



Deccan Education Society's

Fergusson College (Autonomous), Pune

Program Specific Outcomes(PSOs) and Course Outcomes (COs) 2019-20

Department of Biotechnology

Programme: B.Sc. Biotechnology

PSO No.	Program Specific Outcomes(PSOs) Upon completion of this programme the student will be able to
PSO1	<ul style="list-style-type: none"> (i) Demonstrate comprehensive knowledge, imparted by highly qualified and competent faculty, and develop interdisciplinary skills in the fields of Biotechnology. (ii) Acquire good experimental and laboratory skills applied in biotechnology and allied subjects in well-equipped and state of the art laboratories. (iii) Understand the scope and applications of biotechnology and acquire competence in the domain of Biotechnology to enable bright future prospects.
PSO2	<ul style="list-style-type: none"> (i) Demonstrate conceptual learning through systematic thinking and self - study and life- long learning that helps to solve scientific problems in the field of Biotechnology. (ii) Apply appropriate tools and techniques in biotechnology, to design and perform experiments proficiently and become competent to pursue higher studies or join the industry sector. (iii) Acquire good oral and written communication skills. (iv) Discuss the upcoming fields of Biotechnology. (v) Experience opportunity to participate in/manage/curate many co and extracurricular activities for overall development.
PSO3	<p>Research Competence:</p> <ul style="list-style-type: none"> (i) Acquire an ability to identify, formulate, analyze and solve scientific problems in various areas of Biotechnology and allied fields. (ii) Demonstrate appropriate skills in design of experiments with proper scientific approach. (iii) Develop ability to apply scientific research methodology and achieve ethical research aptitude.
PSO4	<p>Entrepreneurial and Social competence:</p> <ul style="list-style-type: none"> (i) Employ skills and knowledge acquired in skill imparting and entrepreneurial courses in upcoming fields of Biotechnology (ii) Develop a sense of environmental, social, ethical and professional responsibility.

F.Y. B. Sc. Semester I		
Title of the Course and Course Code	Concepts and Applications in Biotechnology BTH1101	Number of Credits : 02
On completion of the course, the students will be able to:		Bloom's Cognitive level
CO1	Define and describe the concept of biotechnology as a science. Outline the important milestones in the history of biotechnology	1
CO2	Associate the science of biotechnology with other streams of life sciences Distinguish between traditional know-how in the field of agriculture, medicine etc. and the advances introduced in these fields due to biotechnology	2
CO3	Outline the use of recombinant DNA technology in field of Biotechnology Apply this know how to find solutions against current lacunae in the field of energy, agriculture, medicine and environment conservation	3
CO4	Relate the role of biotechnology to the agriculture industry, pharmaceutical industry, and the field of research and development. Analyze and explain the need of biotechnology in developing novel therapeutics and vaccines against emerging diseases; developing nutritionally enriched crop varieties; and developing newer biofuels to replace non-renewable fuel sources.	4
CO5	Determine the need for genetic engineering, molecular cloning and expression in improving the quality of life. Evaluate and decide the necessity of these techniques in developing novel products with improved features in comparison to the non - transgenic products.	5
CO6	Apply the science of recombinant DNA technology and design new vectors, build new processes Devise new methods to address the current issues and enhance the production of recombinant proteins in transgenic organisms.	6
F.Y. B. Sc. Semester I		
Title of the Course and Course Code	Biological Chemistry I BTH1102	Number of Credits : 02
On completion of the course, the students will be able to:		Bloom's Cognitive level
CO1	Describe macromolecules in the cell in terms of their structure and function and state the strong and weak bonds which influence their interactions with other biomolecules	1
CO2	Interpret the energy flow in metabolic reactions from various high energy molecules in the cell and demonstrate the coupling of endergonic and exergonic reactions	2
CO3	Demonstrate acid base titrations, titration curves and compute the	3

	charge on biomolecules as a function of pH which affects biochemical interactions	
CO4	Analyse conditions of reaction equilibrium, derive the Henderson-Hasselbach equation and solve related problems	4
CO5	Review key concepts in electrochemistry, determine free energy changes in redox reaction and EMF of a cell	5
CO6	Plan and perform simple titration experiments to measure acid-base strengths as well as perform tests to identify the macromolecule composition of a sample.	6

Title of the Course and Course Code	Biophysics BTH 1103	Number of Credits : 02
On completion of the course, the students will be able to:		Bloom's Cognitive level
CO1	Describe Bohr's model for atomic structure and Pauli's exclusion principle and discuss their significance.	1
CO2	Interpret the effect of biomolecules on energy generation and consumption for tissue specific metabolism.	2
CO3	Classify nuclear radiation and describe their properties. Discuss applications of nuclear radiation, quantitation and detection.	3
CO\$	Compare and contrast the ways of maintaining balance of the human body (homeostasis) and describe the role of organs for it. Explain the working of instruments meant for measurement of radiation	4
CO5	Compare the molecular motor proteins and describe their role in energy generation and utilisation.	5
CO6	Specify the role of visible light for different biological processes(photobiology)	6

Title of the Course and Course Code	Animal Science-I BTH1104	Number of Credits : 02
On completion of the course, the students will be able to:		Bloom's Cognitive level
CO1	Outline and recall classification and characterization of non-chordates and chordates with examples.	1
CO2	Differentiate and illustrate various Honey bee body parts. Explain the morphology, life history of honey bees.	2
CO3	Discuss and distinguish the immune mechanisms in parasitic disease control, lifecycle of various parasites and process of immune interactions.	3
CO\$	Compare and Contrast contributions and applications of various model organisms in research.	4
CO5	Explain rearing methods of beneficial organisms from an economic perspective. Apply knowledge of agro based Small scale industries like sericulture, fish farming and Apiculture..	5
CO6	Analyse and specify the structural, functional and	6

	organizational and economic importance of kingdom Animalia.	
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Title of the Course and Course Code	Plant Science- I BTH1105	Number of Credits : 02
On completion of the course, the students will be able to:		Bloom's Cognitive level
CO1	Collect different plant specimens from surrounding or from a particular area and discuss their characteristics. Describe these plant specimens morphologically. Identify in which group of kingdom Plantae they belong to.	1
CO2	Discuss and Distinguish on the basis of similarities and differences exhibited by them.	2
CO3	Demonstrate their anatomical features. Apply Taxonomic criteria and Classify. Identify and find out scientific name.	3
CO4	Analyse the relationship between different groups of plant Kingdom.	4
CO5	Conclude how plants must have conquered the land.	5
CO6	Compile the collected information. Write evolutionary aspects in plants.	6
Title of the Course and Course Code	Introduction to Microbial world BTH1106	Number of Credits : 02
On completion of the course, the students will be able to:		Bloom's Cognitive level
CO1	Recall and Discuss the landmarks and important developments leading to major discoveries: (pre golden, golden and post golden era) in Microbiology.	1
CO2	Associate and Differentiate between Morphological characters of Microorganisms.	2
CO3	Outline the study on structure, chemical composition and functions of the components in bacterial cell .Analyse the structures Internal and external to Cell Wall of bacteria.	3
CO4	Compare and Contrast Prokaryotic and Eukaryotic cells.	4
CO5	Design Bright field microscopy and its use in Microbiology.	5
CO6	Define and describe different Types of stains with principles and methodology techniques used to observe microorganisms.	6

Title of the Course and Course Code	Quantitative Methods in Biology I BTH 1107	Number of Credits : 02
On completion of the course, the students will be able to:		Bloom's Cognitive level
CO1	Apply the knowledge obtained to solve problems in biological mathematics. Calculate the various parameters used in biochemistry, such as normality, molarity, molality and so on.	1
CO2	Classify the variables into categories such as discrete and continuous, qualitative and quantitative and so on.	2
CO3	Create frequency tables, summarise data, represent data visually. Calculate the measures of central tendency and dispersion. Describe the data.	3
CO4	Describe various generations of computers and how computers are evolved. Classify the computers based on memory, capacity, size, price and uses. Explain how word, excel and powerpoint will help biotechnologists to organise, analyse and interpret the data in a scientific manner.	4
CO5	Outline the computer viruses definition and life cycle. Compare various types of antivirus programs for cleaning the infection of computer viruses to the computer system.	5
CO6	Differentiate various operating systems and Explain their interface or GUI. Describe various input and output devices of the computers.	6
Title of the Course and Course Code	Ecology- BTH1108	Number of Credits : 02
On completion of the course, the students will be able to:		Bloom's Cognitive level
CO1	Identify and classify the various kinds of ecosystems in the surroundings. Identify, list and interpret the different kinds of behaviours shown by animals. Explain the role of each of the structural components of the ecosystem.	1
CO2	Analyse the various kinds of interactions that take place between the biotic and the abiotic components in the ecosystems. Relate these interactions with those taking place between the human beings and the environment.	2
CO3	Evaluate the consequences of the anthropogenic activities on the environment. Judge the various long-term impacts of these activities.	3
CO4	in response to interactions such as predation and design experiments to learn how plants and animals respond to the gradients in the environmental variables. Determine the preferred ranges of plants, animals and microorganisms for the various environmental variables.	4
CO5	Assess, tabulate and report the health and the status of the	5

	ecosystems and biodiversity of regions in the surroundings.	
CO6	Manage the habitats and ecosystems in the immediate surroundings	6
Title of the Course and Course Code	Practical's in Biological Chemistry and Biophysics BTH 1109	Number of Credits : 02
On completion of the course, the students will be able to:		Bloom's Cognitive level
Description (Biophysics)		
CO1	Design experiments to study the effect of light for photosynthesis and concept of osmosis	1
CO2	Solve mathematical problems for preparation of chemicals in the laboratory and radiation biology.	2
CO3	Identify and compare the instruments required to carry out the experiments in the laboratory. Analyse whether the instruments they use are calibrated.	3
Description (Biological Chemistry)		
CO4	Test and validate carbohydrates from a natural source and perform its qualitative estimation	4
CO5	Analyse the pI of an amino acid by performing titration	5
CO6	Design an experiment to determine Absorption maxima of proteins	6
Title of the Course and Course Code	Exercises in Animal Science I and Plant Science I BTH1110	Number of Credits : 02
On completion of the course, the students will be able to:		Bloom's Cognitive level
Description (Plant Science I)		
CO1	State and Describe distinguishing features Algae, Fungi, lichens, Bryophytes, Pteridophytes, Gymnosperms and Angiosperms with the help of available suitable material. Explain the terms used for the same.	1
CO2	Apply different morphological terms and describe the specimens to study plant families. Classify and Identify the plant and find out the family in which it belongs	2
CO3	Discuss Anatomical features of different plant parts- Root, Stem, leaf of Dicotyledonous and Monocotyledonous plants. Compare anatomical characters of Dicot and Monocot plants. Employ different techniques like Sectioning, Staining and Maceration. Explain various types of tissues in plants	3
Description (Animal Science I)		
CO4	Identify the animals of invertebrate and vertebrate phyla and to recognize their distinguishing features. Explain theoretical basis and dissection skills. <i>Standardize</i> mounting of Honey Bee parts.	4
CO5	Discuss, distinguish and understand the life cycle of important invertebrate model organisms like Hydra.	5
CO6	Identify , recall and demonstrate life cycle of various parasites	6

Title of the Course and Course Code	Practicals in Microbiology and Ecology BTH 1111	Number of Credits : 02
On completion of the course, the students will be able to:		Bloom's Cognitive level
CO1	Discuss and understand safety rules when in the Microbiology Laboratory and become proficient in Aseptic techniques	1
CO2	Explain the use of Micropipettes and glass pipettes	2
CO3	Use the Compound Microscope and to successfully focus and observe stained bacteria	3
CO4	Design method to observe motility of bacteria.	4
CO5	Analyse the ecological adaptations in Plants (Hydrophytes/mesophytes/Xerophytes)/	5
CO6	Demonstrate Winogradskys column and compare the conditions under dark and light conditions	6
Title of the Course and Course Code	Practicals in Biostatistics and Computers I BTH 1112	Number of Credits : 02
On completion of the course, the students will be able to:		Bloom's Cognitive level
Description (Biostatistics)		
CO1	Arrange, classify, summarize data collected opportunistically or through experimentation.	1
CO2	Apply the theoretical concepts to the collected data to describe the data.	2
CO3	Create an MS Excel workbook to enter the data, analyse the data using Excel workbook and compare the parameters of the collected data	3
Description (Computers)		
CO4	Design and organize the document using features of Microsoft word. Describe the steps for formatting the word document, tabulation of the data, converting the data into meaningful information.	4
CO5	Examine the primary data, do the data tabulation using Microsoft excel, organize it, convert it into information and process the data for statistical validation by using various formulae and calculate the values for mean, mode, median, std. deviation etc using excel. Analyse the data using excel by creating various graphs, bar diagrams charts.	5
CO6	Analyse and explain the information generated through excel, process data and make a powerpoint presentation using Microsoft PowerPoint. Use various tools available in Microsoft PowerPoint for creating the effective presentation. Do the analysis of the data and present it by using Microsoft PowerPoint	6

Title of the Course and Course Code	Evolutionary Biology and Biodiversity BTH1201	Number of Credits : 02
On completion of the course, the students will be able to:		Bloom's Cognitive level
CO1	Differentiate between the actions of the various evolutionary forces including natural selection, genetic drift and so on, and between the different kinds of processes giving rise to the biological diversity on the planet. Explain and summarise these evolutionary processes leading to speciation and diversification.	1
CO2	Compare between the morphology, behaviour and other biological aspects of the taxa occurring in the various geological periods. Compare between the various hypotheses and the theories put forth to explain the origin of life and diversity on the planet.	2
CO3	Explain the processes giving rise to and maintaining the secondary sexual characters such as elaborate ornamentation and attractive colouration in males or females of various sexually reproducing organisms.	3
CO4	Apply the theoretical aspects learnt in class to design experiments to test hypotheses related to evolutionary biology.	4
CO5	Identify, arrange and classify species into their respective taxonomic ranks (kingdoms, phyla, genus etc.) based on the data obtained from morphological, genetic, behavioural observations.	5
CO6	Evaluate the consequences of the anthropogenic activities on the environment. Judge the various long-term impacts of these activities.	6
Title of the Course and Course Code	Biological Chemistry II BTH1202	Number of Credits : 02
On completion of the course, the students will be able to:		Bloom's Cognitive level
CO1	Define reaction rate, rate laws, molecularity and order of reaction. Differentiate zero, first, second and pseudo-order reactions. Explain factors affecting reaction rate.	1
CO2	Analyze the importance of enzymes and their classification. Discuss why coenzymes are equally important and why vitamins are required in our diet.	2
CO3	Illustrate why enzymes are powerful biocatalysts. Discuss general modes of rate enhancement by enzymes	3
CO4	Discuss various methods of representation of the molecules in stereochemistry. Explain various projection formulae of the molecules (Newman and Fisher formula) and the different types of isomerism (Conformational, Optical and Geometrical isomerism)	4
CO5	Determine the nomenclature system of organic molecules. Specify various classes of organic molecule (Alkanes, Alkenes, Alkyne, Alkyl	5

	halides, esters ethers alcohols and amines) and its methods of synthesis, organic reactions	
CO6	Differentiate between oxidation, reduction, addition and substitution reactions.	6
Title of the Course and Course Code	Bioinstrumentation BTH 1203	Number of Credits : 02
On completion of the course, the students will be able to:		Bloom's Cognitive level
CO1	Describe the principle, construction and working of pH meter and conductivity meter and discuss their applications.	1
CO2	Explain the principle behind spectroscopy and Compare and contrast the different forms.	2
CO3	Classify different types of centrifuges and describe their construction, working and applications.	3
CO4	Classify microscopes and discuss the types, their construction, working and applications.	4
CO5	Justify the role of instruments.	5
CO6	Design experiments to test the applications of the instruments used.	6
Title of the Course and Course Code	Animal Science-II BTH1204	Number of Credits : 02
On completion of the course, the students will be able to:		Bloom's Cognitive level
CO1	Describe homeostatic regulation of different body processes.	1
CO2	Identify and classify cells, tissues and organ systems. Identify the structural and functional properties of different types of cells.	2
CO3	Compare and Contrast various tissues and organ systems	3
CO4	Demonstrate basic proficiency in utilising principles of introductory animal histology	4
CO5	Explain how organisms function at the level of, cell, tissue, organ and organ-system.	5
CO6	Specify the diversity and similarity of different organisms at organization levels	6

Title of the Course and Course Code	Plant Science II BTH1205	Number of Credits : 02
On completion of the course, the students will be able to:		Bloom's Cognitive level
CO1	Retrieve major functional aspects of plants.-Photosynthesis, respiration, Mineral nutrition, Uptake of water, Plant water relation. Describe these primary metabolic pathways in plants. Extrapolate the information.	1
CO2	Discuss plant resources and their utilization, secondary metabolites which are commercially important. Describe Forest as potential resource, plant resources used in Cosmetics and Pharmaceuticals, plants with respect to areas where they are cultivated, environmental conditions they favour, Cultivation practices, uses. Explain secondary metabolism in plants. List economically important plants- Cereals, Pulses, Vegetable oils, Sugarcane, Cotton etc.	2
CO3	Demonstrate different physiological processes in plants. Explain Plant Breeding programmes, their need and methods to improve quality of plant products and to develop novel varieties of plants	3
CO4	Categorize different plants with focus on their economic importance. Explain the concept and need of GreenHouse technology- with respect to site selection, climate, basic facilities while raising greenhouse. Integrate information about Plant diseases- various pathogens, how they enter the plant , symptoms, eradication, control measures.	4
CO5	Select different plants of economic importance. Recommend to exploit them biotechnologically for the benefit of mankind.	5
CO6	Compile information and write how plants are useful to mankind, how we can modify and make use of these characteristics of plants by using recent biotechnological tools.	6
Title of the Course and Course Code	Microbial growth, control and Applications BTH1206	Number of Credits : 02
On completion of the course, the students will be able to:		Bloom's Cognitive level
CO1	Classify bacteria according to nutritional requirements, Design of media , Articulate concept of Pure culture, axenic culture, co-culture , mixed culture and isolation of microorganisms and pure culture techniques	1
CO2	Define sterilization and disinfection methods used to control the growth of microorganisms. Outline various physical, chemical and biological principles used to study sterilization and	2

	disinfection.	
CO3	Define Growth curve Generation time, Growth rate and specific growth rate. Discuss the Reproduction in microorganisms by various methods like Binary Fission, Asexual, Sexual, Lytic, Lysogenic Cycle.	3
CO4	List and summarize methods of enumeration of bacteria Formulate factors affecting bacterial growth (pH, Temperature, Solute concentration (Salt and Sugar) and Heavy metals.	4
CO5	Outline and analyse Microbial Interactions with examples	5
CO6	Apply and review the knowledge of microbiology to understand Significance of normal flora and probiotics in human health and Microbes as Biofertilizers and Biocontrol Agents and Fermentation Industries	6
Title of the Course and Course Code	Quantitative Methods in Biology II BTH1207	Number of Credits : 02
On completion of the course, the students will be able to:		Bloom's Cognitive level
CO1	Apply the knowledge obtained to solve problems in biological mathematics.	1
CO2	Identify statistical gaps in biological research. Formulate statistical questions in biology. Build, construct, state hypotheses to answer the formulated questions. Design experiments to collect data. Test the hypothesis based on the collected data.	2
CO3	Compare mean, variance and other parameters and statistics, between groups, samples, populations. Test the goodness of fit and independence of attributes. Make judgement about observed patterns in the data collected, based on the outcomes of hypothesis testing.	3
CO4	Define the networking and communication. Differentiate different forms of network topologies and protocols Explain the concept of world wide web and internet. Discuss about network security, firewalls and various types of networks.	4
CO5	Explain the importance of the database management system in biotechnology. Discuss various types of data models, concept of entity and attributes, entity relationship diagrams, Concept of primary key and relational data models, Define and discuss methods of data retrieval from the biological databases.	5
CO6	Illustrate the methods of retrieval of the literature databases and understand the searching through text-based methods. Discuss the uses of search engines for biological data retrieval such as google and yahoo	6

Title of the Course and Course Code	Cell Biology I BTH 1208	Number of Credits : 02
On completion of the course, the students will be able to:		Bloom's Cognitive level
CO1	Describe the structure of cellular organelles and discuss their functions in detail.	1
CO2	Interpret the events in cell cycle and effect of certain chemicals on regulation of cell cycle. Classify cell junctions and arrange them according to their roles	2
CO3	Classify processes of cell division and describe phases of cell cycle. Classify and describe the checkpoints involved in regulation of cell cycle.	3
CO4	Compare archaeobacterial, prokaryotic and eukaryotic cells with respect to their properties, cellular diversity and cell types. Explain the components and function of the ExtraCellular Matrix	4
CO5	Compare structure and function of plasma membranes. Compare and contrast types of cell walls, their structure and function.	5
CO6	Compile the information on the structural aspect of cellular biology.	6
Title of the Course and Course Code	Practicals in Biochemistry and Bioinstrumentation BTH 1209	Number of Credits : 02
On completion of the course, the students will be able to:		Bloom's Cognitive level
Description (Bioinstrumentation)		
CO1	Describe the components and working of Bright field compound microscope and analyze its working.	1
CO2	Explain Beer Lambert's law and interpret working of the instruments that use the law. Test whether the pH meter is calibrated. Classify different types of centrifuges and their role.	2
CO3	Design experiments to validate the use of instruments	3
Description (Biochemistry)		
CO4	Determine amylase function by DNSA method.	4
CO5	Determine order of reaction	5
CO6	State biochemical redox reaction using DCPIP, describe model making-based conformational studies of biomolecules,	6

Title of the Course and Course Code	Practical's in Microbiology and Cell Biology – I BTH 1210	Number of Credits : 02
On completion of the course, the students will be able to:		Bloom's Cognitive level
Description - Microbiology		
CO1	Design techniques of cultivation, isolation and preservation of bacteria, use and discuss physical and chemical methods to control the growth of micro-organisms	1
CO2	Illustrate and assess the techniques of enumeration of micro-organisms and cells	2
Description - Cell Biology – I		
CO3	Demonstrate the preparation of slides and identify the particulars of the specimen.	3
CO4	Demonstrate and analyze the effect of chemicals on the stages cell division	4
CO5	Illustrate the measurement of size of various types of cells and distinguish between specimens.	5
CO6	Design simple experiments and assess the quality of the results.	6
Title of the Course and Course Code	Exercises in Animal Science II and Plant Science II BTH1211	Number of Credits : 02
On completion of the course, the students will be able to:		Bloom's Cognitive level
CO1	Demonstrate the phenomenon of Osmosis Determine Diffusion Pressure Deficit by using Potato tubers	1
CO2	Determine the rate of Transpiration under different environmental conditions. Describe some economically important plants	2
CO3	Organise Visit to GreenHouse.	3
CO4	Demonstrate basic proficiency to understand tissues in the different organs. Characterize and describe the differences between tissues and organs. Describe regular morphology of the animal organism: cells, tissues, organs and systems	4
CO5	Compare and Contrast circulatory immune system cells and perform total and differential blood cell count	5
CO6	Discuss, classify and specify various physiological reflexes and responses.	6

S. Y B. Sc. SEM III		
Title of the Course and Course Code	Practical's in Biostatistics and Computers II BTH 1212	Number of Credits : 02
On completion of the course, the students will be able to:		Bloom's Cognitive level
CO1	Collect data on the field for analysis in the lab. Arrange, classify, summarise data collected opportunistically or through experimentation.	1
CO2	Apply the theoretical concepts to the collected data to describe the data.	2
CO3	Create an MS Excel workbook to enter the data. Analyse the data using Excel workbook. Compare the parameters of the collected data. Calculate biodiversity indices to measure the level of diversity.	3
CO4	Design the database instances and schemas and organize the data using Microsoft Access Outline the steps for generating the forms and report using Microsoft Access. Create the relationship using the primary key concept .	4
CO5	Explain various DOS commands for creation of directories, remove the directories, format the foreground and background colour. Use the DOS commands and Create the directories, change the date and time, manage the hardware components using DOS prompt.	5
CO6	Illustrate the steps to retrieve the data from the various biological databases. Use various methods for data searching to create the knowledge pool.	6
S. Y B. Sc. SEM III		
Title of the Course and Course Code	Cell Biology-II (BTH 2301)	Number of Credits: 02
Course Outcomes (COs) On completion of the course, the students will be able to:		Bloom's Cognitive Level
CO1	Describe and discuss the roles of different types of cell membrane transport systems and transporter proteins.	1, 2
CO2	Interpret the effects of various signal molecules, and survival factors on cell signaling outcomes.	3
CO3	Classify tumors and describe properties of tumor cells. Classify and discuss diseases related to protein trafficking and targeting.	3
CO4	Compare the cell surface receptors and their use in cell signaling pathways.	4

	Explain the working of channels and carriers and discuss the roles in endocytosis, exocytosis, pinocytosis and phagocytosis.	
CO5	Compare modes of cell death with characteristics, properties and modes of regulation. Describe the processes of protein trafficking and vesicular transport.	4, 5
CO6	Compile the information on the functional aspect of cellular biology.	6
Title of the Course and Course Code	Molecular Biology-I (BTH 2302)	Number of Credits : 02
On completion of the course, the students will be able to:		Bloom's Cognitive level
CO1	Describe the bonding and structure of DNA/RNA along their various forms and types.	1
CO2	Discuss how prokaryotic and eukaryotic genomes are packaged into higher level organization.	2
CO3	Outline the process of DNA replication and its regulation.	3
CO4	Analyze and explain the various DNA damaging effects by various agents	4
CO5	Review DNA repair mechanisms like NER, BER and MMR.	5
CO6	Specify the recombination process and the proteins involved.	6
Title of the Course and Course Code	Metabolic Pathways (BTH 2303)	Number of Credits : 02
On completion of the course, the students will be able to:		Bloom's Cognitive level
CO1	Describe and differentiate anabolism and catabolism. Explain characteristics of metabolic pathways.	1
CO2	Explain different pathways of carbohydrate metabolism. Illustrate how glucose is oxidized and how it is synthesized from non-carbohydrate sources in case of emergency.	2
CO3	Explain why fats and oil are the best source of energy. Outline the synthesis of important lipids including phospholipids and cholesterol. Describe the role of ketone bodies.	3
CO4	Describe key reactions of protein metabolism. Illustrate how amino acids are synthesized. Explain how toxic ammonia is removed from our body.	4
CO5	Review regulation of carbohydrate, lipid and protein metabolism	5

CO6	Integrate carbohydrate and non-carbohydrate metabolism	6
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Title of the Course and Course Code	Medical Microbiology (BTH 2304)	Number of Credits : 02
On completion of the course, the students will be able to:		Bloom's Cognitive level
CO1	Outline basics in Medical Microbiology	1
CO2	Explain types of infectious diseases with respect to Pathogenesis of Bacterial Diseases ,Viral , Protozoan and Fungal diseases	2
CO3	Apply the principle of epidemiological sciences in studying the underlying mechanisms of spread of disease.	3
CO4	Organize in detail study of host parasite relationship of different infections	4
CO5	Standardize strategies about Emerging and reemerging diseases	5
CO6	Revise knowledge of Medical Microbiology by performing various activities and make plan to tie up with hospitals and generate Questionnaire	6
Title of the Course and Course Code	Fundamentals of Genetics (BTH 2305)	Number of Credits : 02
On completion of the course, the students will be able to:		Bloom's Cognitive level
CO1	Describe the fundamentals of Genetics. List the important milestones in the history of Genetics and recall the contributions of great scholars to this field of science	1
CO2	Associate the science of genetics with the expression of characters in living organisms Distinguish between Mendelian genetics and modern genetics	2
CO3	Explain the deviations from Mendelism. Outline the concepts of Incomplete Dominance, Co-dominance, Epistasis, Pleiotropy, Multiple alleles and Lethal genes. Apply this know how to understand the genetic basis of inheritance of certain diseases and disorders	3, 4
CO4	Identify the role of X inactivation and dosage compensation Analyze and explain the need of Barr bodies, X inactivation and dosage compensation	1
CO5	Determine the need for understanding chromosomal aberrations and techniques used therein . Evaluate and decide the necessity of these techniques in predicting the occurrence of chromosomal disorders and observing them	5

CO6	Infer gene linkage in developing linkage maps, finding distances between the genes and determining their correct order. Devise new methods to analyze and address the questions in the field of genetics.	2,6
Title of the Course and Course Code	Plant Development (BTH 2306)	Number of Credits : 02
On completion of the course, the students will be able to:		Bloom's Cognitive level
CO1	Define plant growth and development and their unique features and List developmental stages in plants	1
CO 2	Explain ability of plant cells like Developmental flexibility , concept of competence and Determination and mechanism of plant development	2
CO 3	Apply Concept of Plant Growth Regulators, biosynthesis, bioassay and their applications	3
CO 4	Explain – Embryogenesis, Axial and Radial patterning and major phases of plant development using model system (<i>Arabidopsis thaliana</i> and <i>Fucus spiralis</i>) and their molecular and genetic mechanism.	4
CO 5	Review Programmed Cell Death and Signal transduction in plants governing growth and development	5
CO 6	Compile and Write unique features of Development of plants.	6
Title of the Course and Course Code	English/German/French (BTH 2307)	Number of Credits : 02
On completion of the course, the students will be able to:		Bloom's Cognitive level
CO1	Identify the types of nouns, articles, verbs, adjectives etc. in the provided literature and analyze the provided literature.	1
CO2	Define how and where a particular form of noun, article, verb, adjective, adverb etc. should be used Explain and distinguish between the forms of noun, article, verb, adjective, adverb etc.	1, 4
CO3	Outline the correct use of tenses and sentence types Construct correct sentences using the knowledge of English grammar	1,6
CO4	Create effective oral presentation considering the aspects of	2, 6

	Pronunciation, accent, intonation, clarity, speed, fluency, eye contact, Planning and organization	
CO5	Prepare effective written presentation based on sentence connection, cohesion and coherence; contradiction, tautology, semantic anomaly, circumlocution Determine the correct order of sentences in a paragraph,	6
CO6	Apply the knowledge of word forms and derivations, scientific and technical vocabulary; to construct effective sentences Compose news articles, essays, scientific articles, reports etc.	3

Title of the Course and Course Code	Biotechnology Practical- I [BTH 2308] Exercises in Cell Biology II and Medical Microbiology	Number of Credits : 02
On completion of the course, the students will be able to:		Bloom's Cognitive level
CO 1	Demonstrate the preparation of slides and identify the particulars of the specimen.	1, 3
CO 2	Demonstrate and analyze the effect of chemicals on the stages cell division	3, 4
CO 3	Illustrate the measurement of size of various types of cells and distinguish between specimens.	2, 3
CO 4	Design simple experiments and assess the quality of the results.	5, 6
CO 5	Design the methodology use to Study Normal flora of humans (Skin and oral cavity) and Plan the identification of Candida species and viruses	6
CO 6	Determine strategies for study of pus, urine samples.	5
Title of the Course and Course Code	Biotechnology Practical- II [BTH 2309] Exercises in Molecular Biology and Metabolic Pathways	Number of Credits : 02
On completion of the course, the students will be able to:		Bloom's Cognitive level
CO1	Calculate Molarity, Normality, Ionic strength.Prepare laboratory reagents	3
CO2	Describe DNA isolation from both prokaryotic and eukaryotic cells	1
CO3	Analyze quality of isolated DNA	4
CO4	Arrange protein separation by SDS-PAGE	6

CO5	Estimate cholesterol from synthetic sample	2
CO6	Explain and evaluate liver function test	4, 5
Title of the Course and Course Code	Biotechnology Practical- III [BTH 2310] Exercises in Plant Development and Genetics	Number of Credits : 02
On completion of the course, the students will be able to:		Bloom's Cognitive level
CO1	Describe different techniques to study plant development	1
CO2	Illustrate microsporogenesis and development of male gametophyte	2
CO3	Demonstrate embryo development and study of meristem	3
CO4	Explain and study technique of excision of young embryo of plant	4
CO5	Analyze and compare karyotypes, pedigree and genetic traits	4,5
CO6	Perform the staining and identification of Barr body	1, 6
S.Y. B.Sc. Semester IV		
Title of the Course and Course Code	Immunology (BTH 2401)	Number of Credits : 02
On completion of the course, the students will be able to:		Bloom's Cognitive level
CO1	Define the basis of immune system	1
CO2	Articulate components of immune system, types of immunity and the complement system.	2
CO3	Outline about autoimmune diseases in immunology	3
CO4	Analyse the Complement system	4
CO5	Compare and Contrast various antigen antibody reaction	5
CO6	Design and develop various types of vaccines	6
Title of the Course and Course Code	Molecular Biology II (BTH 2402)	Number of Credits : 02
On completion of the course, the students will be able to:		Bloom's Cognitive level

CO1	Describe the structural features of DNA with its regulatory elements and define the functioning of Lac, Ara, Trp Operons	1
CO2	Discuss the important proteins and enzymes necessary for gene transcription and protein synthesis	2
CO3	Outline the transcription processes in prokaryotes and eukaryotes.	3
CO 4	Justify the need for regulation of gene expression with the mechanisms	5
CO 5	Outline the mutations along with its effects in the genetic code. Specify the protein synthesis process in prokaryotic and eukaryotic systems.	2, 6
CO6	Analyze the need for gene expression regulation and their mechanisms with suitable diagrams.	4

Title of the Course and Course Code	Protein Biochemistry and Enzymology (BTH 2403)	Number of Credits : 02
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On completion of the course, the students will be able to:		Bloom's Cognitive level
CO1	Describe the structure and functions of proteins and enzymes.	1
CO2	Illustrate the principles of enzyme isolation, purification, and characterization methods.	2
CO3	Apply the principles of enzyme kinetics to calculate kinetic constants, analyze the effect of various parameters on velocity of enzyme-catalyzed reaction	3, 4
CO4	Justify why enzymes are so powerful catalysts. Review types of catalytic mechanisms through action of two representative cases	5
CO5	Explain various modes of enzyme regulation including the most common method; the phosphorylation.	2
CO6	Construct a strategy to isolate, purify and characterize the enzyme.	6

Title of the Course and Course Code	Food and Dairy Microbiology (BTH 2404)	Number of Credits : 02
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On completion of the course, the students will be able to:		Bloom's Cognitive level
CO1	Outline and list food based on shelf life Perishable, Semi-perishable & stable food	1
CO2	Articulate concepts and elaborate on general principles, methods of food preservation methods	2

CO3	Classify various types and role of starter culture and other microorganisms used in food	3
CO4	Compare different traditional ,rapid and newer methods used for detection of microbes and their products in food	4
CO5	Assess Common micro-organisms found in milk, Sources of contamination of milk , Fermentation and spoilage of milk , Flavour and Colour defects, Sweet curdling, and Stormy fermentation, Ropiness	5
CO6	Develop and devise microbial quality of milk by performing various test like Total bacterial count. (direct and indirect methods),Brucella ring test and tests for mastitis and Somatic cell count and study about related diseases	6
Title of the Course and Course Code	Environmental Biotechnology (BTH 2405)	Number of Credits : 02
On completion of the course, the students will be able to:		Bloom's Cognitive level
CO1	Outline Global Environmental Problems and environmental toxicants	1
CO2	Articulate different strategies used in Biodegradation and Bioremediation to resolve environmental problems using microorganisms	2
CO3	Define biofertilizers and biocontrol agents and discuss Development of disease resistant transgenic plants as Biopesticides	3, 4
CO4	Explain Biotechnological interventions in waste-water treatment - Primary, secondary and tertiary treatments	5
CO5	Design Effluent disposal strategies used for effluents of Textile and Dairy industries and biotechnology industry. and Evaluate new methods used in Solid waste management, Hospital waste management.	2
CO6	Analyse the role of Biotechnology in Air Pollution Control and monitoring. Use of Microbial biosensors in environmental monitoring.	6

Title of the Course and Course Code	Animal Development (BTH 2406)	Number of Credits : 02
On completion of the course, the students will be able to:		Bloom's Cognitive level
CO1	Summarize the processes in early development and apply the concepts in technology	1,3
CO2	Understand the different cellular organizations during development that leads to development of multicellular organism from a zygote	2
CO3	Organize a play to explain cellular movements and rearrangements	6
CO4	Explain the concept of pattern formation using various model systems	4
CO5	Outline the concept of differentiation, plasticity & trans differentiation and analyse different models of regeneration	1,4
CO6	Cite and debate different theories of aging	1,6
Title of the Course and Course Code	Scientific Writing and Communication\German\French (BTH 2407)	Number of Credits : 02
On completion of the course, the students will be able to:		Bloom's Cognitive level
CO1	Describe the way of using scientific terms while writing Scientific literature.	1
CO2	Interpret the meaning of scientific literature they read.	2
CO3	Classify, compare and differentiate between the modes of scientific communication.	3
CO4	Compare and differentiate between the types of presentation (Oral, Writing, Poster) Explain and discuss the IMRAD format for writing manuscripts Compare the legal forms of communication in science.	2 , 5
CO5	Explain the ethics in scientific communication and describe the concept of Intellectual Property Rights.	4
CO6	Develop scientific writing and reading skills and evaluate the work done by others.	6

Title of the Course and Course Code	Biotechnology Practicals IV Exercises in Immunology and Food & Dairy Microbiology (BTH 2408)	Number of Credits : 02
On completion of the course, the students will be able to:		Bloom's Cognitive level
CO1	Show the methodology used to isolate and identify (Genus level) spoilage causing microorganisms from spoiled foods	1
CO2	Illustrate different ways to determine TDT, TDP and D values	2
CO3	Carry out the determination of efficiency of Pasteurization by quantitative phosphatase test. Examine and Grade raw milk (Dye reduction test).	3
CO4	Explain isolation and identification of starter organisms from Idli batter/ Dahi	4
CO5	Evaluate the working principle and applications in serology	5
CO6	Formulate various antigen-antibody reaction	6
Title of the Course and Course Code	Biotechnology Practicals V Exercises in Molecular Biology, Protein Biochemistry and Enzymology (BTH 2409)	Number of Credits : 02
On completion of the course, the students will be able to:		Bloom's Cognitive level
CO1	Describe absorption spectra of DNA, RNA and proteins by UV-Vis spectroscopy.	1
CO2	Explain enzyme assay conditions	2
CO3	Outline the concept behind Native-PAGE separation of proteins. Plan	3, 6

	to show the enzyme activity on Native-PAGE	
CO 4	Analyze the Effect of mutations on DNA by analyzing growth of auxotrophs on minimal medium	4
CO 5	Analyze the effect of various cell lysis methods on protein extraction efficiency and compare three different protein quantification methods	4
CO6	Determine the Effect of UV/EtBr on DNA and growth for microorganisms	5

Biotechnology Practicals VI Exercises in Environmental Biotechnology and Animal Development (BTH 2410)		
Title of the Course and Course Code	Biotechnology Practicals VI Exercises in Environmental Biotechnology and Animal Development (BTH 2410)	Number of Credits : 02
On completion of the course, the students will be able to:		Bloom's Cognitive level
CO1	Observe different types of egg and correlate the amount of yolk and cleavage pattern	2
CO2	Design an <i>in vitro</i> chick embryo culture method (shell less culture) and compare the development with normal chick development	6
CO3	Demonstrate the isolation, mounting and staging of chick embryo of various stages and analyse the indicators of embryonic development	3,4
CO4	Assemble Hydra culture and demonstrate the regeneration	6,3
CO5	Report the quality of drinking water by suitable tests	1
CO6	Determine levels of organic matter in polluted water sample	5
T. Y. B. Sc. Biotechnology Semester V		
Title of the Course and Course Code	Large Scale Manufacturing Processes - I (BTH3501)	Number of Credits : 02
On completion of the course, the students will be able to:		Bloom's Cognitive level
CO1	Define fermentation and. Describe basic bioreactor design, types of Bioreactors and fermentation types.	1
CO2	Analyse growth kinetics in batch, fed batch and continuous cultures and its application in bioprocess	2
CO3	Explain with examples various methods for Screening a production strain and strain improvement techniques.	3
CO4	Compare and Contrast different techniques of enzyme immobilization and Cite their Industrial applications	4
CO5	Select and construct statistical design for optimization of fermentation media components	5
CO6	Illustrate the principles of Air and Medium Sterilization. and apply them to the designs of Batch and Continuous Sterilization.	6

Title of the Course and Course Code	Introduction to Diagnostic Techniques (BTH3502)	Number of Credits : 02
On completion of the course, the students will be able to:		Bloom's Cognitive level
CO1	Relate and gain proficiency in using modern tools in area of diagnostic microbiology	1
CO2	Outline different methods used to carry out collection and transport of specimens for diagnosis	2
CO3	Analyse and understand antimicrobial susceptibility testing and prenatal diagnosis	3
CO4	Review and understand Pathology Lab reports	4
CO5	Discuss and describe histopathology with respect to collection, preparation and processing of the samples and also to interpret the slides.	5
CO6	Integrate various applications of diseases like cancer, myocardial infarctions, and infectious diseases.	6
Title of the Course and Course Code	Genetics and Introduction to Genetic Engineering (BTH3503)	Number of Credits : 02
On completion of the course, the students will be able to:		Bloom's Cognitive level
CO1	Describe the types of plasmids, their structures, properties and discuss the mechanism and role of transposable elements in prokaryotes.	1
CO2	Interpret the possible outcomes expected after genome mapping by different techniques.	2
CO3	Compare the mechanisms involved in various phenomena of plant breeding and inheritance. Explain the basics of cytoplasmic inheritance and incompatibility in plants. Compare the mechanisms of DNA transfer in prokaryotes	3
CO4	Classify restriction enzymes and other DNA modifying enzymes and describe their properties, mode of action and applications.	4
CO5	Compare vectors, their design, working and use for DNA modification and describe the methods of vector delivery into hosts for manipulation.	5
CO6	Differentiate between prokaryotic and eukaryotic hosts used for Genetic Engineering and specify their importance.	6

Title of the Course and Course Code	Applications in Medical and Microbial Biotechnology (BTH3504)	Number of Credits : 02
On completion of the course, the students will be able to:		Bloom's Cognitive level
CO1	Outline and apply importance of biotechnology and its applications in different spheres of life sciences	1
CO2	Analyse the contribution of Microbial biotechnology as a major participant in global industry.	2
CO3	Integrate and articulate how application of microbial-biotechnological principles has achieved breakthroughs in both research and industrial production.	3
CO4	Design methods and apply the role of medical biotechnology in disease diagnosis, prevention and treatment.	4
CO5	Describe and evaluate Role of Biotechnology in healthcare- disease diagnosis, prevention and treatment.	5
CO6	Devise application for Personalised Medicine .	6
Title of the Course and Course Code	Bioanalytical Techniques - I (BTH3505)	Number of Credits : 02
On completion of the course, the students will be able to:		Bloom's Cognitive level
CO1	Describe basic features and components of different centrifuges, microscopes, spectrometers, and chromatographic system.	1
CO2	State the physicochemical properties and principles used to achieve separation of compounds	2
CO3	Illustrate experimental details of these techniques	3
CO4	Compare and contrast the advantages and limitations of these techniques	4
CO5	Analyze and interpret the results	5
CO6	Design a quality assurance scheme in terms of standard operating procedure for maintenance of instruments	6

Title of the Course and Course Code	Principles in Enzymology (BTH3506)	Number of Credits : 02
On completion of the course, the students will be able to:		Bloom's Cognitive level
CO1	Define key terms in enzymology	1
CO2	Describe and compare cooperative binding models	2
CO3	Illustrate enzyme assay conditions	3
CO4	Justify choice of method for studying enzyme assay	4
CO5	Organize enzyme kinetics data and determine kinetic constants	5
CO6	Design enzyme purification scheme	6
Title of the Course and Course Code	Biotechnology Practical-I (LSMP I + Diagnostic Techniques) (BTH3507)	Number of Credits : 02
On completion of the course, the students will be able to:		Bloom's Cognitive level
CO1	Demonstrate growth curve studies and calculate generation time of bacteria / yeasts. Calculate D value of bacteria	1
CO2	Illustrate: Enrichment and primary screening of an enzyme / antibiotic. Whole cell immobilization technique	2
CO3	Cite various parts and explain working of a bench top fermenter	3
CO4	Design different transport media used in diagnosis of diseases	4
CO5	Analyse and test different methods used for Antimicrobial susceptibility testing	5
CO6	Identify and compile the process of diagnosis	6
Title of the Course and Course Code	Biotechnology Practical-II (Genetic Engineering + Medical and Microbial Biotechnology) (BTH3508)	Number of Credits : 02
On completion of the course, the students will be able to:		Bloom's Cognitive level
CO1	Demonstrate the steps for Genomic DNA isolation from Animal source and design the experimental setup and requirements for isolation from any other source.	1
CO2	Define and describe Plasmid DNA and its applications in genetic engineering. Demonstrate and Standardize the Plasmid isolation protocol by alkaline lysis. Outline and interpret the results of plasmid isolation and select the recombinants	2
CO3	Outline, recall and carry out preparation of competent cells and	3

	Design and demonstrate procedure for transformation of E. coli. Outline and interpret the results and select the recombinants.	
CO4	Describe the principle and Analyze the outcome for auxotrophic / antibiotic resistant mutants by replica plate technique.	4
CO5	Design a protocol to isolate Bioluminescent bacteria and to study its application	5
CO6	Carry out isolation of Biosurfactant / Biopolymer organism and test its potential.	6
Title of the Course and Course Code	Bioanalytical Techniques I + Enzymology) (BTH3509)	Number of Credits : 02
On completion of the course, the students will be able to:		Bloom's Cognitive level
CO1	Apply centrifugal techniques to obtain sub-cellular fractions of goat liver cells	1
CO2	Perform and analyze amino acid separation by paper chromatography/TLC	2
CO3	Validate Beer-Lambert's law and determine the molar extinction coefficient of NADH	3
CO4	Describe the following techniques through electron/ photomicrographs: fluorescence microscopy, positive staining, negative staining, freeze fracture, freeze etching	4
CO5	Perform partial purification and assay of enzyme	5
CO6	Perform assay for the partially purified enzyme, Calculate kinetic parameters such as Km, Vmax, Kcat	6
Title of the Course and Course Code	Biotechnological Skills in Agriculture Industry (BTH3511)	Number of Credits : 02
On completion of the course, the students will be able to:		Bloom's Cognitive level
CO1	Define and Describe types of Biofertilizers and Mushrooms, their advantages and limitations	1
CO2	Demonstrate the techniques involved in isolation of organisms from soil with biofertilizer potential	2
CO3	Formulate and prepare carrier bases biofertilizers and Demonstrate the field application and quality control techniques	3
CO4	Discuss development of fruiting bodies and Demonstrate the techniques of cultivation of Mushrooms	4
CO5	Analyse the nutritive value of Mushrooms and discuss the beneficial effect of mushrooms on soil	5
CO6	Standardize suitable methods of mushroom cultivation.	6

Title of the Course and Course Code	Phytochemistry (BTH3512)	Number of Credits : 02
On completion of the course, the students will be able to:		Bloom's Cognitive level
CO1	Describe the use of medicinal plant in drug discovery process	1
CO2	Discuss various methods of extraction, isolation and characterization of natural products.	2
CO3	Classify primary and secondary metabolites and various therapeutic classes.	3
CO4	Carryout the identification tests for general classes, marker specific tests of phytochemicals	4
CO5	Explain the computational methods for phytochemical analysis.	5
CO6	Generate the lead library for phytoconstituents and evaluate the synthesis feasibility of identified lead molecules.	6
Title of the Course and Course Code	Biosafety and Bioethics (BTH3513)	Number of Credits : 02
On completion of the course, the students will be able to:		Bloom's Cognitive level
CO1	Discuss the use of ethics and bioethics, human interaction with its environment.	1
CO2	Analyze influence of environment on human performance, bioethical issues, and their solutions. Identify and gain the insights into the regulatory affairs	2
CO3	Explain various processes of biosafety and infrastructure setup according to national and international standards.	3
CO4	Acquire adequate knowledge in the use of genetically modified organisms and its effect on human health.	4
CO5	Describe the biosafety future aspects to address the advancement in the subject.	5
CO6	Discuss the need of the establishment of bioethics committee at institute level	6

Title of the Course and Course Code	Model systems in Biotechnology (BTH3514)	Number of Credits : 02
On completion of the course, the students will be able to:		Bloom's Cognitive level
CO1	Define applications of model organisms in biology	1
CO2	Analyze and describe the use of various model systems in research.	2
CO3	Explain application of model organisms with examples.	3
CO4	Compare and contrast different types of model organisms and their advantages / disadvantages.	4
CO5	Review and recommend choice of a model organism for a particular research approach.	5
CO6	Illustrate different model systems and justify its use. Design experiments to employ a certain model system successfully.	6
T. Y. B. Sc. Biotechnology Semester VI		
Title of the Course and Course Code	Large Scale Manufacturing Processes-II (BTH3601)	Number of Credits : 02
On completion of the course, the students will be able to:		Bloom's Cognitive level
CO1	Review methods of determination and control various parameters during fermentation and illustrate the role of computers in process control	1
CO2	Specify concept of KLa, Scale up and Scale Down	2
CO3	Outline the processes involved in product recovery	3
CO4	Illustrate the downstream process techniques	4
CO5	Elucidate the large-scale manufacturing and recovery processes of fermentation products of various sectors	5
CO6	Outline the concept of Good manufacturing practices (GMP) and Standard Operating practices (SOP) and their relevance. Define and discuss the common terms used in Bioprocess economics	6

Title of the Course and Course Code	Plant Tissue Culture (BTH3602)	Number of Credits : 02
On completion of the course, the students will be able to:		Bloom's Cognitive level
CO1	Recall basic concepts of cell theory, Unique properties of plant cells like Totipotency, Differentiation, Dedifferentiation.	1
CO2	Compare in vivo and in vitro growth of plants. Describe Infrastructural requirements and basic facilities necessary in PTC laboratory. Discuss nutritional requirements of plants, various methods to maintain aseptic conditions.	2
CO3	Demonstrate media preparation, selection and sterilization of explants.	3
CO4	Identify the role of plant growth regulators, different techniques of PTC for various applications.	4
CO5	Standardise different parameters to maintain cultures.	5
CO6	Compose standardised protocol for particular technique using a specific plant. Extrapolate the basic technique of Plant Tissue Culture for various applications.	6
Title of the Course and Course Code	Techniques and applications in Genetic Engineering (BTH3603)	Number of Credits : 02
On completion of the course, the students will be able to:		Bloom's Cognitive level
CO1	Describe basic techniques of cloning from DNA and RNA, making clone libraries and gene expression	1
CO2	Discuss various strategies for clone selection and screening using PCR and blotting based methods	2
CO3	Examine DNA sequencing methods employed for genetic analysis	3
CO4	Analyse various applications of genetic engineering from transgenic plants to healthcare and therapeutics	4
CO5	Review key concepts in mutagenesis and transgene insertion and expression, determine the advantages and limitations of transgene technology	5
CO6	Integrate genetic engineering tools and knowhow to produce transgenic animals and for gene therapy	6

Title of the Course and Course Code	Animal Tissue Culture (BTH3604)	Number of Credits : 02
On completion of the course, the students will be able to:		Bloom's Cognitive level
CO1	Describe the different aspects for successful animal cell culture	1
CO2	Understand the rationale behind different media compositions and techniques used in ATC	2
CO3	Consider different factors that establish a cell line in vitro and describe variations in cell culture	3
CO4	Illustrate the problems associated with cryopreservation and outline the different techniques for successful outcome	4
CO5	Assess different methods of cell characterization	5
CO6	Design different methods of cell culture and describe the applications	6
Title of the Course and Course Code	Bioanalytical Techniques-II (BTH3605)	Number of Credits : 02
On completion of the course, the students will be able to:		Bloom's Cognitive level
CO1	Describe basic features and components of different spectrometers, biosensors, and imaging devices	1
CO2	State the physicochemical properties and principles used in these techniques. Discuss <i>in silico</i> analysis of sequencing data	2
CO3	Illustrate experimental details of techniques	3
CO4	Compare and contrast the advantages and limitations of these techniques	4
CO5	Analyze and interpret the results	5
CO6	Design a quality assurance scheme in terms of standard operating procedure for maintenance of instruments	6

Title of the Course and Course Code	Applications in Agriculture and Environmental Biotechnology (BTH3606)	Number of Credits : 02
On completion of the course, the students will be able to:		Bloom's Cognitive level
CO1	Describe the role of biotechnology in agriculture	1
CO2	Compare important methods and strategies used for developing transgenic crops. Explain the strategies used for designing biotic / abiotic stress resistant crops, crops with enhanced nutrition and for therapeutics. Summarize the concept of gene pyramiding	2
CO3	Hypothesize and design new strategies for developing transgenic crops with desired traits	3
CO4	Outline the importance of bioinformatics and the concept of "omics" in biology. Evaluate and justify the need of genomics, proteomics, transcriptomics techniques in research and development	4
CO5	Assess the conservation concerns of various taxa currently threatened by anthropogenic activities	5
CO6	Compile information on the various biotechnological interventions in the conservation of biodiversity	6
Title of the Course and Course Code	Biotechnology Practical-IV (LSMP II + PTC) (BTH3607)	Number of Credits : 02
On completion of the course, the students will be able to:		Bloom's Cognitive level
CO1	Perform lab scale production and recovery of a primary and secondary metabolite	1
CO2	Determine / Estimate the amount of primary and secondary metabolite	2
CO3	Demonstrate Sterility check technique for a product. Wine production process and determine its properties	3
CO4	Explain how to prepare stock solutions and media for various culture techniques	4
CO5	Demonstrate Callus culture technique, Suspension culture technique, embryo culture and axillary bud culture technique.	5
CO6	Manipulate Auxin: Cytokinin ratio to regenerate the entire plant. (Micropropagation) Standardise the protocol for specific plant	6

Title of the Course and Course Code	Biotechnology Practical-V (Techniques in Genetic Engineering Bioanalytical Techniques II) (BTH3608)	Number of Credits : 02
On completion of the course, the students will be able to:		Bloom's Cognitive level
CO1	Discuss the concept of restriction mapping and solved related problems	1
CO2	Plan and prepare an experiment of plasmid DNA digestion and ligation	2
CO3	Describe the process of PCR / DNA fingerprinting and perform the amplification using molecular markers	3
CO4	Illustrate how spectroscopic techniques (IR, ESR, NMR) can be used for structure determination	4
CO5	Review basics of mass spectrometry and discuss its applications	5
CO6	Compare various methods of glucose estimation and explain working of a glucometer	6
Title of the Course and Course Code	Biotechnology Practical-VI (ATC + Applications in Agriculture and Environmental Biotechnology) (BTH3609)	Number of Credits : 02
On completion of the course, the students will be able to:		Bloom's Cognitive level
CO1	Identify the infrastructural requirements for ATC	1
CO2	Interpret the importance of aseptic conditions and transfer the understanding in practice	2
CO3	Demonstrate different cell morphologies and characteristics	3
CO4	Appraise different staining methods and their specific use	4
CO5	Perform different types of cell cultures and understand the rationale behind them	5
CO6	Describe the use of mutagenesis approach to introduce genetic variability in plants. Analyze the effects of mutagenesis on genetic variability in plants	6

Title of the Course and Course Code	Introduction to Bioinformatics (BTH3611)	Number of Credits : 02
On completion of the course, the students will be able to:		Bloom's Cognitive level
CO1	Describe various bioinformatics tools and technique	1
CO2	Explain the structure and data storage formats in the biological databases and flow of biological information	2
CO3	Discuss various methods for the data retrieval, data storage, and data mining and use that data for the further analysis.	3
CO4	Use various sequence alignment tools and compare the unknown sequence with known sequence	4
CO5	Analyse the biological experimental data using bioinformatics tools.	5
CO6	Analysis of Multiple sequences by using various MSA tools and evaluate the level of homology	6
Title of the Course and Course Code	Soil Analysis (BTH3612)	Number of Credits : 02
On completion of the course, the students will be able to:		Bloom's Cognitive level
CO1	Define soil, describe its properties, state the factors that decide soil fertility	1
CO2	Discuss objectives of soil testing and requirements for setting up a soil testing laboratory	2
CO3	Apply basic analytical methods to evaluate physico-chemical properties of soil	3
CO4	Perform microbiological analysis of soil	4
CO5	Analyze the soil type based on results of various tests	5
CO6	Discuss the importance and limitations of mobile soil testing laboratory	6

Title of the Course and Course Code	Survey Methodology (BTH3613)	Number of Credits : 02
On completion of the course, the students will be able to:		Bloom's Cognitive level
CO1	Describe basic types of survey methods	1
CO2	Discuss aspects of survey design and modes of data collection	2
CO3	Examine various errors in surveys	3
CO4	Analyze data and present results	4
CO5	Review ongoing surveys and the ethical and legal issues of data collection	5
CO6	Interpret survey data and review outcome	6
Title of the Course and Course Code	Research proposal writing and presentation (BTH3614)	Number of Credits : 02
On completion of the course, the students will be able to:		Bloom's Cognitive level
CO1	Explain the importance of a good research proposal	1
CO2	Order and arrange the research proposal in its standard format	2
CO3	Illustrate features of a good research proposal	3
CO4	Outline the basics and requirements for acquiring a start-up grant	4
CO5	Determine and justify the ethics of scientific writing and anti-plagiarism	5
CO6	Design and develop a project proposal for applying for a start-up grant	6