



JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY

(Established by H.P.State Legislative vide Act No. 14 of 2002)
Waknaghat, P.O. Dumehar Bani, Kandaghat, Distt. Solan – 173234 (H.P.) INDIA
Website : www.juit.ac.in
Phone No. (91) 01792-257999 (30 Lines)
Fax : (91) 01792 245362

Criteria	2 Teaching-learning and Evaluation
Key Indicator	2.6 Student Performance and Learning Outcomes
Metric	2.6.1 The institution has stated learning outcomes (generic and programme specific) / graduate attributes which are integrated into assessment process and widely publicized through the website and other documents

COs of All Courses – Department Biotechnology and Bioinformatics

(BTech- BT)



Semester: I

SNo	Course Codes	Course Name	Course Outcomes
1.	18B11BT111	Fundamental Biology	<p>CO1 Overview of living system, different life forms and Maintenance of Life.</p> <p>CO2 Fundamental understanding of Bio-molecules: Building blocks of living system</p> <p>CO3 Understanding of structure and function of cell: Prokaryotic and Eukaryotic cells system.</p> <p>CO4 Understanding the Basic of cellular transport system and cellular inheritance.</p> <p>CO5 Flow of information in biological system- Central Dogma, DNA replication, Transcription, and Translation</p>
2	18B17BT171	Fundamental Biology lab	<p>CO1 Introduction to basic laboratory practices, microscopy, Bio- safety cabinet and sterilization.</p> <p>CO2 Fundamental understanding of Biological buffers preparation and application.</p> <p>CO3 Introduction to microscopic examination of different biological system.</p> <p>CO4 Introduction to analytical technique and application in macromolecular estimation.</p> <p>CO5 Able to understand ethics, team work and discipline.</p>

Semester: III

SNo	Course Codes	Course Name	Course Outcomes
1	18B11BT311	Genetics	<p>CO1 Students will combine their knowledge of probability theory with the rules of inheritance to do pedigree analysis and accurately predict genetic outcomes.</p> <p>CO2 Students will be able to interpret pedigrees and phenotypic ratios to determine if genes are autosomal or sex-linked, linked or sorting independently, and genotypes of parents</p> <p>CO3 Students will develop an appreciation of how genes work within organisms</p> <p>CO4 Students will develop an understanding and ramifications of gene mutations</p> <p>CO5 Students will be able to recognize</p>



			<p>real-world examples of genetics topics and demonstrate the interaction of genetics in society.</p> <p>CO6 Students will develop an understanding of the ethical issues related to genetic research and its applications.</p>
2	18B11BT312	Biochemistry	<p>CO1 To understand the structural fundamentals of various biochemical present in organisms</p> <p>CO2 To understand the principles of structural-functional relationship of Biomolecules</p> <p>CO3 To understand primary metabolic pathway of energy production in Organism.</p> <p>CO4 To understand the regulation of various metabolic pathway of organism.</p> <p>CO5 To integrate knowledge of biochemical pathways for understanding the various disorders and their rectification</p>
3	18B11BT313	Thermodynamics & Chemical Processes	<p>CO1 Use of correct Thermodynamic alters to describe & analyze phenomena/problems in physico- chemical processes</p> <p>CO2 Understanding the concepts of thermodynamics for biological processes as bioenergetics</p> <p>CO3 Understanding basic reaction theory and general reaction kinetics for biological Systems in terms of Michaelis-Menten Kinetics.</p> <p>CO4 To familiarize basic principles form macroscopic analysis of cell growth and product formation. Calculation of nutrient and oxygen requirements during various fermentation processes for both material balances and energy balances.</p> <p>CO5 To know the flow behavior of different fermentation fluids ,their Classification, flow curves for Non-Newtonian fluids with examples from Biotechnology as well as Rheological properties of fermentations Broths</p> <p>CO6 Understanding the principles governing heat transfer with applications in bioprocess design. Modes of heat transfer, Heat- transfer equipments and Heat transfer coefficients</p>
4	18B11BT314	General Chemistry	<p>CO1 Able to understand the fundamental chemistry of various functional group</p> <p>CO2 Able to understand the principles of stereochemistry</p> <p>CO3 Able to understand organic reaction</p>



			<p>mechanisms that impact on biochemical processes</p> <p>CO4 Able to recall the characteristics of important bio-molecules and be able to discuss the relationships between structure properties and functions</p> <p>CO5 Able to design experiments and interpret numerical, chemical and general scientific information</p>
5	18B17BT371	Genetics Lab.	<p>CO1 To acquaint the students with methods and techniques used in experimental Genetics.</p> <p>CO2 Obtain hands-on experience in performing fundamental genetics experiment including working safely and efficiently in a modern laboratory setting.</p> <p>CO3 Correctly analyze and interpret experimental results within the limitations of the experimental design</p> <p>CO4 Students will be trained students with genetics experiments related to Model Organism <i>Drosophila</i></p> <p>CO5 They will develop a statistical analysis of genetic data relevant to forensic, conservation and evolutionary genetics, and summarize and interpret the outcomes along with ethical issues.</p> <p>CO6 Students will develop an understanding and importance of Virtual Genetics Labs.</p>
6	18B17BT372	Biochemistry Lab	<p>CO1 Able to understand the fundamental chemistry of various functional group</p> <p>CO2 Able to understand the principles of stereochemistry</p> <p>CO3 Able to understand organic reaction mechanisms that impact on biochemical processes.</p> <p>CO4 Able to recall the characteristics of important bio-molecules and be able to discuss the relationships between structure properties and functions</p> <p>CO5 Able to design experiments and interpret numerical, chemical and general scientific information</p>
7	18B17BT373	Thermodynamics & Chemical Processes lab	<p>CO1 Able to familiar with the various experiments involved with the flow of heat in terms of water equivalent/heat capacity, enthalpy calculation of various biological compounds as well as energy calculation of different food items</p> <p>CO2 Able to correlate the activity with the thermodynamic parameters</p>



			$\Delta H, \Delta G, \Delta S$, and C_p CO3 To understand the variation of activity of enzymes with different physical parameters as pH, Temp. and concentration CO4 Able to correlate the chemical processes with reaction kinetics as well as Michael-Menton kinetics CO5 Able to enhance practical skills related to all the measurements of different Parameters of liquids as viscosity, surface tension. CO6 Able to enhance practical skills related to all the measurements of fluid flow Mechanics in order to check the flow patterns with the help of Reynolds number.
8	18B17BT374	General ChemistryLab	CO1 Able to understand proper procedures and regulations for safe handling and use of chemicals CO2 Able to apply knowledge of functional groups in identification of unknown compounds CO3 Able to understand the use of stereo models CO4 Able to do purification at small scale using chromatography and crystallization techniques CO5 Able to do titrations for various analytical purposes

Semester: IV

SNo	Course Codes	Course Name	Course Outcomes
1	18B11BT411	Cell Biology and Culture Technologies	CO1 Successful student will understand fundamental concepts of cellular function CO2 Be able to critically analyze, the scientific evidence underlying current understanding of cellular processes. CO3 To enable students for applying the knowledge about basic techniques of plant tissue culture. CO4 They will earn the strategies for analyzing, up-scaling and commercialization of plant based products CO5 Basic understanding of animal tissue culture, Maintain aseptic condition, primary and continuous culture of cell lines, suspension and adherent cells, cryopreservation and revival of Cell lines. CO6 To understand functional assay at cellular level, cell morphology and immune labeling.



2	18B11BT412	Molecular Biology	<p>CO1 To understand the basic structures of various genetic materials of cells</p> <p>CO2 To understand the structural-functional relationship of genetic Material with other biomolecules of cells</p> <p>CO3 To understand foundational genetic processes of molecular biology</p> <p>CO4 To Understand how molecular machines within the cell are regulated so that they can accurately copy, repair, and interpret genomic information.</p> <p>CO5 To integrate knowledge of molecular biology principles for understanding the various disorders and their rectification</p>
3	18B11BT413	Introduction to Bioinformatics	<p>CO1 Knowledge of bioinformatics databases and resources</p> <p>CO2 Sequence analysis including pair wise sequence alignment</p> <p>CO3 Sequence analysis using multiple sequence alignment</p> <p>CO4 Sequence annotation by identifying motifs, domains, conserved regions, predicting secondary structure of protein sequences</p> <p>CO5 Perform phylo genetic analysis of protein sequences and RNA secondary Structure prediction</p>
4	18B11BT414	Microbiology	<p>CO1 Exhibit competence in fundamental aspects of Microbiology (e.g. Microbial Genetics, Classification, functions)</p> <p>CO2 Scientifically test the hypothesis provided under a given situation involving microbial world and demonstrate practical skills in basic microbiological techniques</p> <p>CO3 Designate vital role of the microorganisms in the environment and their association with human beings.</p> <p>CO4 Analyze and interpret the experiments/pathways relevant to microbes</p> <p>CO5 Retrieve and use cotemporary information related to microbial world</p>
5	18B17BT471	Cell Biology and Culture Technologies lab	<p>CO1 To understand, design, analyze and interpret experiments related to cell biology and link practical knowledge to theoretical.</p> <p>CO2 To understand, design, analyze and interpret experiments related to Animal cell culture and link practical knowledge to theoretical</p> <p>CO3 To understand, design, analyze and interpret experiments related to Plant tissue Culture and link practical knowledge to theoretical</p> <p>CO4 Able to perform cell count using haemocytometer and maintain aseptic condition</p> <p>CO5 To understand teamwork, ethics and work</p>



			discipline
6	18B17BT472	Molecular Biology Lab	<p>CO1 Able to understand the fundamental procedures of isolation, visualization of various biomolecules from cellular or tissue organization</p> <p>CO2 Able to understand, and perform, molecular biology techniques accurately And safely.</p> <p>CO3 Able to isolate, quantify and visualize various biomolecules having application in the field of biotechnology.</p> <p>CO4 Able to report experimental results in a standard written format and to write coherently and persuasively about conclusions from such results and their significance.</p> <p>CO5 Able to interpret experimental results and conclusions for their understanding various biological processes and Abnormalities.</p>
7	18B17BT473	Introduction to Bioinformatics lab	<p>CO1 Understand the use of common bioinformatics resources (NCBI</p> <p>CO2 Understand various databases and tools in NCBI(PubMed, Nucleotide ,gene)</p> <p>CO3 Understand various databases and tools in Expasy (Swissprot, PROSITE</p> <p>CO4 Hands-on of pair wise sequence alignment tools-global and local</p> <p>CO5 Hands-on of multiple sequence alignment tools-global and local</p> <p>CO6 Hands-on of phylogenetic analysis tools and visualization</p>
8	18B17BT474	Microbiology Lab	<p>CO1 To familiarize the students with basic microbiology instruments in the precautions to be taken.</p> <p>CO2 To aware the students about basic Microbiological technique to study the micro-organisms</p> <p>CO3 Able to analyze bacterial growth kinetics (homogeneous reaction in the laboratory)</p> <p>CO4 Able to understand the basis of microbial resistance against antibiotics and growth of pathogenic organisms</p> <p>CO5 To develop a strong foundation about microbes and their applications</p>
9	18B11GE411	Environmental Studies	<p>CO1 Introducing basic concept of environmental studies, interdisciplinary nature and scope of the subject</p>



			<p>CO2 Understanding ecosystem services and its functioning as well as equitable use of natural resources.</p> <p>CO3 Understanding Pollution, A threat to the environment and finding its solutions, Pollutant sampling and monitoring of samples</p> <p>CO4 Correlating the concept of Biodiversity and its importance to human mankind</p> <p>CO5 Understanding Social issues and their impact on environment</p> <p>CO6 Role of Information Technology in environment and human health</p>
--	--	--	--

Semester: V

SNo	Course Codes	Course Name	Course Outcomes
1	18B11BT511	Bioprocess Engineering	<p>CO1 Able to use correct biological terms to describe & analyze phenomena/problems in bioprocesses</p> <p>CO2 Able to apply engineering principles to address issues in various bioprocesses</p> <p>CO3 Able to analyze bacterial growth kinetics(homogeneous reaction) in batch /continuous/Fed-batch reactor and sterilization</p> <p>CO4 Able to understand and to solve problems related to bioprocess phenomena including mixing, Mass transfer and sterilization</p> <p>CO5 To develop a strong foundation about bioreactor designs and their applications</p> <p>CO6 Able to understand the basis of bioprocess scale up and the related basic design calculations</p>
2	18B11BT512	Genetic Engineering	<p>CO1 Students will become aware of concept of genetic engineering and its applications</p> <p>CO2 Students will have knowledge of tools and strategies used in genetic engineering</p> <p>CO3 Student will acquire knowledge about gene libraries and isolation of genes, DNA and genome sequencing technologies</p> <p>CO4 Student will have acquaintance about protein expression hosts and genetic manipulation of plants and animals</p> <p>CO5 Can use and apply the knowledge of genetic engineering in problem solving and in practice from academic and industrial perspective</p>



3	18B11BT513	Immunology	<p>CO1 To understand and apply basic concepts of immunology.</p> <p>CO2 To understand the role of immune cells, major histo compatibility complex, antigen-antibody interactions in diagnostics</p> <p>CO3 To understand the mechanisms of regulation of immune responses and immunological tolerance</p> <p>CO4 To understand the roles played by immune response in: infectious diseases, autoimmunity.</p> <p>CO5 To understand hypersensitivity reactions, immune deficiency diseases and vaccines</p>
4	18B17BT571	Bioprocess Engineering Lab	<p>CO1 Able to apply practical knowledge to understand the various important process engineering aspects involved in biotechnology industries</p> <p>CO2 Able to design experiments and analyze various data related to various practices in bioprocess engineering</p> <p>CO3 Ability to apply theoretical concepts for data analysis and interpretation and their documentation</p> <p>CO4 Able to run fermenter and also to analyze their results</p> <p>CO5 Able to understand and determine various growth kinetics parameters in a batch culture</p> <p>CO6 Able to work in a team to accomplish the experiments and to document the experiments properly in lab notebooks</p>
5	18B17BT572	Genetic Engineering Lab	<p>CO1 Students will be able to isolate and analyze plasmid vectors</p> <p>CO2 Students will be cut and ligate DNA fragments/vectors with help of Restriction enzymes and ligase.</p> <p>CO3 The students will be able to prepare competent cells and demonstrate bacterial transformation with given vectors</p> <p>CO4 The students will be able to amplify specific DNA fragment and cloning it in Tvectors demonstrate bacterial transformation</p> <p>CO5 Student will acquire proficiency in designing and conducting experiment involving genetic manipulation</p>
6	18B17BT573	Immunology Lab	<p>CO1 To understand, design, analyze and interpret experiments related to Immunology and link practical knowledge to theoretical</p> <p>CO2 To detect antigen and check quality of antigen</p> <p>CO3 To quantitate antigen using techniques various techniques</p>



			CO4 To check changes in the number of leucocytes and their isolation from the blood. CO5 To understand team work, ethics and work discipline.
		Departmental Elective-I	
7	18B1WBT531	Phytopharmaceuticals and Biologicals	CO1 Able to understand pharmacopoeial standards of ayurvedic products CO2 Able to understand the phytopharmaceuticals, monographs and Quality control of medicinal herbs CO3 Able to understand the extraction and evaluation process of phytopharmaceuticals CO4 Able to understand Pharmacopoeial standards of Indian Pharmacopoeia CO5 Able to understand the monographs, specifications and quality control of biologicals
7	18B1WBT532	Comparative & Functional Genomics	CO1 Students will have a thorough understanding of various genomic technologies such as whole genome mapping & sequencing, genome annotation, global gene cloning and gene expression technologies, comparative genomics, introduction to Pharmacogenomics CO2 The students will know the vast amount of genome information in publically available databases and how to access and be sterilize For practical purposes. CO3 Able to analyze the gene expression data sets to derive the biologically meaning information CO4 Able to apply the knowledge of function genomics in public health

Semester: VI

SNo	Course Codes	Course Name	Course Outcomes
1	18B11BT611	Downstream Processing	CO1 Able to understand the importance and financial considerations of downstream processing in compare to upstream processing CO2 Conceptually sound in understanding about the difference between the downstream processing of intracellular and extracellular products CO3 Able to understand various separation techniques used in downstream process. CO4 Able to apply principles of various unit operations in designing and optimization of downstream processes CO5 Able to apply the principles of major unit



			operations used in downstream Processing for the purification and formulation of final products obtained from Fermentation Technology
2	18B11BT612	Food and Agricultural Biotechnology	<p>CO1 Able to learn the mechanisms of preservation methods applied to different food products.</p> <p>CO2 To understand different bioprocesses involved in food production</p> <p>CO3 To provide knowledge of different streams of agriculture having biotechnological interventions</p> <p>CO4 Able to apply knowledge and analyze the problems associated with food and Agricultural biotechnology</p> <p>CO5 Able to apply these methodologies and techniques for developing modified Crops and agricultural products</p>
3	18B17BT671	Downstream Processing Lab.	<p>CO1 Able to set up of different kind of fermentation processes for biomass and product production</p> <p>CO2 Able to describe and to apply the principles of various unit operation such as sonication, centrifugation, filtration, precipitation etc. used in DSP</p> <p>CO3 Able to strategize the downstream processes for the purification of various bioproducts such as enzymes, wine etc.</p> <p>CO4 Able to design experiments and analyze various data related</p> <p>CO5 Able to analyze and characterize the synthesized bioproducts</p>
4	18B17BT672	Food and Agricultural Biotechnology Lab	<p>CO1 To enable students for apply basic knowledge of techniques used for food And agricultural biotechnology</p> <p>CO2 Apply practical knowledge to understand the various important parameters Involved in food production and preservation</p> <p>CO3 Able to conceptualize experimental setups related to various practices in food and agriculture</p> <p>CO4 To enable students for exploring their avenues for entrepreneurship and Social welfare through projects</p> <p>CO5 Able to use different techniques for the development of different food and Agricultural products</p> <p>CO6 Able to apply biotechnological techniques for the development of improved products</p>



Departmental Elective-II			
5	18B1WBT631	Peptide Therapeutics	<p>CO1 Able to understand various peptide design consideration and their important structural concepts.</p> <p>CO2 Able to understand and learn the concept of solid phase peptides synthesis</p> <p>CO3 To develop methods of peptides and proteins for their quality control.</p> <p>CO4 To understand the mechanism of action of Antibiotic, Anticancer, Antihypertensive and Opioid peptides</p> <p>CO5 To develop a strong foundation therapeutic peptide design and their applications</p>
6	18B1WBT632	Infectious Diseases	<p>CO1 The students would have knowledge of infectious diseases for practical use in medicine and biotechnology</p> <p>CO2 The students would have in-depth knowledge of basic concepts related to infectious diseases ,immunology and epidemiology</p> <p>CO3 The students would develop knowledge and understanding of the basic form, function ,behavior, and diversity of infectious agents and Their interaction with the host</p> <p>CO4 The students would develop knowledge and skill about important technique use to study host pathogen Interactions</p> <p>CO5 The students would have sound knowledge of mode of action And resistance towards the agents used to treat infectious diseases</p>
Departmental Elective-III			
7	18B1WBT633	Nano-Biotechnology	<p>CO1 Introduction to nanotechnology(Basics of nanoscience and nanotechnology)</p> <p>CO2 Introduction to the two approaches(bottom up and top down)followed for the synthesis of nanomaterial and fundamental properties of Nano-materials(Nano-effect)</p> <p>CO3 Introduction to various technique used for the characterization of nano structures and nanomaterial</p> <p>CO4 Fundamental understanding of nanomaterial/nanobiotechnological application in health and science</p>
8	18B1WBT634	Bioenergy & Biofuels	<p>CO1 Advantages and disadvantages of Bioenergy and Biofuels over fossil fuels.</p> <p>CO2 Technical barriers in Bioenergy and Biofuel Technology</p> <p>CO3 Whole biorefinery approaches for economical</p>



			implementation into the market CO4 Conversion technologies of waste to Biofuels, Bioproducts, and Bioenergy CO5 Conversion of waste and Mixed feedstock to Biofuels
		Open Elective-II	
	18B1WBT636	Industrial Chemistry	CO1 Able to understand the basic principles in chemical technology. CO2 Students will have knowledge of industrial gases, inorganic chemicals & fertilizers. CO3 Students will acquire knowledge about surface coatings and its applications CO4 Student will have acquaintance to the use of chemical technology in batteries, catalyst and propellants

Semester: VII

SNo	Course Codes	Course Name	Course Outcomes
		Departmental Elective-IV	
1	18B1WBT733	Industrial Enzymes Technologies	CO 1 To develop an understanding of basic concepts of enzymes. CO2 To understand the basic mechanism of action and working behavior of enzymes CO3 To familiarize the students with various applications of enzymes in Laboratory as well as Industrial scale. CO4 To conceptualize about immobilized enzyme technology, and other specific Enzymes and their applications CO5 To familiarize the students with present potential of enzyme industrial application and improved activity of the enzyme using various Molecular biology techniques CO6 To understand the principle and function of enzyme in various adverse Conditions like high temperature and pH(s).
	18B1WBT734	Intellectual Property Rights & Commercialization	CO1 To enable students with basic concepts and knowledge of intellectual property rights. CO2 To apply and execute different types of IP protection in research and academics. CO3 Able to understand about the mechanisms of different IP protections, registrations and Applications CO4 To be capable of tackling issue related to IP and its commercialization CO5 To apply the knowledge of IPR for the benefit generation and form.



		Open Elective-III	
	19B1WBT731	Sustainable Technologies for Waste Management	<p>CO1 Students will know about the types of waste, their prevalence and available treatment options</p> <p>CO2 Students will be able to grasp the concepts of waste to energy technologies and apply their knowledge to look for appropriate one.</p> <p>CO3 Students will develop the skill of linking waste and management strategies to society and its needs.</p> <p>CO4 Students will develop an understanding risk assessment and life cycle of the waste</p> <p>CO5 Students will be able to recognize real-world examples of waste disposal and handling</p>
		Open Elective-IV	
	19B1WBT732	Food Nutrition & Health Care	<p>CO1 To understand the basics of nutrition, energy balance and essential nutrients</p> <p>CO2 To understand the nutritive and functional value of food products</p> <p>CO3 To understand the basics of stress, life style diseases and its management</p> <p>CO4</p>

Semester: VIII

SNo	Course Codes	Course Name	Course Outcomes
		Departmental Elective-V	
	18B1WBT831	Genetic Counselling	<p>CO1 To understand basics of genetic counselling, the nature of the directive and non-directive genetic counselling process and to counsel the patients with genetic diseases and help the mind decision Making</p> <p>CO2 To understand genetic basis of various diseases (Chromosomal, monogenic and oligogenic disorder).</p> <p>CO3 To understand gene therapy, its role in genetic disorders and recent development in gene therapy</p> <p>CO4 To understand risk assessment in genetic counseling</p>
	18B1WBT832	Traditional Bioprocessing & Their Up Scaling	<p>CO1 Introduction to Traditional Bioprocesses and Technologies</p> <p>CO2 Bioprocessing of Biopharmaceuticals</p> <p>CO3 Recent trends in Immobilization technology and bioreactor technology</p> <p>CO4 Upscaling studies of bioprocess products</p> <p>CO5 Scale up considerations of different bioprocess</p>



			commodities
		Departmental Elective-VI	
18B1WBT833	Diagnostics & Vaccine Manufacture		<p>CO1 The students would be able to identify and analyze what DNA based approach and methodology should be used for diagnostic purpose in different settings, their comparative advantages and limitations.</p> <p>CO2 The students would be able to identify and analyze what antigen - antibody based approach and methodology should be used for diagnostic purpose in different settings ,their comparative advantages and limitations.</p> <p>CO3 The students would have in-depth knowledge of various types of vaccines and approaches used for their production.</p> <p>CO4 The students would have in-depth knowledge of quality control and assurance consideration used in the industry for diagnostics</p> <p>CO5. The students would have in-depth knowledge of antimicrobial susceptibility and its application in the industry for diagnostics</p>
18B1WBI834	NGS Data Analysis & Applications		<p>CO1 The students will acquire knowledge of Next Generation Sequencing technologies used in genomics and genetics research.</p> <p>CO2 The students will acquire knowledge of Next Generation Sequencing technologies used in genomics and genetics research.</p> <p>CO3 The students will learn about the various platforms used in NGS</p> <p>CO4 The students will learn about the tools and techniques used in NGS data analysis.</p> <p>CO5 The students will know the applications and scopes of genomics research using the latest genome-wide data centric approaches</p>

