SIES College of Arts, Science & Commerce (Empowered Autonomous)

RISE WITH EDUCATION

NAAC REACCREDITED "A" GRADE

Faculty: Science

Program: Bachelor of Science

Program code: SIUSBT

Subject: BIOTECHNOLOGY

Academic Year: 2025 – 2026

T.Y.B.Sc. Biotechnology

Credit Based Semester and Grading Syllabi as per NEP 2020 approved by Board of Studies in Biotechnology to be brought into effect from June 2025.

PREAMBLE

Biotechnology, broadly defined, includes any technique that uses living organisms, or parts of such organisms, to make or modify products, to improve plants or animals, or to develop microorganisms for specific use. The interdisciplinary nature of biotechnology integrates living systems including animal, plant and microbes and their studies from molecular biology to cell biology, from biochemistry to biophysics, from genetic engineering to stem cell research, from bioinformatics to genomics-proteomics, from environmental biology to biodiversity, from microbiology to bioprocess engineering, from bioremediation to material transformation and so on.

Biotechnology is the science of today and tomorrow. It has applications in all major service sectors. i.e. health, agriculture, industry, environment etc. Biotechnology as an application science has taken firm footing in many countries, abroad where a number of transgenic crops, genetically modified food and recombinant therapeutic molecules for human and animal health are available in the market. Biotechnology as a science of service to human society is yet to make inroads in India

With the advent of the World Wide Web in the early nineties and its subsequent growth, the latest research trends have become accessible from drawing rooms across the globe. This acted as a positive feedback mechanism in increasing the pace of research in all fields including Chemical Engineering and Bio-technology. This was the motivation for an in depth analysis of what is actually required for today's technology. It is also important to take advantage of the freely available software to enhance the quality and quantity of material that can be covered in the classroom.

This restructured syllabus is therefore intended to combine the principles of physical, chemical and biological sciences along with developing advanced technology. The undergraduate curricula is prepared to impart primarily basic knowledge of the respective subject from all possible aspects. In addition, students will be trained to apply this knowledge particularly in day-to-day applications of biotechnology and hence get a flavor of research

SEMESTER V					
Course Code	**Course Type**	**Course Title**	**Theory/ Practical**	**Credits**	**Lectures /week**
SIUBTMJ311	DSC-Major	Cell Biology	Theory	3	3
SIUBTMJ312	DSC-Major	Medical Microbiology and Instrumentation	Theory	3	3
SIUBTMJ313	DSC-Major	Genomics and Molecular biology	Theory	3	3
SIUBTMJP311, SIUBTMJP312 & SIUBTMJP313	DSC-Major Practical	Practical based on Cell Biology, Medical Microbiology, Instrumentation, Genomics and Molecular Biology	Practical	3	6
SIUBTEL311	DSC-Major Elective	Bioprocess Technology I	Theory	3	3
SIUBTELP311	DSC-Major Elective Practical	Practicals based on Bioprocess technology	Practical	1	2
SIUBTMN311	Minor	Bioorganic Chemistry I	Theory	2	2
SIUBTVS311	VSC	Biostatistics	Theory	1	1
	VSC	Practicals based on Biostatistics	Practical	1	2
SIUBTFP311		Field Projects/Internships/ Apprenticeship/ Community Engagement and Services		2	2
		Total		**22**	**27**

SEMESTER VI					
Course Code	**Course Type**	**Course Title**	**Theory/ Practical**	**Credits**	**Lectures/ week**
SIUBTMJ321	DSC-Major	Agri & Environmental Biotechnology	Theory	3	3
SIUBTMJ322	DSC-Major	Immunology	Theory	3	3
SIUBTMJ323	DSC-Major	Pharmacology and Neurochemistry	Theory	3	3
SIUBTMJP321, SIUBTMJP322 & SIUBTMJP323	DSC-Major Practical	Practical based on Agri, environmental biotechnology, Immunology, Pharmacology & Neurochemistry	Practical	3	6
SIUBTEL321	DSC-Major Elective	Bioprocess Technology II	Theory	3	3
SIUBTELP321	DSC-Major Elective Practical	Practicals based on Bioprocess Technology II	Practical	1	2
SIUBTMN321	Minor	Bioorganic Chemistry II	Theory	2	2
OJT		On Job Training		4	4
		Total		**22**	**26**

DSC MAJOR 1

COURSE CODE	TITLE	CREDITS	LECTURES
SIUBTMJ311	**CELL BIOLOGY**		
Course Objectives	On successful completion of the course the learner will be able to: ● describe cell cycle mechanism and its control, identify the roles of oncogenes and tumor suppressors in Cancer and examine the causes, ● outline signal transduction pathway, mechanism of cellular responses underlying various conditions & defects in signaling and related disorders, ● discuss gametogenesis, pre & post fertilization events as well as enlist different artificial reproductive technologies		
I **Cell cycle**	Cell cycle Introduction: Prokaryotic and Eukaryotic **(2L);** The Early Embryonic Cell Cycle and the Role of MPF; Yeasts **(2L)** and the Molecular Genetics of Cell Cycle Control and its role in cancer (RB, TP53, BRCA1/2 and apoptotic factors) **(3L)**; Cancer: Introduction and its types and causes **(2L)**; Apoptosis and necrosis **(2L)**; Cell-Division Controls in Multicellular Animals **(4L)**	**3**	**15**
II **Cell Signalling**	Cell signalling and signal transduction: Introduction General Principles of Cell Signaling **(2L)**; Signaling via G-Protein-linked Cell-Surface Receptors **(2L)**; Signaling via Enzyme-linked Cell-Surface Receptors **(2L)**; Target-Cell Adaptation **(2L)** Role of cell signalling molecules in cancer (Ras and Raf **(2L)**; wnt signalling **(2L)**, growth factors and growth factor receptors **(3L)**)		**15**
III **Developmental Biology**	Introduction to Developmental biology; Gametogenesis-Spermatogenesis and Structure of sperm **(2L)** , Oogenesis, morphological changes during maturation and structure of ovum **(3L)**, Ovarian and Uterine cycle **(2L)**, Events during fertilization- Capacitation and acrosome reaction **(2L)**, Post fertilization events- Cleavage, Blastulation, Implantation, Gastrulation **(4L)**. Artificial Reproductive techniques - IVF & Embryo transfer, Intrauterine, intrafallopian and intracytoplasmic transfer **(2L)**.		**15**
Total			**45**

DSC MAJOR 2

COURSE CODE	TITLE	CREDITS	LECTURES
SIUBTMJ312	**MEDICAL MICROBIOLOGY AND INSTRUMENTATION**		
Course Objectives	On successful completion of the course the learner will be able to: ● classify viruses, understand its replication, propagation and assays, ● compare the mode of action of various antimicrobial agents as well as illustrate the mechanism of resistance development ● enlist the principle and applications of various bioanalytical techniques including electrophoresis and radioactivity		
I **Virology**	Introduction to viruses-Position in biological spectrum; Virus properties **(1L)**; General structure of viruses **(1L)**; Baltimore Classification and Taxonomy (ICTV) **(2L)**; Cultivation of viruses **(2L)**; Reproduction of ds DNA phages (Hepatitis) /ss RNA (influenza) **(2L)**, animal viruses and plant (TMV) virus **(1L)**; Virus purification and assays **(2L)**; Cytocidal infections and cell damage **(2L)**; Viroids and Prions **(1L)**; Antiviral drugs **(1L)**.	**3**	**15**
II **Chemotherapeutic drugs**	Discovery and Design of antimicrobial agents; Classification of Antibacterial agents, Selective toxicity, MIC, MLC **(2L)**; Inhibition of cell wall synthesis (Mode of action for): Beta lactam antibiotics: Penicillin, Cephalosporins; Glycopeptides: Vancomycin; Polypeptides: Bacitracin **(3L)**; Injury to Plasma membrane: Polymyxin **(1L)**; Inhibition of protein synthesis Aminoglycosides, Tetracyclines Chloramphenicol, Macrolides-Erythromycin **(2L)**; Inhibition of Nucleic acid synthesis: Quinolones, Rifampicin, Metronidazole **(1L)**; Antimetabolites: Sulphonamides, Trimethoprim **(1L)**; Drug Resistance: Mechanism, Origin and transmission of drug resistance **(2L)**; Use and misuse of antimicrobial agents; Antifungal drugs, Anticancer drugs**,** Traditional formulations as chemotherapeutic agents **(3L)**		**15**
III **Bioanalytical techniques**	Principle, working and applications of: IEF & 2D PAGE **(2L)**; Isotopes in Biology: Nature of radioactivity **(2L)**; Detection Techniques using GM counter, Scintillation counter, autoradiography **(4L)**; Applications of Tracer techniques in Biology **(2L)**, H-NMR and C-NMR **(3L),** mass spectrometry **(2L)**		**15**
Total			**45**

DSC MAJOR 3

COURSE CODE	TITLE	CREDITS	LECTURES
SIUBTMJ313	**GENOMICS AND MOLECULAR BIOLOGY**		
Course Objectives	On successful completion of the course the learner will be able to demonstrate the understanding of: ● methods of producing transgenic plants and animals; advantages and ethical concerns of using transgenic animals ● gene cloning and hybridization methods ● recent advances in techniques in genetics and molecular biology- NGS, microarray, and different sequencing techniques and modification of genes in vivo, Crispr-Cas		
I **Genetic engineering of plants & animals**	Genetic engineering of plants; Methodology. Plant transformation with the Ti plasmid of *A. tumefaciens* **(2L)**, Ti plasmid derived vector system **(2L)**; Transgenic plants: Physical methods of transferring genes to plants: electroporation, microprojectile bombardment, liposome mediated **(3L)**, protoplast fusion; Vectors for plant cells; Improvement of seed quality protein **(1L)**; Transgenic mice-methodology-retroviral method, DNA microinjection, ES method **(3L)**; genetic manipulation with cre-loxP **(2L)**; Cloning livestock by nuclear transfer **(1L)**; Transgenic fish and applications **(1L)**.	**3**	**15**
II **Tools in Molecular Biology I**	Restriction Endonucleases and restriction enzyme mapping, cutting, and joining DNA **(3L)**, Gene cloning, Cloning vectors-Plasmids (pUC series), Cosmids, phagemids M13, shuttle vectors, YAC vectors, expression vectors pET **(4L)**; Genomic DNA libraries, cDNA libraries, Methods of gene transfer in prokaryotes and eukaryotes; Recombinant selection and screening methods **(3L)**, HART, HRT **(2L),** chromosome walking and jumping **(1L)**; Hybridization techniques and its clinical applications **(2L)**		**15**
III **Tools in Molecular Biology II**	Sanger's dideoxy method, Automated DNA sequencing, Pyrosequencing; Introduction to NGS **(3L);** Gene editing- CRISPR/Cas system **(2L);** Target amplification: PCR - General Principle; Components of a Typical PCR reaction; Experimental Design; **(2L)**; PCR Types: Reverse Transcriptase and Real Time PCR **(2L);** Polymorphism and Identification: RFLP and Parentage Testing; RFLP and Sickle-Cell Anaemia **(2L);** Genetic Counselling and Molecular Diagnosis: Genetic testing- Need and uses; genetic counselling. Case studies- Diagnostic testing for Cystic fibrosis; Fragile X diagnostic and Carrier testing, CML and Down Syndrome **(3L);** Ethical, Social and legal issues to molecular genetic testing **(1L)**		**15**
Total			**45**

DSC MAJOR PRACTICALS

COURSE CODE	TITLE	CREDITS	NOTIONAL HOURS
SIUBTMJP311, SIUBTMJP312 & SIUBTMJP313	**Practical based on Cell Biology, Medical Microbiology, Instrumentation, Genomics and Molecular Biology**	**3**	**6 hrs.**
Course Outcomes	On successful completion of the course, the learner will be able to ● perform diffusion-based experiments to analyze the sensitivity pattern of test strains against commonly prescribed antibiotics and explore antimicrobial synergy ● gain proficiency in DNA manipulation through extraction, restriction digestion, and PCR ● perform bacterial transformation, recombinant protein expression, and GMO detection		

1. Antibiotic sensitivity test using agar cup method
2. Antibiotic sensitivity test using paper disc method
3. Antibiotic sensitivity test using ditch method.
4. Synergy testing of any two antibiotics
5. MIC and MLC of any one antibiotic
6. Chick embryo candling and inoculation methods (Demonstration experiment)
7. Transformation in *E.coli*
8. Genomic DNA Extraction from animal cells and analysis of DNA purity using spectrophotometer
9. Perform restriction enzyme digestion and ligation
10. Problem based questions on restriction digestion
11. Phage titration (Demonstration)
12. Replica plate technique
13. Expression of recombinant protein
14. GMO identification using PCR

DSC MAJOR ELECTIVE

COURSE CODE	TITLE	CREDITS	LECTURES
SIUBTEL311	**BIOPROCESS TECHNOLOGY I**		
Course Objectives	On successful completion of the course the learner will be able to: ● understand screening, cultivation, and preservation of industrially important microbial strains, and develop optimized inocula for industrial fermentation ● outline basic fermenter design, parts, media optimization, enabling them to understand various fermenter types for specific industrial processes ● demonstrate a comprehensive understanding of diverse industrial fermentation processes and analyze fermentation products through various chromatographic products		
I **Strain & inoculum development**	**Screening and maintenance of strains (8L):** Primary Screening and Secondary Screening; Cultivation; Preservation of Industrially Important Microbial Strains; Strain improvement **Inoculum Development (4L):** Introduction to Inoculum development; Bacterial and fungal inoculum development with one example each **Scale up and Scale down:** factors affecting the processes **(3L)**	**3**	**15**
II **Fermenters**	**Design of a fermenter (3L):** Stirred Tank Fermenter- Basic Design; Parts of a Typical Industrial Fermenter. **Types of Fermenters (7L):** Batch and continuous fermenters, Submerged and solid-state fermenters, Air Lift, Bubble, Column, Deep jet and Membrane bioreactor **Fermentation Media (2L):** Components; Design and Optimization. **Sterilization (3L):** Sterilization of Fermenter and Fermentation Media.		**15**
III **Fermentation process**	**Study of representative fermentation processes (10L)**: Penicillin, Beer, Wine, Vinegar, Protease; Mushroom; Glutamic acid, Vitamin B12, Humulin, Algae as SCP, Probiotics and Prebiotics. **Analysis of Industrial Products (5L):** Chromatographic techniques - HPLC, HPTLC, GC		**15**
Total			**45**

DSC MAJOR ELECTIVE PRACTICALS

COURSE CODE	TITLE	CREDITS	NOTIONAL HOURS
SIUBTELP311	**Practicals based on Bioprocess Technology**	**1**	**2 hrs.**
Course Outcomes	On successful completion of the course, the learner will be able to screen industrially important strains, estimate penicillin and ethanol concentration as well as interpret outputs of chromatographic techniques		

1. Comparison of Growth curve of two bacterial strains
2. Screening for an Antibiotic Producing Strain of Microorganism.
3. Estimation of Penicillin by Biological (Bioassay) Method
4. Purification & estimation of Ethanol content from Broth Culture of *Saccharomyces* spp.
5. HPLC data interpretation
6. GC data interpretation
7. Extraction of alkaloids and their separation by TLC
8. Bioassay of Vitamin B_{12}

DSC MINOR

COURSE CODE	TITLE	CREDITS	LECTURES
SIUBTMN311	**BIOORGANIC CHEMISTRY I**		
Course Objectives	On successful completion of the course the learner will be able to describe: ● synthesis and regulation of various biomolecules & crosstalk of various metabolic pathways ● the concepts of enthalpy, entropy, and free energy & explain the role of ATP in active transport processes		
I Metabolism	Classification of Carbohydrates and lipids **(1L);** Carbohydrate biosynthesis and its regulation **(2L)**, Gluconeogenesis **(1L)**, Pentose Phosphate pathway **(1L)**, Glyoxylate pathway **(1L)**, reductive TCA **(1L)**, Starch and sucrose in Plants **(2L)**; Glycogen in Animals **(2L)**; Biosynthesis and regulation of Fatty acids **(2L)**, Cholesterol and atherosclerosis **(2L**).	**2**	**15**
II Bioenergetics	Laws of thermodynamics, Concept of enthalpy, Entropy, Free energy with relation to living system **(2L)**, Standard free energy change and equilibrium constant **(2L)**, Energy rich compound-ATP as energy currency **(2L)**, Structure of ATP hydrolysis, other energy rich compounds **(2L)**, Phosphoryl group transfers **(1L)**, ATP and muscle contraction **(1L)**, ATP and active transport **(1L)**, Transphosphorylation reaction **(1L)**, nucleophilic displacement reactions of ATP **(1L);** Biological oxidation-reduction reaction, Flavin nucleotides, NAD, NADP **(2L)**		**15**
Total			**30**

VOCATIONAL SKILL COURSE

COURSE CODE	TITLE	CREDITS	LECTURES
SIUBTVS311	**BIOSTATISTICS**		
Course Objectives	On successful completion of the course the learner will be able to: ● understand the fundamentals of probability and distributions ● perform hypothesis testing procedures and apply chi-square test for goodness of fit ● analyze relationships with correlation and regression		
I Biostatistics	Normal distribution - properties, Sampling distribution of means, Standard error of means, Hypothesis testing: Null and alternative hypothesis, importance; Type I and II errors, Level of significance Steps in Testing Statistical Hypothesis; Concept of inferential statistics; Parametric Tests: - Z Test- Single Mean and Two Means, t-Test-Single Mean, Paired and Unpaired; Chi-square test (test of goodness of fit) Coefficient of Correlation and Simple Linear Regression Analysis	**1**	**15**
Total			**15**

COURSE CODE	TITLE	CREDITS	LECTURES
SIUBTVS311	**Practical based on Biostatistics**	**1**	**2 hrs.**
Course Objectives	On successful completion of the course, the learner will be able to formulate null and alternative hypotheses, determine appropriate levels of significance and gain proficiency in using Microsoft Excel to perform statistical analyses.		
1. Probability problems related to normal distribution 2. Problems based on Z-test and t-test 3. Problems based on test of goodness of fit 4. Problems based on Correlation and regression 5. Use of Microsoft Excel for plotting chart with SD, R^2 value and regression equation			
Total			**30**

SEMESTER VI AC/0.0.2025/RS1

DSC MAJOR 1

COURSE CODE	TITLE	CREDITS	LECTURES
SIUBTMJ321	**AGRI & ENVIRONMENTAL BIOTECHNOLOGY**		
Course Objectives	On successful completion of the course the learner will be able to: ● design PTC media and discuss the importance of PTC for production of fine chemicals; classify and explain different plant breeding markers and examine the significance of barcoding ● describe different methods of effluent treatment as well as strategize treatment of industrial wastes and ● discuss heavy metal treatment methods as well as explain the biodegradation of persistent chemicals		
I Plant Tissue Culture & Molecular Markers in Plant Breeding	Introduction to PTC media and role of phytohormones **(1L)**, Micropropagation, Initiation and maintenance of callus **(1L)**, organogenesis and virus elimination **(1L)**, plant suspension cultures and its use for production of fine chemicals **(1L)**, elicitation, permeabilization and biotransformation **(1L)**, Hairy root culture **(1L)**, Somatic embryogenesis and synthetic seeds **(1L)**. Genetic markers in plant breeding- Classical markers **(1L)**, DNA markers (RFLP, RAPD, AFLP, SSR, SNP **(5L)**; Application of Molecular Markers to Plant Breeding **(1L)**; Plant DNA Barcoding: Benefits, Limitations **(1L)**.	**3**	**15**
II Primary and Secondary waste treatment	Introduction to industrial wastewater treatment **(1L);** Primary Treatment **(2L);** Secondary Treatment: Biological processes for industrial effluent treatment **(1L)**, Aerobic biological treatment - activated sludge process, CASP, advanced activated sludge processes (any two). Biological filters, RBC, Fixed Bed Reactors **(5L)**; Anaerobic biological treatment - contact digesters, packed bed reactors, anaerobic baffled digesters, UASB **(4L)**; Characteristics and treatment strategies of Industrial wastewater: tanning industry, paper & pulp industry, Dairy, Distillery **(2L)**		**15**
III Waste Management	Heavy metal pollution – sources, toxicity **(1L);** Heavy metal remediation- Physical-chemical methods, Microbial systems for heavy metal accumulation **(2L)**, Techniques used for heavy metal removal: Bioremediation **(2L)** & Phytoremediation **(1L)** Solid waste treatment **(2L)**; Composting and Vermicomposting **(1L)** Pollution indicators & biosensors **(1L)**, Removal of oil spillage & grease deposits **(2L)** Biodegradation of xenobiotics-persistent compounds, chemical properties influencing biodegradability **(2L);** Radioactive waste management **(1L)**		**15**
Total			**45**

SEMESTER VI AC/0.0.2025/RS1

DSC MAJOR 2

COURSE CODE	TITLE	CREDITS	LECTURES
SIUBTMJ322	**IMMUNOLOGY**		
Course Objectives	On successful completion of the course the learner will be able to: ● describe the general organization, structure and diversity of major histocompatibility complex as well as T cell development & T-cell Receptor Complex ● comprehend B cell development and function and understand innate immune receptors ● explain the principles of immunization and describe different types of vaccines		
I **MHC & Antigen Presentation**	**MHC Classes**: General Organization and Inheritance; Structures and Peptide Interactions; Class I and II Diversity and Polymorphism; Antigen Presentation - Endocytic and Exocytic Pathways; Self MHC Restriction **(8L)** **T cell development & T-cell Receptor Complex:** Structure, Signaling, T cell co-receptor complex Cell mediated effector responses **(7L)**	**3**	**15**
II **Humoral and Innate Immunity**	**B cell development & B-cell Receptor:** Structure, Mechanism, Introduction to VDJ recombination, B cell co-receptor complex, B-T cell interaction, Antibody mediated effector functions **(7L)** Monoclonal & Polyclonal antibody, Engineered antibodies **(4L)** **Innate Receptors (3L):** Toll-like receptors (TLRs); C type lectins; Nod like receptors		**15**
III **Vaccines**	Immunization, immunization schedule **(2L)** **Vaccines**- Live and Attenuated Vaccines, Inactivated and killed vaccines **(3L)** **Subunit vaccines**-HSV, cholera, HPV, Peptide vaccines- Foot and mouth disease, Malaria; **(4L)** **Attenuated vaccines** – Cholera, HSV, Edible vaccines; Gene therapy, Human gene therapy- in vitro & in vivo **(4L)** DNA vaccines, mRNA vaccines **(2L)**		**15**
Total			**45**

SEMESTER VI AC/0.0.2025/RS1

DSC MAJOR 3

COURSE CODE	TITLE	CREDITS	LECTURES
SIUBTMJ323	**PHARMACOLOGY & NEUROCHEMISTRY**		
Course Objectives	On successful completion of the course the learner will be able to: ● describe the mechanism of drug action and inspect the dose response relationship ● discuss the absorption, distribution, metabolism and excretion of drugs ● explain the generation and propagation of nerve impulse and examine the action of neuromodulators as well as neurotoxins		
I **General principles of Pharmacology**	Introduction to Indian system of medicine; Modern medicines: general principles of pharmacology and toxicology **(2L);** Mechanism of drug action; drug receptors and biological responses**;** second-messenger systems, the chemistry of drug–receptor binding **(3L);** dose–response relationship: therapeutic index; ED, LD; Potency and Intrinsic Activity **(3L)**; Drug antagonism **(2L);** Toxicity testing **(1L)** Pharmacokinetics: Drug concentration–time profiles, Cmax, Tmax, AUC, half-life of drug, Bioavailability, clearance, volume of distribution, Elimination kinetics, Concept of Bioequivalence **(4L)**	**3**	**15**
II **Drug Absorption, Distribution, Metabolism and Excretion**	Relationship between pH and pKa of drug; Lipid-water coefficient of drug; Transport of drug across membrane **(2L)** Absorption of drugs from the alimentary tract - oral cavity, stomach, small intestine, large intestine; factors affecting rate of gastrointestinal absorption; absorption of drugs from lungs; skin; absorption of drugs after parenteral administration **(4L);** Drug distribution: factors influencing drug distribution **(2L)** Drug metabolism: oxidative and reductive enzymes: phase I reactions; conjugative enzymes: phase II reactions; Pharmacogenomics of drug metabolizing enzymes **(4L)** Excretion of drugs: Renal excretion; Biliary Excretion; Pulmonary excretion **(3L)**		**15**
III **Neurochemistry**	Nervous system and its types, Anatomy and functioning of the brain **(2L)**; structure and classification of neuron **(2L)**, Neuronal pathways **(1L)**; Ion channels **(2L)**; Propagation of nerve impulses **(1L)**; Neuronal excitation and inhibition, Generation and propagation of Action potential, Graded potential **(3L)**, Synapses and gap junctions **(2L)**; Action of Neurotoxins and neurotransmitters, Incapacitating agents **(2L)**.		**15**
Total			**60**

SEMESTER VI

DSC MAJOR PRACTICALS

COURSE CODE	TITLE	CREDITS	NOTIONAL HOURS
SIUBTMJP321, SIUBTMJP322 & SIUBTMJP323	**Practical based on Agri, environmental biotechnology, Immunology, Medical microbiology, Pharmacology & Neurochemistry**	**3**	**6 hrs.**
Course Outcomes	On successful completion of the course, the learner will be able to ● design and conduct a toxicity test and understand the impact of heavy metals on microbial growth, ● determine total solids, BOD/COD, analyze and interpret the result data & assess the environmental impact of the effluent ● learn the techniques for surface sterilizing plant explants & callus induction ● determine the thermal death point and time for microorganism		

1. LD 50 evaluation using suitable model
2. Study the effect of heavy metals on the growth of bacteria.
3. Determination of Total Solids from an effluent sample.
4. Study of physico-chemical (pH, color, turbidity, BOD, COD) parameters of any one industrial effluent sample
5. Preparation of MS medium (media preparation)
6. Problems based on normality, molarity, molality, etc.
7. Surface sterilization of explant and inoculation in MS medium
8. Callus induction
9. Study of Phagocytosis (Demonstration)
10. Estimation of antioxidants and antioxidant enzymes - Ascorbate, Catalase, and Peroxidase
11. Study of thermal Death Point
12. Study of thermal Death time
13. Visit to facilities having biogas/effluent treatment plants.

SEMESTER VI AC/0.0.2025/RS1

DSC MAJOR ELECTIVE

COURSE CODE	TITLE	CREDITS	LECTURES
SIUBTEL321	**BIOPROCESS TECHNOLOGY II**		
Course Objectives	On successful completion of the course the learner will be able to: ● prioritize the importance of starter culture as well as outline the steps involved in manufacturing of various fermented products ● discuss the different methods of downstream processing for purification ● Implement good manufacturing practices, QA/QC as well as restate the importance of ISO		
I **Dairy technology**	Milk: Normal flora, changes in raw and pasteurized milk; grades of milk **(2L)**; Enumeration; Factors affecting bacteriological quality; Preservation methods **(2L)**; Pasteurization **(1L)**; Starter Cultures **(2L)**; Fermented products - Production process and spoilage of - Cheese: Swiss and Cheddar **(3L)**; Butter **(2L)**; Yogurt **(2L)** and cultured buttermilk **(1L)**	**3**	**15**
II **Down-stream Processing (DSP)**	Introduction of DSP **(1L)**; Foam separation; Types of Precipitation **(2L)**; Filtration **(3L)**, Centrifugation **(3L)**; Chromatography in DSP **(1L)**; Cell disruption-physical and chemical methods **(2L)**; Solvent Solvent extraction **(2L)**, Drying; Crystallization and Whole broth processing **(1L)**		**15**
III **Quality Assurance and Quality Control**	Concept of GMP **(2L)**; Requirements of GMP implementation **(1L)**, Documentation of GMP practices **(1L)** ; Regulatory certification of GMP **(1L)** ; Quality Control (QC): Concept of QC **(2L)**, Requirements for implementing QC **(1L)**; QA concepts: Concept of QA **(2L)** , Requirements for implementing QA **(2L)**, ISO concepts and benefits, ISO 45001, ISO 9000, ISO 13485**(3L)**.		**15**
Total			**45**

DSC MAJOR ELECTIVE PRACTICALS

COURSE CODE	TITLE	CREDITS	NOTIONAL HOURS
SIUBTELP321	**Practical based on Bioprocess Technology II**	**1**	**2 hrs.**
Course Outcomes	On successful completion of the course, the learner will be able to: ● check the quality of milk ● validation and calibration of common laboratory equipments ● identify adulterants in food samples, analyze the microbial quality of food products and determine the efficacy of disinfectants		

1. Isolation of Lactic acid bacteria on Rogosa agar medium
2. Microbial analysis of Milk by MBRT and RRT
3. Phosphatase test of Milk
4. DMC of milk sample
5. Validation of micropipette, measuring cylinders, colorimeters
6. Calibration of pH meter and weighing balance
7. Sterility testing of injectables
8. Effect of UV as a method of microbial control
9. Testing of common adulterants in food
10. Visit to fermentation industry.

DSC MINOR

COURSE CODE	TITLE	CREDITS	LECTURES
SIUBTMN321	**BIOORGANIC CHEMISTRY II**		
Course Objectives	On successful completion of the course the learner will be able to describe: ● structure, storage, release, transport, function as well as disorders associated with various hormones ● protein structure, interactions between Proteins and Ligands as well as interactions modulated by chemical energy		
I Endocrinology	Mechanism of action of group I and II hormones **(1L)**; Structure, storage, release, transport, biochemical functions and disorders associated with: Growth Hormone, stimulating hormones; oxytocin and vasopressin **(2L)**; Thyroxine, calcitonin; Parathyroid Hormone **(3L)**; epinephrine and norepinephrine **(2L)**; Glucocorticoids **(1L)**; insulin and glucagon **(3L)**; estrogen and progesterone and hCG **(2L)**; testosterone **(1L)**; hormones secreted by Hypothalamus**.**	**2**	**15**
II Proteins	Protein structure: Protein Primary, Secondary, Tertiary and Quaternary Structures **(3L)**; Ramachandran Plot **(1L)**; Protein Denaturation and Folding **(2L)**; Chaperones **(2L)**; diseases due to protein misfolding **(1L);** Protein Function: Reversible Binding of a Protein to a Ligand **(1L)**: Oxygen-Binding Proteins **(2L)**; Protein Interactions with examples **(1L)**, Protein Interactions Modulated by Chemical Energy: Actin and Myosin **(2L).**		**15**
Total			**30**

References

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EVALUATION SCHEME

The performance of the learner shall be evaluated into TWO Parts.
The learner's performance shall be assessed by Internal Assessment of **25 Marks**, Semester End Examination (theory) of **50 Marks** and Practical Examination of **25 marks** for **DSC Major** and **DSC Major Electives**.
The allocation of marks for the Internal Assessment and Semester End Examinations are as follows:

Course Type	**Internal**	**Sem-End**	**Practical**	**Participation/ Reports**	**Total**
DSC Major	25	50	25	-	100
DSC Major Elective	25	50	25	-	100
DSC Minor	20	30	-	-	50
VSC	25	-	25	-	50
FP/CEP	-	-	-	50	50
OJT	-	-	-	100	100