

Bachelor of Science

CHEMISTRY, ZOOLOGY & BIOTECHNOLOGY (CZBT)

Programme Outcome

After completion of B.Sc. program in either Physical Sciences or Life Sciences the student will be able to:

- PO1. Understand the basic concepts of science, its relevance to society and impact on the human race and environment.
- PO2. Effectively communicate scientific ideas through electronic media, report writing and publication of articles.
- PO3. Display the spirit of team work and collaboration towards building healthy inter personal relationships.
- PO4. Demonstrate the ability for critical thinking and logical reasoning towards scientific research.
- PO5. Exhibit self-confidence, high self-esteem and a sense of pride for themselves and the nation.
- PO6. Acquire the ability to engage in self-learning and lifelong learning towards building resilience in the dynamic macro environment.
- PO7. Recognize the ethical, cross-cultural and historical context of environmental issues and the links between human and natural systems.
- PO8. Identify specific issues concerning the nation, critically evaluate and find solutions through application of knowledge of science.

Programme Specific Outcome

On Successful completion of CZBT, 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. Understand the importance of applied Zoology in various fields such as Sericulture, Apiculture, Aquaculture, Vermiculture, Industrial microbiology & Zoology, rDNA technology and medicine.
- 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 CZBT, 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.

ZOOLOGY

I Sem: ZOO.T1-1

- CO1.1: This unit helps to understand evolution of animals at various levels. This knowledge finds applications in evolutionary biology, paleontology, phylogeny and so on.

- CO1.2: Origin and evolution of single celled organism paving path to understand physiology, reproduction and other physiological functions at unicellular level.
- CO1.3: This unit will enable students to understand the cellular grade of organization, which is crucial to understand cell-cell interactions, evolution of higher organisms.
- CO1.4: Applications in phylogenetic studies
- CO1.5: Origin and evolution of tissue grade of animals. This unit also deals with importance of coral and coral reef which is world's amazing natural phenomenon. Coral reefs as habitat for array of other organisms creating a biodiversity in itself and a need for protection of coral reefs.

Practicals

ZOO.P1-1

- Learn how to use and handle microscopes – both simple and compound microscopes.
- Study of bottled specimens and permanent slides bridges the gap between the theoretical and real-time knowledge.
- Knowledge of parasites, their life history and their prophylaxis equip the students to quickly identify similar infections and diseases wherein timely intervention could improve the health of the individual.

BIOTECHNOLOGY

I SEM 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)

Practical knowledge in Cell Biology and Genetics will strengthen student's confidence in obtaining skills which include:

- 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.

ZOOLOGY

II Sem: ZOO.T2 – 2

- CO2.1: This unit deals with unique characters along with general characters which signifies phylum Arthropoda as one of the most successful phyla existing from billions of years. Type study of prawn, respiratory organs, sense organs of Arthropoda will reinforce the evolution of organs which are precursor for other next level of organization among animals.
- CO2.2: As soft bodied organism with external exoskeleton, which phylum is unique in its own way, which has enormous economical benefits employed in aquaculture.
- CO2.3: Echinoderms are unique, spectacular and exclusively marine animals. Students understand survival strategies of these creatures in oceans.
- CO2.4: Phylogenetic applications.

CO2.5: All the topics in this unit deals with imparting basic theoretical knowledge to students which shall help them to pursue their interest in future (M.Sc. sericulture, M.Sc. Fisheries so on) and also become entrepreneurs.

CO2.6: Importance of animals from minor phyla in maintaining ecosystems, ecological balance, biodiversity

Practicals

ZOO.P2-2

- Students learn to observe and identify different animals based on the museum specimens and permanent slides provided.
- Knowledge on insect vectors help in the mitigation and management of insect pest.
- They learn the skill of doing minor dissections which later aids them in the research field.

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

BIT.P2-2: BIOTECHNOLOGY- II **(GENERAL MICROBIOLOGY)**

Students can have hands-on exposure on some of the routinely practiced microbiology procedures like

- 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.

ZOOLOGY

III Sem: ZOO.T3-3

- CO3.1- Identify and summarize the morphological and anatomical features and basis of chordate classification. Know how to examine and describe representative species for chordate subphyla; such as Cephalochordata, Urochordata, Hemichordata, and Vertebrata. The course gives a clear idea about the evolution of anatomical and organo-systems of Amphioxus features of the different classes of chordates especially vertebrate animals including fishes and tetrapods that are the matter of study in this course. Compare between specific characters of chordates classes using their representative examples.
- CO3.2- This unit helps understand the evolution of fishes at various level and also about different system in scoliodon.
- CO3.3- This unit helps to know how amphibians play important role in nature both as predator and prey. At the end of the lesson, the students will be able to define Parental Care, explain parental Care in Amphibians, list the different modes of Parental Care in amphibians and elucidate how they protect their eggs and young ones
- CO3.4- Adaptive radiations of reptiles helps to know the existence of a suite closely related species adapted to exploit different habitats or life style Adaptive features of crocodile and turtles has special focus on how the structure has adapted in response to the functional requirements of the different habits and habitats
- CO3.5- Migration helps in finding the geographical location of birds in adverse condition. understanding flight adaptation inspires the students to come up with new models for more sustainable and efficient air craft.
- CO3.6- Migration has considerable ecological significance, the findings of these study emphasize the importance of trans –frontier areas in conservation of the greater land scape
- CO3.7 - This unit helps to know the process in different industries such as poultry, pisciculture and dairy. This unit help students in understanding of experiential learning on the methodology of fish culture, poultry and dairy. It will also provide information about economic aspects of culturing animals. It would promote Community and Youth Development.

CO3.8 - It helps to improve practical knowledge about handling experimental animals, which motivates students for research.

Practicals

ZOO.P3-3

- The students understand the biological significance of the prepared slides and bottle specimens.
- Study of Dissections of various systems of shark and rat are crucial in understanding the basic models of research.

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

Practical:

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

IV Sem 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

ZOOLOGY

IV Sem: ZOO.T4-4

- CO4.1 - The unique features of humans helps to know why humans are different from other animals. it is a practical oriented subject and interesting in knowing about their own system. It helps in clearing the fundamental concepts as to how our bodies function. Studying different body system helps to know their vital role in physiology and it is foundation for their higher studies. Studying nervous system helps to know about the neurons and their function.
- CO4.2 - This unit illustrate the structural and fundamental unit of living organisms, studying giant chromosomes helps to study function of genes in transcription. Cell to cell Interaction puts a foundation to understand immune system. Biology of cancer describes the fundamental mechanistic principles behind cancer diagnosis and prevention.
- CO4.3 - This unit able to identify the cellular and molecular basis of immune responsiveness and describe the role of the immune system in both maintaining health and contributing to disease. The antigen and antibody reaction helps to know about blood transfusion and also about drugs and vaccine
- CO4.4- This unit helps to identify the basic structure of cells, tissues and organs and describe their contribution to normal function and also helps in identifying pathological condition of tissues. Studying histological techniques helps them to take tissue sections and slide preparations in their higher studies

Practicals

ZOO.P4-4

- Students learn the comparative structures of heart, brain, skin and integument which gives them a clear view on the function and origin of organs.
- They learn to prepare whole mounts, permanent slides and other laboratory preparation which increases their practical skill component in handling various cells and tissues.

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.

Practical:

***BIT.P4-4: BIOTECHNOLOGY- IV
(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

ZOOLOGY

ZOO.T5-5

CO5.1- The students develop a clear understanding on the working principles and fundamentals of ecology which makes them sensitive to their immediate environment in which they live. It also gives a bird's view on the current environmental issues like global warming, green house effect, Acid rain and Global ozone layer depletion wherein the cause, effects and mitigation are discussed which equips the students to solve the real-time issues on an individual level. The unit also enlightens students on aquaponics which nurtures them to be entrepreneurs.

CO5.2- The students demonstrate an understanding of the core concepts of toxicology, identify different types of toxins, compare how wide spread they are and discuss perceptions of their effects including hazard identification, and an understanding of the mechanisms of action and effects of toxic chemicals at multiple levels of biological organization. Demonstrate critical thinking skills including creative thinking, innovation, inquiry, and analysis, evaluation and synthesis of information. The students can analyze and identify simple domestic and agricultural pest problems and formulate ethical solutions using the principles of IPM. Students understand the new and renewable source of energy available in nature and develop innovative ideas on using cost-effective, sustainable and clean energy to overcome the energy crisis and improve the economic development of the country. Students learn about solid waste management, disposal and recovery and can apply the knowledge to reduce carbon footprint on an individual level. The students can identify different species of wildlife and are sensitized to the need of conserving them and are aware of human wildlife conflict and how to mitigate it. Students develop knowledge on remote sensing, different types of satellite and sensors, GIS and apply the concept to solve issues in forestry department, resource management, urban planning and many more.

CO5.3: Students grasp knowledge on instinct and acquired behavior of animals, their social and migratory behavior which helps them to identify, interpret and resolve adaptive problems in behavioral ecology. Helps students to understand human behavior and learn better survival strategies. Understanding of biological and circadian rhythms equip students to understand and improve the efficiency of their body physiology. Knowledge of various types of animal communication can inspire the students to come up with creative ideas to develop new methods of communication. The unit sparks the student's interest to pursue higher studies and research in the field of wildlife and forestry, animal studies and many more.

ZOO.T5-6

CO6.1: This unit will give the knowledge about basic topics of developmental biology, like development and formation of male and female gametes, different types of eggs and egg membrane. Students also learn about different patterns of development and mechanisms of fertilization. These basic knowledge's help the students in their higher studies. Students can confidently take this paper as specialization.

CO6.2: The unit II is continuation of unit I, student will get detailed knowledge about early development of organisms. This unit deals with blastulation, gastrulation and neurulation, types of placenta, transplantation experiment. This gives detailed knowledge to the students about development after fertilization. This also tells about how development differ from one organism to other, this basic learning about development make the students curious and they may show interest towards further detailed study through research. Therefore these studies may create more research interest in students.

CO6.3: This unit is very interesting to students because this deals with evolution of organism including man and origin of new species. Learning about Darwinism creates excitement in student to know more about evolution, origin of new species and evidences of evolution. This basic knowledge will help the student while taking up competitive exams in life science. All together this makes the student more fascinated towards research on evolution.

Practicals

ZOO.P5-5

- Students learn to examine and estimate various limnological parameters like BOD, Salinity, DOM, pH and total hardness.
- They learn on various unique ecological adaptations of animals which generate ideas on creating bio mimicking products.
- They also learn statistics which is helpful in understanding and interpreting data.

ZOO.P5-6

- Students understand the embryological aspects of animal development which enable them for further thought synthesis of the topic.
- They also learn about evolution through specimen evidences and connecting links.

BIOTECHNOLOGY

BIT.T5-5 BIOTECHNOLOGY- V

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- V

(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- VI

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- VI (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.

ZOOLOGY

ZOO.T6-7

- CO7.1 - Topics in this unit help students to have a strong fundamental knowledge of inheritance of genes. Advanced topics namely epigenetics, role of RNA in inheritance and gene silencing help to understand gene regulation. Its applications are in the field of drug designing, plant and animal biotechnology.
- CO7.2 - This unit deals with causes for various syndromes, gene mutations which are responsible for onset of diseases, cancer etc. Knowledge about mutation is important for gene therapy. In pharmaceutical industry to develop drugs to counteract the effects of mutations and also nutraceutical industry, Research & Development of new drug target molecules for cancer treatment,
- CO7.3 - This unit deals with basic knowledge of genetic engineering which has enormous potential in various fields. Some of the applications of the same are - gene therapy, animal improvement, fermentation industry/ breweries, bio-engineering, forensic sciences, fingerprinting technique for hybrid plant for better yield.

ZOO.T7-8

- CO8.1 - Study of Animal Physiology helps in understanding the physiological functions of the human organs and disorders, diagnosis and preventive measures associated with it. Muscle physiology is one of the important aspects in the field of physiotherapy, sports. To understand about neurotransmitter, their role in aging neurological disorders, like stress, epilepsy, Alzheimer's and their diagnosis. To enhance the knowledge in the topics in pharmaceutical fields, Diagnostic centers, Hospitals etc
- CO8.2 - It provides basic knowledge of the endocrine system, its functions and how homeostasis is maintained. To understand role of endocrine hormones, their role in controlling mood, growth, the way organ works, metabolism and reproduction especially in adolescence.
- CO8.3 - To provide students with a broad conceptual background of biological sciences. To demonstrate a thorough understanding of important principles and laboratory techniques, in at least two different biological sub disciplines - (a) Cellular and molecular biology (b) Organism biology and physiology. To have a general understanding of the standard laboratory tools. Methodology and process of biological research and scientific writing. To gain the knowledge about the assays and analyzing data in different fields of biology.

Practicals

ZOO.P6-7

- Students learn drosophila genetics which paves way in analyzing and correlating higher studies on genomics in research field.
- They also learn to perform many experiments on genetics and biotechnology which furthers their interest and expertise in the field.
- Students present Investigatory Research paper which inculcates research interest and identify new, frontier areas in the field of research and development.
- This unique initiative has helped students to hone their soft skills (presentation, analytical)

ZOO.P6-8

- By performing physiological experiments, students understand and analyse the principles which governs the system physiology of organisms.
- Students develop hands-on skills while performing various techniques.

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.

Practical:

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.

