress in plants and emphasize on different methods of production of stress-resistant plants with suitable examples.

***Practicals***

***BIT.P6-7***

***BIOTECHNOLOGY-VII (PLANT BIOTECHNOLOGY)***

- Handling of laboratory equipments and maintenance of aseptic conditions within plant tissue culture lab.
- Preparation of media, culturing techniques in plant tissue culture laboratory.

**The practicals will involve project-based learning to enable students to gain experience in planning and executing a project with focus on teamwork, time-management and effective use of resources.**

***BIT.T6-8***

***BIOTECHNOLOGY-VIII (INDUSTRIAL BIOTECHNOLOGY)***

- CO1.1 An overview to basic principle involved in fermentation technology, isolation of microorganisms and strain improvement.
- CO1.2 Introduce to different fermentation types, types of media and different sterilization conditions which is significant in industrial set up.
- CO1.3 Students learn about the principle, construction and applications of various fermenters, commonly found in industries.
- CO1.4 Explain different techniques for recovery and purification of various compounds.
- CO1.5 Understand commercial applications of microbial fermentation with various examples.
- CO1.6 An insight on production of Biotechnological products of commercial value using fermentation technology.
- CO1.7 Focus on application of fermented foods and enzymes in various commercial industry, dairy and food industry

***Practicals***

***BIT.P6-8***

***BIOTECHNOLOGY-VIII (INDUSTRIAL BIOTECHNOLOGY)***

- Lab and pilot scale production of products of commercial importance by microbial fermentation process.
- Hands on experience on working of pilot-scale Fermenter
- Industrial visits will gain practical knowledge for students.

**The practical will involve project-based learning to enable students to gain experience in planning and executing a project with focus on teamwork, time-management and effective use of resources.**