



SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY

(DEEMED TO BE UNIVERSITY)

Accredited A++ Grade by NAAC | 12B Status by UGC | Approved by AICTE

www.sathyabama.ac.in

School of Bio & Chemical Engineering

Department of Biotechnology

1.1.3 Courses having focus on Employability / Entrepreneurship / Skill Development

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B. TECH. BIOTECHNOLOGY

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Employability



Entrepreneurship



Skill Development

SBTA1101	MICROBIOLOGY AND CELL BIOLOGY	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVE

- The course aims to develop skills of the Students in the area of Microbiology and Cell biology particularly to identify microbes, structure, metabolism and Cell Signaling pathways

UNIT 1 CLASSIFICATION AND MULTIPLICATION

9 Hrs.

Overview of history of Microbiology- Classification of Microbes - Systems of classification, Numerical taxonomy, Identifying characters for classification, General properties and principles of classification of microorganisms Structural organization and multiplication of bacteria, viruses, algae and fungi.

UNIT 2 MICROBIAL NUTRITION, GROWTH AND METABOLISM

9 Hrs.

Nutritional requirements of bacteria and different media used for bacterial culture; growth curve. Mathematical nature and expression of microbial growth and different methods to quantitate bacterial growth, aerobic and anaerobic bioenergetics and utilization of energy for biosynthesis of important molecules.

UNIT 3 CONTROL OF MICROORGANISMS

9 Hrs.

Definition of sterilization, Physical and chemical control of microorganisms; host-microbe interactions; antibacterial, anti-fungal and anti-viral agents, mode of action and resistance to antibiotics; clinically important microorganisms.

UNIT 4 CELL ORGANELLES

9 Hrs.

Evolution of cell; Cell as a unit of living organism, evolution and structure of prokaryotic cell, evolution of eukaryotic cell - Structural and functional features of eukaryotic cell: cell organelles; endoplasmic reticulum, golgi complex, lysosomes, vacuoles, peroxisomes, mitochondria, chloroplast, cytoskeleton, microtubules, nucleus, extracellular matrix etc.

UNIT 5 CELL CYCLE AND APOTOSIS

9 Hrs.

Cell cycle - An overview of cell cycle; Components of cell cycle control system; Intracellular and Extra-cellular control of cell division, Programmed cell death (Apoptosis), intrinsic & extrinsic pathways of cell death, Apoptosis in relation with Cancer, Viral disease (AIDS) & Organ transplant.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Familiar with overview and scope of microbiology.
- CO2 - Explore the systemic classification of microbes.
- CO3 - Study the methods for cultivation of organisms.
- CO4 - Understand the basic principles of cellular components.
- CO5 - Study the cell cycle principle.
- CO6 - Understand the application of microbiology and cell biology in biotechnology.



Employability



Entrepreneurship



Skill Development

SBTA1102	BIOMECHANICS	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVES

- To gather adequate knowledge the mechanics involved in human beings.
- To understand the fundamental principles related to mechanical actions of biological tissues

UNIT 1 INTRODUCTION

9 Hrs.

Biomechanics, History, Applications, Perspectives in Biomechanics; Rigid Body BioMechanics; Anatomical Concepts in Biomechanics., Fundamentals of Biomechanics, Anthropometric Considerations, Newtons Laws of motions

UNIT 2 MECHANICS OF HARD TISSUES

9 Hrs.

Whole body modeling, Structure of bones – Composition and properties of bones and relationship to structure – Elastic properties of bones, Bone fracture mechanics, Implants for bone fractures, Lubrication of joints.

UNIT 3 MECHANICS OF SOFT TISSUES

9 Hrs.

Tissue Mechanics-Structure and functions of cartilages, tendons, ligaments., Mechanical Properties of Tissues, Biological materials, Pseudo elasticity, nonlinear stress-strain relationship, viscoelasticity and models, structure, function and mechanical properties of skin, ligaments and tendons, Mechanical testing of Soft tissue.

UNIT 4 CARDIOVASCULAR MECHANICS

9 Hrs.

Cardiovascular Physiology, Heart Valve Dynamics, Prosthetic Valve Dynamics. Mechanical properties of blood vessels – arteries, arterioles, capillaries, veins, blood flow: laminar and turbulent.

UNIT 5 APPLICATIONS OF BIOMECHANICS

9 Hrs.

Mechanics of spinal distraction rods, Biomechanics of human motion and control interfaces with application to limb orthotics and prosthetics. Design of hip prosthesis, Automated driver's training programme, Sports biomechanics.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Understand the principles and mechanics of hard tissues.
- CO2 - Outline the principles of biofluid dynamics.
- CO3 - Explain the fundamentals of soft tissues
- CO4 - Apply the knowledge obtained in cardiovascular mechanics
- CO5 - Discover mechanics related to cardiovascular system.
- CO6 - Apply the knowledge gained to find solutions to various need in biomechanics



Employability



Entrepreneurship



Skill Development

SEEA1101	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVES

- To impart knowledge on the analysis of DC and AC Circuits.
- To gain knowledge about the working of electrical machines.
- To impart Knowledge on the operation of the basic electronic devices.

UNIT 1 D.C. CIRCUITS

9 Hrs.

Electrical Quantities - Ohm's law - Kirchoff's laws -Resistance in series and parallel combinations - Current and Voltage division rules - Mesh analysis and Nodal analysis.

UNIT 2 A.C. CIRCUITS

9 Hrs. Sinusoidal

functions - R.M.S and Average values for Sinusoidal waveform - Phasor representation - Sinusoidal excitation applied to purely resistive, inductive and capacitive circuits - RL, RC and RLC series circuits - power and power factor - Introduction to three phase circuits with balanced load.

UNIT 3 INTRODUCTION TO MACHINES

9 Hrs.

Construction and Principle of Operation of DC Generators - DC Motors - Single Phase Transformer - Single Phase Induction Motors - Stepper Motor.

UNIT 4 SEMICONDUCTOR DEVICES

9 Hrs.

VI Characteristics of PN-junction diodes and Zener diodes, BJT and its configurations – input/output Characteristics, Junction Field Effect Transistor – Drain and Transfer Characteristics, MOSFET – Depletion type and Enhancement type, Uni Junction Transistors - Silicon Controlled Rectifiers.

UNIT 5 DIGITAL ELECTRONICS

9 Hrs.

Number systems – Binary arithmetic - Boolean algebra, laws & theorems – Boolean Functions - Simplification of Boolean functions - Logic gates - Implementation of Boolean expressions using logic gate - Standard forms of Boolean expression.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Analyze electrical circuits using Kirchoff's Laws.
- CO2 - Compare the behaviour of R, L and C and their combinations in AC circuits.
- CO3 - Describe the construction and working principle of DC and AC machines.
- CO4 - Demonstrate the characteristics of various semi-conductor devices.
- CO5 - Understand the concept of digital electronics.
- CO6 - Recognize the importance of electronic devices



Employability



Entrepreneurship



Skill Development

SBTA1301	MOLECULAR BIOLOGY AND GENETICS	L	T	P	Credit	Total Marks
		3	*	0	3	100

COURSE OBJECTIVES

- The course aims to give an understanding on the fundamentals of conventional genetics and the intricate molecular mechanisms of heredity and variations.
- To understand storage of genetic information and its translation at molecular level in prokaryotic and eukaryotic systems.

UNIT 1 CLASSICAL GENETICS

9 Hrs.

Fundamental principles of genetics- Mendel's principles and experiments, gene interaction, multiple alleles, complementation, linkage, sex linked, sex limited and sex influenced inheritance; Chromosomes basis of heredity- extra-chromosomal inheritance; Linkage and crossing over; Hardy-Weinberg equilibrium, Extensions of Hardy- Weinberg equilibrium.

UNIT 2 STRUCTURE AND PROPERTIES OF NUCLEIC ACIDS

9 Hrs.

Introduction to nucleic acids: Evidence for DNA&RNA as a genetic material; Structure and physicochemical properties of elements in DNA and RNA, Biological significance of differences in DNA and RNA. Primary structure of DNA: Chemical and structural qualities of 3',5'-Phosphodiester bond. Secondary Structure of DNA: Watson & Crick model, Chargaff's rule; DNA replication- Overview of differences in prokaryotic and eukaryotic DNA replication, D-loop and rolling circle mode of replication, Telomere replication in eukaryotes; Okazaki fragments, Fidelity of DNA replication, Inhibitors of DNA replication, DNA repair- Mutagens, DNA mutations and various types of repair mechanisms.

UNIT 3 TRANSCRIPTION

9 Hrs.

Central Dogma in molecular biology -Structure and function of mRNA, rRNA tRNA and micro RNAs. Characteristics of promoter and enhancer sequences. RNA synthesis: Initiation, elongation and termination of RNA synthesis, Proteins of RNA synthesis, Fidelity of RNA synthesis, Inhibitors of transcription, Differences in prokaryotic and eukaryotic transcription. Basic concepts in RNA world: RNA processing: 5'-Capping, Splicing-Alternative splicing, Poly 'A' tail addition and base modification.

UNIT 4 TRANSLATION

9 Hrs.

Introduction to Genetic code: Elucidation of genetic code, Codon degeneracy, Wobble hypothesis and its importance, Prokaryotic and eukaryotic ribosomes. Steps in translation: Initiation, Elongation and termination of protein synthesis. Inhibitors of protein synthesis. Post-translational modifications and its importance.

UNIT 5 REGULATION OF GENE EXPRESSION

9 Hrs.

Organization of genes in prokaryotic and eukaryotic chromosomes- operon concept; Gene expression and regulation- Hierarchical levels of gene regulation, Prokaryotic gene regulation -lac and trp operon, Eukaryotic gene regulation- gene silencing.

Max.45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Explain the foundations of Mendelian genetics and chromosomal theory and apply these, with appropriate terminology, to contemporary concepts in genetics.
- CO2 - Emphasize the molecular mechanism of DNA replication and repair in various organisms
- CO3 - Explain the properties of genetic materials and storage and processing of genetic information.
- CO4 - Analyze the processes of transcription and translation in both prokaryotes and eukaryotes at molecular level.
- CO5 - Understand the redundant and universal qualities of the genetic code and how it is used to determine the amino acid sequence of a polypeptide.
- CO6 - Compare the mechanisms of gene regulation in prokaryotes and eukaryotes.



Employability



Entrepreneurship



Skill Development

SBTA1303	PROTEIN ENGINEERING AND BIOINFORMATICS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

- To understand the protein structure and its applications in bioinformatics

UNIT 1 PROTEIN STRUCTURE

9 Hrs.

Hierarchical representation of proteins, structural classification of proteins, protein folding pathways and protein stability

UNIT 2 STRUCTURAL CHARACTERIZATION OF PROTEINS

9 Hrs.

Primary structure: peptide mapping, peptide sequencing - automated Edman method & mass-spectroscopy, an overview of spectroscopic techniques for the analysis of protein secondary and tertiary structure; an overview of techniques for analysis of protein quaternary structure.

UNIT 3 PROTEIN DATABASES AND SEQUENCE ANALYSIS

9 Hrs.

Databases for protein sequence and structure, Protein sequence analysis: sequence alignment, programs for sequence alignment, amino acid properties for sequence analysis

UNIT 4 PROTEIN STRUCTURE PREDICTION

9 Hrs.

Overview on protein structure analysis, Secondary structure prediction-tools used, 3D Structure prediction-Homology modelling, threading and Ab initio methods

UNIT 5 PROTEIN ENGINEERING AND APPLICATIONS

9 Hrs.

Strategies for protein engineering; Random and site- directed mutagenesis; Various PCR based strategies; Role of low-fidelity enzymes in protein engineering; Gene shuffling and Directed evolution of proteins; Protein backbone changes; Antibody engineering. Biotechnological and Biomedical Applications: Industrial, Environmental and Biomaterial applications, Applications in Nanotechnology, Biosensors, virus engineering, Engineered proteins and scaffold proteins as therapeutics.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Analyse and compare the amino acid sequence and structure of proteins, and relate this information to the function of proteins
- CO2 - Understand and differentiate several biophysical techniques used for characterisation of protein structure
- CO3 - Understanding protein databases that are storehouse to the latest information in protein research
- CO4 - Analyse the protein sequence for their structural properties
- CO5 - Use appropriate tools to predict the structure of proteins
- CO6 - Appraise different protein design strategies used to design completely new proteins tailored to specific tasks



Employability



Entrepreneurship



Skill Development

SBTA1304	ENVIRONMENTAL BIOTECHNOLOGY	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

- To study about the ecology, pollution and control

UNIT 1 INTRODUCTION TO ECOLOGY

9 Hrs.,

Historical perspective, Our Environment: Atmosphere; Hydrosphere; Lithosphere; Scope of Ecology; Development and Evolution of Ecosystem; Principles and concepts of ecosystem; Structure of ecosystem; Strata of an ecosystem; Types of ecosystem; Cybernetics and Homeostasis; Biological control of chemical environment; Energy transfer in an ecosystem; Food chain, food web; Energy budget; Production and decomposition in a system; Ecological efficiencies; Trophic structure and energy pyramids; Principles pertaining to limiting factors; Biogeochemical cycles (N, C, P cycles)

UNIT 2 MICROBES AND ENVIRONMENT

9 Hrs.

Role of microorganisms in natural system and artificial system; Influence of Microbes on the Earth's Environment and Inhabitants; Ecological impacts of microbes; Symbiosis (Nitrogen fixation and ruminant symbiosis); Microbes and Nutrient cycles (Biogeochemical cycles (N, C, P cycles); Microbial communication system; Quorum sensing; Microbial fuel cells; Prebiotics and Probiotics

UNIT 3 ENVIRONMENTAL CHEMISTRY & POLLUTION

9 Hrs.

Water and water quality parameters Origin and effect of waste water on aquatic environment. Industrial water pollution ; Chemistry of waste water-DO,BOD,COD,TOC Chemistry of air and air pollutants; Sources; Sinks; Classification and effects of air pollutants on living and non-living things; Chemistry of soil: Formation; Constituents and properties of soils; Composition of types of soil; Chemical factors affecting the soil quality; Adsorption of contaminants in soil. Industrial waste; Urban waste; Chemical and metallic pollutants; Radioactive waste; Trace heavy metals; Pesticides; Fertilizers effect of modern agro-technology on quality of soil

UNIT 4 POLLUTION CONTROL & BIOPRODUCTS

9 Hrs.

Air Pollution Treatment: Treatment technologies, Biofilters and Bioscrubbers for treatment of industrial waste. Primary, secondary and tertiary treatment of wastewater—Comparison between aerobic and anaerobic processes, Activated sludge process – Trickling filter – Rotating biological contactors – Fluidized bed reactor – anaerobic digester, emerging process in waste water treatment and their applications - municipal and industrial wastewater treatment. Composting- types, systems, quality- vermicomposting. Biofertilizers – Biopesticides - Biofuel production - Bioethanol – Biohydrogen and Biodiesel

UNIT 5 BIOREMEDIATION & BIODEGRADATION

9 Hrs.

Bioremediation- *Insitu* and *Exsitu*- bioventing, Biosparging and Phytoremediation. Role of microbes in improving soil fertility- Mycorrhiza. Microbial leaching of heavy metals - extraction of metals from ores- Bioaccumulation-Biosorption and Bioprecipitation of heavy metals. Aerobic and Anaerobic degradation of recalcitrants - aliphatic, aromatic polyaromatic - hydrocarbons.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Bring about an insight on the basic concepts of ecology
- CO2 - Describe the role of microbes in the environment
- CO3 - Outline the Source and effect of pollutants in the environment
- CO4 - Present an overview of important environmental technologies involved in treatment of pollutants and resource recovery.
- CO5 - Explain the different bioremediation processes
- CO6 - Insight into the mechanism of degradation of organic pollutants



Employability



Entrepreneurship



Skill Development

SBTA1401	ENZYME TECHNOLOGY	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVE

- To understand the working of different enzymes and applying the functions in industrial biotechnology

UNIT 1 INTRODUCTION TO ENZYMES

9 Hrs.

Nature and function of enzymes, Enzyme nomenclature, classification of enzymes, mechanisms of catalysis - Acid base catalysis, electrostatic catalysis, covalent catalysis and enzyme catalysis., Role of co-enzymes and co-factors.

UNIT 2 ENZYME KINETICS

9 Hrs..

Michaelis - Menton kinetics, determination of Km, Lineweaver Burke plot, Eadie - Hofstee plot, Hanes-Woolf plot. Turnover number, Enzyme inhibition -Types of enzyme inhibition, competitive inhibition, uncompetitive inhibition, non-competitive inhibition, Irreversible inhibition and inactivation kinetics. Multi substrate enzyme catalysed reaction.

UNIT 3 ENZYME IMMOBILIZATION

9 Hrs.

Classification of enzyme immobilization, physical and chemical techniques for enzyme immobilization -adsorption, matrix entrapment, encapsulation, cross-linking, covalent bonding, advantages and disadvantages, Application of immobilized enzymes, mass transfer effect on immobilization, properties of immobilized enzymes.

UNIT 4 ENZYME SPECIFICITY AND EXTRACTION

9 Hrs.

Types of specificity, Active site- Fischer hypothesis and Koshland hypothesis, Extraction of soluble enzymes, membrane bound enzymes, purification procedures, criteria of purity.

UNIT 5 CLINICAL AND INDUSTRIAL APPLICATIONS OF ENZYMES

9 Hrs.

Application of enzymes in medicine and industry – Assay of plasma enzyme, enzyme biosensors, design of enzyme electrodes, Synzymes, Abzymes, Enzymes in genetic engineering

Max.45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - The knowledge on enzyme and enzyme reactions will be the helpful to understand various concepts in biotechnology.
- CO2 - Enzyme kinetics will give inputs to use enzyme in research and industry.
- CO3 - Methods of enzyme immobilization help in food, pharmaceutical and chemical industries to innovate a useful product to society.
- CO4 - Concepts on Isolation, Purification and characterization of enzymes will be helpful to work technologically.
- CO5 - Application of enzymes in industry.
- CO6 - Identify novel applications of enzymes in bioengineering.



Employability



Entrepreneurship



Skill Development

SBTA1402	IMMUNOTECHNOLOGY	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVES

- To know the fundamentals of innate and acquired immunity.
- To understand how immune system fights and combats the infection and diseases.

UNIT 1 INTRODUCTION TO IMMUNOLOGY AND IMMUNE SYSTEM

9 Hrs.

History and Scope of Immunology, Hematopoiesis, Innate and Acquired Immunity; Cells of the immune system, Primary and Secondary lymphoid organs. Maturation, structure, activation and differentiation of T and B cells.

UNIT 2 HUMORAL IMMUNITY

11 Hrs.

Antigens: Characteristics and Types of Antigens, Factors affecting the immunogenicity, Haptens, Antigenic Determinants, Adjuvants, Immunoglobulins: Basic structures, classes and sub classes; Molecular Biology of Immunoglobulin synthesis, Antigenic determinants on Immunoglobulins. Monoclonal antibodies. Complement system - Alternate, Classical and Lectin pathways.

UNIT 3 CELL MEDIATED IMMUNITY

7 Hrs.

Phagocytosis, Inflammatory mediators, Structure, types and function of MHC, Exogenous and Endogenous pathways of antigen processing and presentation; Cytokines - Characteristics, function and regulation of the immune response.

UNIT 4 IMMUNOTECHNIQUES

9 Hrs.

Nature of Antigen Antibody Interactions, Precipitation reactions, Agglutination reactions - Immunofluorescence, Immunoelectroscopy, RIA, ELISA. Detection of bacterial endotoxins using immunological methods (LAL Test), Western Blot

UNIT 5 IMMUNOLOGICAL DISORDERS

9 Hrs.

Hyper-sensitivity, Autoimmunity, Immunological Tolerance, Immunodeficiency diseases: Primary and secondary diseases, Transplantation immunology, Tumor immunology

Max.45 Hrs.

COURSE OUTCOMES

On completion of course, student will able to

- CO1 - Understand overall concept of immune system.
- CO2 - Acquire knowledge about different cells and organs involved in immune system.
- CO3 - Recognize effectors molecules fight against infectious diseases.
- CO4 - Demonstrate to produce monoclonal antibodies to diagnose and treat infectious diseases.
- CO5 - Apply suitable knowledge to develop acquired immunity to maintain health.
- CO6 - Implement immunotechniques to diagnose infectious diseases.

SCHA1411	CHEMICAL REACTION ENGINEERING	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

- To impart basic knowledge on the principles of different kinds of reaction, reaction kinetics and to introduce various types of reactors that are used in Chemical Engineering operations.

UNIT 1 CHEMICAL KINETICS**9 Hrs.**

Introduction to reactor, reaction system, chemical kinetics, rate equation, Elementary and non- elementary reactions. Molecularity and order, dependence of rate on concentration, temperature dependent term of a rate equation, concept of activation energy -Arrhenius theory, collision theory, transition state theory, determination of rate equation for non- elementary reactions. Methods to determine order of a reaction- Integral & differential method of analysis of data, Half-life method & Ostwald's isolation method.

UNIT 2 IDEAL REACTORS**9 Hrs.**

Introduction to Batch reactor, semi batch reactor, Plug flow reactor, Mixed flow reactor, Packed bed reactor, Concept of ideal flow, space time and velocity, performance or design equations for batch reactor, Plug flow reactor, Mixed Flow reactor.

UNIT 3 DESIGN OF MULTIPLE REACTOR SYSTEMS**9 Hrs.**

Mixed flow reactors in series and parallel connection, Plug flow reactors in series and parallel connection, reactors of different types in series, size comparison of reactors using performance charts.

UNIT 4 IDEAL AND NON-IDEAL FLOW**9 Hrs.**

Reason for non ideality, Residence time distribution, E curve, F curve, relationship between E and F curve, relationship between mean residence time and space time, State of aggregation- micro and macro fluid, Earliness or lateness of mixing, basic models for non ideal reactor like tanks in series model.

UNIT 5 CATALYSIS**9 Hrs.**

Introduction to catalysis, catalytic reactions, promoters, poisons, preparation of catalyst, Physical properties of catalyst: Surface area (BET isotherm), Pore volume distribution; Steps in a catalytic reaction, rate of catalytic reaction (adsorption, surface reaction and desorption as rate limiting steps).

Max.45 Hrs.

- CO1 - Develop rate laws for homogeneous reactions
- CO2 - Design of ideal reactors for single and complex reactions
- CO3 - Develop skills to choose the right reactor among single, multiple, recycle reactor, etc. schemes.
- CO4 - Predict and design the conversion in a non-ideal reactor using tracer information
- CO5 - Design reactors for fluid-solid reactions
- CO6 - Understanding the principles of catalytic reactions.



Employability



Entrepreneurship



Skill Development

SAIC4001	INDUSTRY 4.0	L	T	P	Credits	Total Marks
		2	-	2	2	100

UNIT 1 ADVANCED TECHNOLOGY AND ADVANCED MATERIALS**7 Hrs.**

Advanced electro-optical sensing technology-active, passive multi-spectral and hyper spectral imaging; electronic beam steering; vacuum technology, surface and coating technology, health care technology, Nanotechnology- Nanomechanics, Nano optoelectronics; energy storage technology-next generation Li-based Batteries, Hydrogen storage, solar photovoltaic's, Flexible electronics. Intellectual Property Rights - case studies governing/pertaining to Materials/Technology.

UNIT 2 TRANSFORMING TECHNOLOGIES IN BIOENGINEERING**7 Hrs.**

Establishment of smart biotechnology factory, Artificial intelligence in Bioprocess technology, Omics – Big data analysis through automation, 3D bio printing for tissue engineering. Simulation tools, RSM and Box model. Cyber physical system based telemedicine, diagnosis and therapeutics through real time biosensors. Bionanotechnology. Intellectual Property rights (IPR): Case Studies.

UNIT 3 ADVANCEMENTS IN SUSTAINABLE BUILT ENVIRONMENT**7 Hrs.**

Introduction – Technological developments in Architectural, Engineering and Construction (AEC) - Building Information Modelling (BIM) using Cloud computing technology and Internet of things (IoT) – Unmanned Aerial Vehicles, sensors – Additive manufacturing in construction – Concrete 3D printing - Materials used - Lightweight and functionally graded structures - Net Zero Energy buildings, Bioswales, Biofiltration pond, Ecosan systems- Recent developments in Waste water Management, Air pollution control, waste disposal - Integration of energy, water and environmental systems for a sustainable development- Emerging Technologies: Robot Highway- Vertical farming - Intellectual Property rights: Case studies

UNIT 4 SMART MANUFACTURING**8 Hrs.**

Smart factories and interconnection, Smart Manufacturing – automation systems, Additive Manufacturing, Smart grids, Micro Electro Mechanical Systems (MEMS), Stealth technology, Metal Finishing, Self-propelled vehicles, e mobility, Green fuels, drones – unmanned aerial vehicles(UAVs), aerodynamics. Robotic Automation and Collaborative Robots – Augmented reality and haptics, engineering cybernetics and artificial intelligence (AI), Disruptive Technologies – Frugal Innovations – Emerging Technologies - Autonomous Robots, Swam Robot, Modular Robotics, Space craft, Intellectual Property Rights (IPR): Case Studies.

UNIT 5 SMART WORLD**8 Hrs.**

Smart Sensors and IIOT, Smart grid, Hybrid renewable energy systems, Electronics in Smart city, Integration of Sensors in Robots and Artificial Intelligence, 5G Technology, Communication protocols, Human-Machine Interaction, Virtual Reality, Quantum Computing: Changing trends in transistor technology: Processor, Emerging Trends: Deep Space, Swarm Robots, Cyborg, Geofencing, Pervasive Computing, Intellectual Property Rights- Case Studies.

UNIT 6 CYBER PHYSICAL SYSTEMS**8 Hrs.**

Introduction to Cyber Physical Systems (CPS), Architecture of CPS, Data science and technology for CPS, Prototypes of CPS, Emerging applications in CPS including social space, crowd sourcing, healthcare and human computer interactions, Industrial Artificial Intelligence, Deep Learning, Gamification, Networking systems for CPS applications, Wearable cyber physical systems and applications, Domain applications of CPS: Agriculture, Infrastructure, Disaster management, Energy, Transportation, Intellectual Property Rights (IPR) : CaseStudies.

Max. 45 Hrs.

SBTA1501	GENETIC ENGINEERING	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

- Genetic Engineering course explores the manipulation of DNA using various tools and methods for its diverse application in the field of industry, medicine, plant and animal Biotechnology.

UNIT 1 MOLECULAR TOOLS IN GENETIC ENGINEERING

9 Hrs.

History, milestones and recent developments in Genetic Engineering; Steps involved in rDNA technology. DNA manipulative enzymes -Restriction enzymes: Endo & Exonucleases. Modifying enzymes- DNA & RNA polymerase, reverse transcriptase, terminal transferase; nucleases (DNases, RNases, S1) T4 polynucleotide kinase, Alkaline Phosphatase and ligase (E.coli & T4). Ligation (cohesive & blunt end ligation) – linkers, adaptor & homopolymer tailing.

UNIT 2 CLONING VECTORS

9 Hrs.

Ideal properties of a cloning vector. Plasmid vectors -pBR322 and its derivatives, phage vectors (λ & M13), Cosmid vectors, Shuttle and expression vectors; Yeast vectors-YAC & BAC (E.coli); Gene transfer methods.

UNIT 3 CLONING STRATEGIES

9 Hrs.

Screening and selection of recombinants; Hybridization methods-Southern, Northern, Western; Construction of genomic & c DNA libraries. Expression in bacteria, yeast, insects, plant & mammalian cells.

UNIT 4 TECHNIQUES IN GENETIC ENGINEERING

9 Hrs.

DNA sequencing – Maxam Gilbert & Sanger's, Nicolson sequencing methods, Pyrosequencing. PCR - Principle, types and applications; Site directed mutagenesis. Gene mapping-definition and types. Restriction mapping, FISH. Molecular markers used for gene mapping .PCR based and Hybridization based methods- RFLP, AFLP, VNTR, STS.

UNIT 5 APPLICATIONS OF GENETIC ENGINEERING

9 Hrs.

Strategies in plant and animal genetic engineering. Application of Genetically modified organisms; hazards and ethics associated with use of GMO. Production of recombinant proteins. DNA vaccines. Chromosomes engineering, targeted gene replacement, gene editing, gene silencing. Gene therapy, Human Genome Project.

Max.45 Hrs.

COURSE OUTCOMES

On completion of course, student will able to

- CO1 - Explain the steps involved in rDNA technology
- CO2 - Prioritize a specific cloning vector for cloning in prokaryotes and eukaryotes.
- CO3 - Express specific model organisms used for recombinant protein production
- CO4 - Consider the efficiency of PCR based cloning in comparison to traditional cloning strategies.
- CO5 - Show the prospects of gene editing
- CO6 - Evaluate the hazard and impact of genetically modified organism



Employability



Entrepreneurship



Skill Development

SBTA1502	BIOPROCESS ENGINEERING	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVES

- To develop skills of the students in design operation, medium design, fermentation process and metabolic stoichiometry.
- To understand the modern industrial biotechnological process, sterilization and growth kinetics of microorganisms.

UNIT 1 CONCEPTS OF BIOPROCESS

9 Hrs.

Historical of bioprocess technology, concept of Bioprocess, Fermentation process-types, fermentor, basic parameters of fermentation process. Basic outline of upstream and downstream process. Isolation and preservation of industrially important organisms. Production of industrial important enzymes and their applications. Modes of operation including batch, fed-batch and perfused systems.

UNIT 2 DESIGN OF FERMENTATION PROCESS

9 Hrs.

Medium requirement for fermentation processes; development of inocula for industrial fermentations. Different types of fermentation processes: aerobic and anaerobic processes and their application in the biotechnology industry. Construction of fermentor and ancillaries, solid-substrate fermentation and its applications. Media for fermentation processes, Types of media: microbial culture medium, plant and animal cell culture medium

UNIT 3 MEDIA AND STERILIZATION KINETICS

9 Hrs.

Medium-simple and complex media, medium requirement for fermentation process, formulation of good medium and its optimization methods. Modes of media sterilization- FSIP and ESIP, modes of air sterilization, media sterilization by membrane filtration method. Thermal death kinetics, batch sterilization, equipment for continuous sterilization, air sterilization, Validation Issues.

UNIT 4 STOICHIOMETRY OF CELL GROWTH AND PRODUCT FORMATION

9 Hrs.

Growth Stoichiometry and elemental balances, Product stoichiometry, degrees of reduction, theoretical prediction of yield coefficient, theoretical oxygen demand.

UNIT 5 MICROBIAL GROWTH KINETICS

9 Hrs.

Phases of cell growth in batch cultures, quantifying cell growth, batch growth kinetics, environmental conditions affecting the growth kinetics, heat generation by microbial growth, quantifying growth kinetics: unstructured kinetic models for microbial growth, growth models of filamentous organisms, growth kinetics of Monod model.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of course, student will able to

- CO1 - Summarize the overall bioprocess technology and demonstrate the upstream and downstream process
- CO2 - Design of fermenter and fermentation media for the production of metabolites
- CO3 - Integrate Concepts and knowledge from various sterilization methods
- CO4 - Analyze the stoichiometry cell growth and evaluate Monod kinetics parameter
- CO5 - Evaluate an appropriate technique for novel downstream processing and its applications.
- CO6 - Determine the microbial growth rate by structure and unstructure models



Employability



Entrepreneurship



Skill Development

SBTA1503	NANOBIOTECHNOLOGY	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVES

- To produce and apply various types of nanostructured materials.
- To suggest methods for the characterization of nanomaterials.
- To use basic principles to solve biotechnical problems
- To assess risks of nanobiotechnology to society and environment.

UNIT 1 INTRODUCTION OF NANOTECHNOLOGY

9 Hrs. History

of nanotechnology, definitions in nanotechnology, approaches in nanotechnology, generations of nanotechnology, properties and application of nanotechnology

UNIT 2 CHARACTERIZATIONS OF NANOMATERIALS

9 Hrs.

Optical (UV-Vis/Fluorescence) –X-ray diffraction – Bragg's law, Imaging and size (Electron microscopy, light scattering, Zeta potential Surface and composition (ECSA, EDAX, AFM/STM etc) –Vibrational (FT-IR and RAMAN),

UNIT 3 PRODUCTION OF NANOPARTICLES

9 Hrs.

Production of nanomaterials by physical, chemical and biological method - Fabrication- Characterization - Biopolymer derived nanomaterials (Chitosan, PHB, polysaccharides) - applications

UNIT 4 NANOMATERIALS AND DIAGNOSTICS/DRUG DELIVERY AND THERAPEUTICS

9 Hrs.

Self-assembly of nanoparticles - Modified Nanoparticles - Peptide/DNA /Lipid Nanoparticles For Drug Delivery. Metal/Metal Oxide Nanoparticles for biological activity (antibacterial/anti-fungal/anti-viral/ anticancer), imaging and hyperthermia using nanomaterials

UNIT 5 TOXICITY EVALUATION OF NANOMATERIALS

9 Hrs.

Evaluation of genotoxicity, cytotoxicity of nanoparticles using invitro and invivo systems. Nanoparticles disposal methods and risk management.

Max.45 Hrs

COURSE OUTCOMES

On completion of course, student will able to

- CO1 - Understand the evolution of Nanotechnology and its applications
- CO2 - Study the techniques used for characterization of nanomaterials
- CO3 - Production of nanoparticles by different methods
- CO4 - Understand the drug delivery system using nanotechnology
- CO5 - Understand the toxicity evaluation methods of nanoparticles
- CO6 - Understand the development of nanotechnology in biology



Employability



Entrepreneurship



Skill Development

SBTA1504	PHARMACEUTICAL BIOTECHNOLOGY	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVE

- To understand drug metabolism pathway, thereby we able to come up with novel lead molecules.

UNIT 1 INTRODUCTION

9 Hrs.

Development of Drug and Pharmaceutical Industry -Therapeutic agents, their uses and economics; Routes of drug administration. Selection criteria for route of administration.

UNIT 2 DRUG METABOLISM AND PHARMACOKINETICS

9 Hrs.

ADME of Drugs, Drug metabolism- pharmacokinetics-action of drugs on human bodies, Factors in influencing metabolism

UNIT 3 IMPORTANT UNIT PROCESSES AND THEIR APPLICATIONS

9 Hrs.

Bulk drug Manufacture: Types of Reactions in Bulk drug Manufacture and Processes. Special Requirements for Bulk Drug Manufacture and its regulatory aspects.

UNIT 4 PRODUCT FORMS AND DEVELOPMENT

9 Hrs.

Compressed tables, wet granulation-dry granulation or slugging-direct compression-tablet presses, coating of tablets, capsules sustained action dosage forms-parental solutions-oral liquids-injections-ointments-Topical Application, Preservation, analytical methods and test for various drugs and pharmaceuticals, Labeling, Packing, Packing Techniques, Quality Management, GMP.

UNIT 5 PHARMACEUTICAL PRODUCTS

9 Hrs.

Therapeutic categories such as laxatives - analgesics - non steroidal contraceptives - external antiseptics - antacids and other, antibiotics - biological - hormones - vitamins with respect to system. Pharmaceutical Development: Introduction to drug regulations, pre clinical and clinical trials.

Max.45 Hrs

COURSE OUTCOMES

On completion of course, student will able to

- CO1 - Summarise the drug development process and pharmaceutical industry
- CO2 - Discuss the mode of drug interaction and contra interaction
- CO3 - Apply the chemical processes in Drug manufacturing process
- CO4 - Sketch the steps involved in the manufacturing process of various formulation
- CO5 - Asses the quality control and good manufacturing practices in the pharmaceutical industry
- CO6 - Know the mechanism of drug action in the human body



Employability



Entrepreneurship



Skill Development

SBTA4003	MEDICAL GENOMICS	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVES:

The course has been designed to show how genomics will be used for patient care with genetic disorders, and the knowledge and skills required to treat them.

UNIT 1 Genetic disorders and therapy

9 Hrs.

Single gene disorders and Multifactorial disorders - conventional and contemporary methods: Pedigree analysis, Linkage mapping, Positional/structural and functional cloning; Bioinformatic analysis; Genetic polymorphism and disease susceptibility. Treatment of genetic disorders: Methods of therapy - Drug (recombinant proteins); Gene (Viral vectors, delivery methods, efficacy); Some examples (Thalassemia, Phenylketonuria, Cystic fibrosis).

UNIT II Diagnostic genetics

9 Hrs.

Cytogenetics/ Molecular methods; Screening for mutation/ chromosomal anomaly - Adult/Prenatal/New-born screening; Preimplantation screening (Assisted reproductive technology- in vitro fertilization and Embryo transfer); Forensic testing - DNA fingerprinting, paternity testing, individual identification. Genetic counselling; Prenatal/adult diagnosis of genetic disorders; Risks and benefits; Informed consent; Right of choice; Case studies.

UNIT III Functional genomics and animal models in human disease

9 Hrs.

cDNA/gene cloning; site-directed mutagenesis; mammalian tissue culture; cell line transfections; functional assays; Use of model organisms, methods for generation of transgenic animals/ knock-in, knockout models (microinjection, ES cell transformation); ENU mutagenesis; RNAi approach.

UNIT IV CRISPR-Based Genome Engineering

9 Hrs.

Origins of CRISPR; CRISPR Knockout Basics (Experimental Design, Guide RNA design, Delivery into Cells, Genotyping, Validation); CRISPR Knockin (Inserting or Mutating DNA Sequences in the Genome); CRISPR Editing in Animal Models (Knockout and Knockin Strategies in Mice); CRISPR Screens (High throughput applications of CRISPR); CRISPR-Based Gene Therapy; The Future of CRISPR and Ethical Considerations (CRISPR in the Clinic, CRISPR Babies, Case-Studies)

UNIT V Pharmacogenetics

9 Hrs.

Genetic drug response profiles, the effect of drugs on Gene expression. Concept of individualized drug therapy, Drivers and the promise of personalized medicine, Strategies for application of pharmacogenomics to customize therapy, Barriers.

Max.45 Hrs.**COURSE OUTCOMES**

On completion of the course, student will be able to

CO 1- Evaluate the genetic basis of disease

CO 2-Choose a genetic test that is appropriate for a given clinical scenario

CO 3- Assess the evolution of genomic technologies

CO 4-Appraise the applications CRISPR technology for research, gene-therapy and the discovery of novel therapeutics

CO 5-Criticise ethical problems pertaining to the use of transgenic models in biomedical research

CO 6-Distinguish the effect of genetic differences between individuals in the outcome of drug therapy and in drug efficacy and toxicity.



Employability



Entrepreneurship



Skill Development

SBTA1601	ANIMAL BIOTECHNOLOGY	L	T	P	C	Total Marks
		3	*	0	3	100

COURSE OBJECTIVES

- To Provide fundamentals Of Animal Cell Culture and its application
- To Offer The Knowledge About The Micromanipulation And Transgenic Animals

UNIT 1 ANIMAL CELL CULTURE

9 Hrs.

Introduction, importance, history of cell culture development, Basic Tissue Culture Techniques; Media for animal cell culturing – serum free Media; Primary cell cultures, secondary cell Cultures, Their Maintenance And Preservation; cell lines and cloning - Somatic Cell Fusion; Cell Cultures for production of pharma products and for Organ Culturing.

UNIT 2 GROWTH AND SCALE UP

9 Hrs.

Cell growth and growth kinetics of animal cells, Various Types Of Cultures microcarrier attached growth, suspension Cultures, Continuous Flow Cultures, Immobilized Cultures; hollow fibre reactor.

UNIT 3 TRANSGENIC ANIMALS

9 Hrs.

Concepts Of Transgenic Animal Technology; Strategies For The Production Of Transgenic Animals - chimeric animals generation and cloning; Pronuclear injection - generation of knockout animals and generation cloned animals. Gene editing technologies TALEN, CRISPR Cas9. Importance In transgenic animals in Biotechnology; Stem Cell Cultures in the production of Transgenic Animals.

UNIT 4 MANIPULATION OF EMBRYO'S

9 Hrs.

What Is Micromanipulation Technology; Equipment Used In Micromanipulation; Enrichment Of X And Y Bearing Sperms From Semen Samples Of Animals; Artificial Insemination And Germ Cell Manipulations; embryo cloning- quadriparental hybrid, nuclear transplantation (Dolly), embryonic stem cells, In Vitro Fertilization And Embryo Transfer; Micromanipulation Technology And Breeding Of Farm Animals.

UNIT 5 THERAPEUTICAL APPLICATION AND SAFETY GUIDELINES

9 Hrs.

Recombinant Cytokines And Their Use In The Treatment Of diseases; Monoclonal Antibodies – immunotoxins - Ex vivo and In vivo gene therapy, vaccines production; molecular pharming - . Containment of Safety use and release of transgenic animals- biosafety guidelines – national, Institutional and International level.

Max.45 Hrs

COURSE OUTCOMES

On completion of course, student will able to

- CO1 - Understand the cell culture techniques
- CO2 - Explain the importance of aseptic techniques of cell culture
- CO3 - Generalize the requirement need for cell culture
- CO4 - Recommend the methods of isolation and manipulation of embryo
- CO5 - Understand the importance of therapeutically applications and safety guidelines
- CO6 - Understand the knowledge about the Micromanipulation and Transgenic Animals



Employability



Entrepreneurship



Skill Development

SBTA1602	BIOSAFETY, BIOETHICS AND IPR	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVES

- To understand biosafety and the importance of bioethics.
- To be able to distinguish the different IPR and biotechnological patent.

UNIT 1 INTRODUCTION TO BIOSAFETY

9 Hrs.

Biosafety – definition, need, importance, applications, levels of biosafety and criteria for biosafety levels. NIH guidelines for biosafety. Regulations specific to biotechnology companies and research institutions. Biosafety guidelines in India. Role of institutional biosafety committee.

UNIT 2 IMPLICATIONS OF BIOSAFETY

9 Hrs.

Guidelines for research with transgenic organisms. Environmental impact of genetically modified organisms (beneficial and hazardous impact), Field trials with GMO. Containment levels. Biosafety protocol, Cartagena Biosafety protocol, Mechanism of implementation of biosafety guidelines. Biosafety and politics. Biosafety database.

UNIT 3 INTRODUCTION TO BIOETHICS

9 Hrs.

Bioethics – need, applications. Impact of bioethics to the environment and society. Bioethical issues pertaining to various aspects of Biotechnology. Bioengineering ethics, responsible researchers, research ethics, ethical decision making. Biowarfare and biopiracy.

UNIT 4 INTELLECTUAL PROPERTY RIGHTS

9 Hrs.

Forms of Intellectual property – patent, copyright, trademark, design, trade secret, domain name and geographical indications. WTO treaties, GATT articles, main features of TRIPS agreement, practical aspects of WIPO. IPR related legislatures in India.

UNIT 5 PATENT

9 Hrs.

History of Indian patent system and law. Patenting authority. Different types of patent. Requirements and procedure for patenting. Patentable and Non-patentable things. Patent search and patent co-operation treaty (PCT). Farmer's right and plant breeders right. Importance, social consequences and controversies on biotechnology patents.

Max.45 Hrs

COURSE OUTCOMES

On completion of course, student will able to

- CO1 - Define biosafety, bioethics and intellectual property rights.
- CO2 - Discuss the different regulations pertaining to biosafety.
- CO3 - Categorize the various forms of IPR.
- CO4 - Appraise the importance of bioethics in biotechnology.
- CO5 - Elaborate the different patents and the process of patenting.
- CO6 - Interpret biotechnological novelty as patents.



Employability



Entrepreneurship



Skill Development

SBTA1603	DESIGN AND OPERATION OF BIOREACTORS	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVES

- To develop knowledge and technical's skills on bioreactors and its various types.
- To make understand the knowledge on growth parameters such as structure and unstructured models

UNIT 1 INTRODUCTION TO BROAD SCOPE OF BIOCHEMICAL ENGINEERING

9 Hrs.

Concept of Bioreactors, Overview of SLF and SSF. Medium optimization-Plackett Burman method. Response surface methodology, Introduction to bioreactor configuration-Basic mode of operation batch, fed-batch and continuous reactor-bioreactor lay out-Kinetics of batch and continuous culture. Criteria of scale up and scale down of bioreactor.

UNIT 2 IDEAL CONTINUOUS STIRRED TANK BIOREACTOR

9 Hrs.

Material balance-Evaluation of Monod Kinetic parameter, Alternatives to Monod equation-Blackman, Tessier, Moser, Contois equation -Comparison of batch and CSTB-Multiple CSTB connected in series-CSTB with cell recycling.

UNIT 3 GENERAL CHARACTERISTIC OF MODELS:

9 Hrs.

Basic concept of Linear model, dynamic, lumped, continuous, white or black box model. Unstructured and structured models. Models with growth inhibitors- Substrate inhibition, Product inhibition-Competitive and Noncompetitive product inhibition.

UNIT 4 AGITATION AND AERATION DESIGN

9 Hrs.

Henry's Law - mass transfer, Two film Theory, Definitions of oxygen Transfer Rate, Oxygen Uptake Rate, Specific Oxygen Uptake Rate. Mass transfer and rheology: Rheology of broths - impact on transfer processes Oxygen transport from the bubble to the cell.

UNIT 5 DESIGN CONSIDERATIONS

9 Hrs.

Animal and plant cell bioreactors. Determination of k_La - Correlation for k_La . Introduction to Single Use, Bioreactors (SUBs).

Max.45 Hrs

COURSE OUTCOMES

On completion of course, student will able to

- CO1 - Study of basic working principle of bioreactors and optimization of medium preparation
- CO2 - Design and operation of industrial bioreactors pipeline and working process
- CO3 - Evaluate the various microbial growth kinetics and comparative analysis of bioreactors
- CO4 - Discuss and evaluating the microbial growth determination models
- CO5 - Critique on the validity of experimental data and measurements of mass transfer rate
- CO6 - Application and Operation of industrial bioreactors for various economical important products



Employability



Entrepreneurship



Skill Development

SBTA3005	MEDICAL BIOTECHNOLOGY	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

- The course will provide students with an historical perspective in the fast emerging medical biotechnology and the innovative processes that ensures the success of such endeavors.

UNIT 1 BASIC CONCEPTS AND TOOLS

9 Hrs.

Understanding human body, Genomics, Proteomics, Genetic disorders, Drugs, Pharmacogenomics, Pharmacokinetics.

UNIT 2 SIGNALING MECHANISMS

9 Hrs.

Receptor mediated signal transduction – primary messenger – hormones and drugs- secondary messenger and neurotransmitters. G- Protein coupled receptors – cyclic AMP –calcium ions – Nitric oxide (NO) – prostaglandin and inositol triphosphates.

UNIT 3 DIAGNOSTICS

9 Hrs.

Hematology, Biochemistry (Serum & Tissue), Histology (Biopsy and Autopsy) and Endocrinology. Diagnosis of Bacteria (Mycobacterium), DNA virus (HBV/H1N1), RNA virus (HIV/HCV), Parasite (Malaria).

UNIT 4 TREATMENT AND PREVENTION

9 Hrs.

Traditional medicine (AYUSH), Chinese and Modern medicine, Antibacterial, Antiviral, Antibiotics, use of interferon, immunomodulators. Active and passive immunization, vaccines and toxoids, Food as medicine-Nutraceuticals.

UNIT 5 THERAPEUTIC DEVELOPMENTS AND DRUG DESIGNING

9 Hrs.

Basics of Regenerative medicine, Nanomedicine, Combinatorial antibody designing, Gene therapy, Anti sense therapy- RNAi. Drug designing process, receptor–ligand interaction, ligand docking-Bioinformatics tools.

Max.45 Hrs

COURSE OUTCOMES

On completion of course, student will able to

- CO1 - Develop an ability to use appropriate knowledge to identify and analyze the molecular basis of disease & emerging technology.
- CO2 - Conduct investigations of complex problems by methods that include appropriate experiments, analysis and interpretation of data and synthesis of information in order to reach valid conclusions
- CO3 - Design solutions for complex, open-ended problems that meet specified needs with appropriate attention to health and safety risks
- CO4 - Create, select, apply, adapt, and extend appropriate techniques, resources, and modern tools
- CO5 - Work effectively as a member and leader in teams, preferably in a multi-disciplinary setting
- CO6 - Address their own educational needs in a changing world in ways sufficient to maintain their competence and to allow them to contribute to the advancement of knowledge in Medical & Pharmaceutical fields



Employability



Entrepreneurship



Skill Development

SBTA4002	Synthetic biology	L	T	P	Credits	Total Marks
		3	0	0	3	100

Course objectives

The course familiarizes students to the rapidly developing field of synthetic biology. The components of synthetic biology are introduced and its commercial applications are elaborated.

Unit I : Introduction to Synthetic biology

Introduction to synthetic biology. Background of Gene Regulatory Mechanisms (Gene Parts- Gene Structure, Promoters, Terminators, Enhancers, Inducers, Repressors, Transcription Factors, Co-factors, transcriptional and post-transcriptional regulation, post-translational modifications). Genetic Engineering and Genome Editing

Unit II : Elements of synthetic biology - Tools

Gene shuffling for large scale pathway assembly and engineering; Choices for microbial hosts for industrial applications— bacteria, yeast, insect. Gene editing methods – CRISPR/ Cas; Gene sequencing – Pyrosequencing, Nanopore sequencing.

Unit III : Bacterial circuits and Biobricks

Bacterial circuits: feedback, feed-forward, toggle switch, signal propagators and band filter, synchronized oscillators. Introduction to Bio Bricks & its applications. Microarrays & systems biology- a basic introduction

Unit IV : Mathematical modeling, simulation & applications

Noise in Gene Expression. Mathematical Modeling and Simulation. Biosensors. Application of software tools for modelling gene expression. Commercial Applications - Biomedicine, Biomaterials, Biofuels and Bioremediation; Global events & competitions- iGEM, synbiobeta.

Unit V : Regulations & ethics

Safety & bioethics, legal & IP elements involved in synthetic biology applications for human, animals and plants.

Max.45 Hrs

Course outcome

On completion of the course, the student will be able to;

CO1 : Define synthetic biology and outline its components.

CO2 : Paraphrase the biological mechanisms as circuits.

CO3 : Articulate on the elements of synthetic biology

CO4 : Illustrate bacterial circuits and biobricks

CO5 : Appraise on the applications, regulations and ethics of synthetic biology

CO6 : Design biobricks and novel metabolic pathways.

SBTA3007	FOOD PROCESSING TECHNOLOGY	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

- To impart knowledge of various areas about the food safety and processing technology.

UNIT 1 PROPERTIES OF FOODS AND PROCESSING THEORY

9 Hrs.

Properties of liquids, solids and gases - Material transfer - Fluid flow - Heat transfer - Water activity - Effects of processing on sensory characteristics of foods - Effects of processing on nutritional properties - Food safety, good manufacturing practice and quality assurance : HACCP, Hurdle technology - Process control Automatic control, Computer-based systems.

UNIT 2 AMBIENT-TEMPERATURE PROCESSING

9 Hrs.

Raw material preparation : Cleaning, Sorting, Grading, Peeling - Size reduction in solid , liquid foods – mixing and forming – separation and concentration of food components – fermentation and enzyme technology – Irradiation – processing using electric fields, high hydrostatic pressure, light and ultrasound.

UNIT 3 PROCESSING BY APPLICATION OF HEAT

9 Hrs.

Heat processing using steam and water – Blanching – Pasteurization – Heat sterilization – Evaporation and distillation – Extrusion : Heat processing using hot air – Dehydration – Baking and roasting : Heat processing using hot oils – Frying : Heat processing by direct and radiated energy – Dielectric , ohmic and infrared heating.

UNIT 4 PROCESSING BY REMOVAL OF HEAT

9 Hrs.

Chilling – Controlled or modified atmosphere storage and packaging – Freezing – Freeze drying and Freeze concentration.

UNIT 5 POST – PROCESSING OPERATIONS

9 Hrs.

Coating and enrobing – Packaging – Types of packaging materials – printing – interactions between packaging and foods – environmental considerations – Filling and sealing of containers – materials handling, storage and distribution.

Max.45 Hrs

COURSE OUTCOMES

On completion of course, student will able to

- CO1 - Learning of properties of food and food safety.
- CO2 - Knowledge about the food processing by using ambient temperature
- CO3 - Study of processing of food by using heat
- CO4 - Processing of food by removal of heat using direct and radiant energy
- CO5 - Scrutinizing of Post processing of food
- CO6 - Gain wide knowledge about the processing technology of food



Employability



Entrepreneurship



Skill Development

SBTA4004	Research Methodology in Biotechnology	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

- To acquaint the students with key concepts and tools of data analysis techniques.

UNIT 1: BASIC CONCEPTS OF PROBABILITY AND STATISTICS

9 Hrs.

Rules of probability, discrete and continuous probability distribution. Moments: Mean, variance and covariance. Bayes theorem and likelihood. Statistical tests – t-test, ANOVA, Chi square test.

UNIT 2: BASIC CONCEPTS OF LINEAR ALGEBRA

9 Hrs.

Vector and vector operations, matrix and matrix operations. Determinant and inverse of matrix. Eigen value and eigenvector. Linear system of equations, singular value decomposition.

UNIT 3: CORRELATION AND REGRESSION

9 Hrs.

Correlations, linear regression, multiple linear regression, nonlinear regression and logistic regression.

UNIT 4: CLUSTERING, CLASSIFICATION AND HIGHER DIMENSIONAL DATA

9 Hrs.

Distance measures for clustering, k-means clustering, hierarchical clustering, decision tree classifier, support vector machines. Higher dimensional data in biology, Principal component analysis, t-SNE, diffusion maps.

UNIT 5: Research and publication

9 Hrs.

Forming a Hypothesis, Techniques of Scientific Measurement, Testing of hypothesis, Methods of Theoretical Research, The Art of Scientific Communication, Presentation in Seminars and Conferences, Sponsored Research, Ethical Conduct in Science.

Max.45 Hrs

COURSE OUTCOMES

On completion of course, student will able to

- CO1** –Interpret scientific data using statistical methods.
- CO2** –Articulate biological data as algebraic equations
- CO3** –Correlate and deduce inference from data.
- CO4** –Categorize data to infer scientific knowledge.
- CO5** –Write a research report and analyze ethical issues.
- CO6** –Write a research proposal following ethical norms.



Employability



Entrepreneurship



Skill Development

SBTA3001	MARINE BIOTECHNOLOGY	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

- To know the marine organisms of interest in biotechnology, their basic functions and role in the marine ecosystems; to understand the essential elements related to aquaculture and fish genetics and to acquire knowledge on marine natural products and fishery by-products; and also, to apply biotechnological methods for the conservation and protection of marine environment

UNIT 1 INTRODUCTION TO MARINE ECOSYSTEMS AND MICROBIAL DIVERSITY

9 Hrs.

Physical and chemical properties of sea water. Zonation of sea: Euphotic zone, Bathyal zone, Abyssal zone, Benthic zone, Deep sea. Marine ecosystems and biodiversity: Estuary, Seagrass, Seaweed, Salt marsh, Mangroves and Coral reef. Marine microbial diversity: Marine microbial habitats, Microbial distribution in the ocean, Factors that impact marine microbial diversity. Interactions between marine microbes and other living organisms.

UNIT 2 AQUACULTURE AND FISH GENETICS

9 Hrs.

Aquaculture: Definition- Criteria of selection of aquaculture species. Culture practices of marine Fish, Shrimp, Crab, Lobster, Oyster, and Seaweed. Fish genetics: Gynogenesis, Androgenesis, Polyploidy, Artificial insemination, Eye stalk ablation and Cryopreservation of fish gametes.

UNIT 3 ECONOMIC IMPORTANCE OF MARINE ORGANISMS

9 Hrs.

Production of live-feeds in marine aquaculture: Rotifers, Artemia, Copepods and Microalgae. Biofuel production. Marine enzymes, Production of omega-3 fatty acids from marine organisms. Marine pharmacology: New and novel antibiotics from marine organisms. Secondary metabolites from marine bacteria, actinomycetes and marine endophytic fungi. Probiotics and Prebiotics for aquaculture.

UNIT 4 MARINE AND FISHERY BY-PRODUCTS

9 Hrs.

Marine algal by-products: Chitin, Chitosan, Agar, Alginates, Carrageenan and Heparin. Fishery by-products: Fish oil, Isinglass, Fish glue, Fish silage, Fin rays,

UNIT 5 MARINE ENVIRONMENT PROTECTION

9 Hrs.

Marine Pollution. Human impacts on marine microbial diversity - Usage of marine microbes to ameliorate environmental deterioration. Control of oil spills and bioremediation. Effects of bio-fouling and bio-deterioration on marine structures. Protection methods against corrosion and fouling. Red tides: Causative factors and effects on the organisms of marine environment.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of course, student will able to

- CO1 - Learn the importance of marine ecosystems and microbial biodiversity
- CO2 - Develop the aquaculture practices of marine fish, shrimp, crab, lobster, edible oyster, pearl oyster and seaweeds
- CO3 - Devise the various fish genetic techniques involved in aquaculture
- CO4 - Formulate the production methodologies for economically and pharmaceutically important products from marine organisms
- CO5 - Generate the production strategy of various seaweed and fishery by-products and its applications
- CO6 - Evaluate the human impacted pollution in the marine environment and the usage of marine microbes to ameliorate environmental deterioration



Employability



Entrepreneurship



Skill Development

SBAA4002	PRINCIPLES OF MANAGEMENT AND PROFESSIONAL ETHICS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE**OBJECTIVES**

- To gain knowledge about the fundamentals of management.
- To understand the tools and techniques of the various aspects of management.
- To apply management concepts in decision making.

UNIT 1 MANAGEMENT THEORIES**9 Hrs.**

Definition of management, science or art, manager vs entrepreneur; Types of managers - managerial roles and skills; Evolution of management-scientific, human relations, system and contingency approaches; Types of Business Organizations, sole proprietorship, partnership, company, public and private enterprises; Organization culture and environment; Current trends and issues in management.

UNIT 2 PLANNING, DECISION MAKING AND ORGANISING**9 Hrs.**

Nature and purpose of Planning, types of Planning, objectives, setting objectives, policies, Strategic Management, Planning Tools and Techniques, Decision making steps & processes. Nature and purpose of Organizing, formal and informal organization, organization structure, types, line and staff authority, departmentalization, delegation of authority, centralization and Decentralization, job design,

UNIT 3 STAFFING AND LEADING**9 Hrs.**

Human resource management, HR Planning, Recruitment selection, training & development, performance management, career planning and management, Directing individual and group behavior, motivation, motivation theories, motivational techniques, job satisfaction, job enrichment, leadership, types & theories of leadership, effective communication.

UNIT 4 CONTROLLING AND REPORTING**9 Hrs.**

Controlling, system and process of controlling, budgetary and non-budget control technique, use of computer and IT in management control, productivity problems and management, control and performance, direct and preventive control, reporting.

UNIT 5 VALUES AND ETHICS**9 Hrs.**

Human Values – Natural acceptance - Ethics – Definition- Objectives - Virtues – Challenges in the work place - Engineering ethics - Scope - Moral issues and judgment - Moral development theories – Engineers as responsible experimenters - Codes of ethics - Industrial standards - Global Issues: Environmental ethics- Computer ethics - Ethics and codes of business conduct in MNC.

Max. 45 Hrs.**COURSE OUTCOMES**

On completion of the course, student will be able to

- CO1 - Describe the evolution and development of management concepts.
- CO2 - Understand the functions of management.
- CO3 - Apply the concepts and develop key competencies for managing human resources.
- CO4 - Analyze appropriate management techniques for Controlling and Reporting.
- CO5 - Evaluate the various aspects of decision making and demonstrate critical thinking.
- CO6 - Elaborate the importance of the ethical dimension in workplace.



Employability



Entrepreneurship



Skill Development

SBTA3003	TRANSLATIONAL BIOTECHNOLOGY FROM IPR TO LICENSING	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To emphasize the role of Biotechnology for sustainable development
- To highlight the role of Biotechnology in product production
- To analyze the needs and success of Biotech companies
- To develop effective skills for scientific documentation and communication
- To discuss principles and significance of Intellectual Property Rights

UNIT 1 BIOTECHNOLOGY IN DEVELOPMENT

9 Hrs.

Classical and modern biotechnological concepts in products development: therapeutic, environmental, agricultural, energy utilization. Manipulation of genetic information for sustainable development.

UNIT 2 BIOTECHNOLOGY IN PRODUCT PRODUCTION

9 Hrs.

Biotechnology in multidisciplinary undertaking: entrepreneurship, economic, legal and ethical considerations in the development and scale up production of a product.

UNIT 3 VIRTUAL BIOTECH COMPANY

9 Hrs.

Creation of a virtual biotech company based on the societal needs: data collection, incubation of idea, design of business plan, funding, regulatory authority interactions, partnerships, collaborators – (Industrial visits and interactions).

UNIT 4 SCIENTIFIC COMMUNICATIONS

9 Hrs.

Communicating science: documentation, strategies to effectively communicate the scientific data to the non scientific stakeholders, plagiarism, online communication, verbal communications skills through (seminars)

UNIT 5 INTELLECTUAL PROPERTY RIGHTS

9 Hrs.

Intellectual property rights: patents, copy rights, trade marks, infringements. Guidelines involved in patent process in India.

Max.45 Hrs

COURSE OUTCOMES

On completion of course, student will be able to

- CO1 - Comprehend the diverse application of biotechnological process
- CO2 - Create awareness on the global scenario on various aspects in technology transfer
- CO3 - Design of a model biotech company for sustained development
- CO4 - Address the conceptual ideas to the diverse stakeholders
- CO5 - Protection of the intellectual property
- CO6 - Understand the steps involved in the conversion to licensing



Employability



Entrepreneurship



Skill Development

SMTA1202	ENGINEERING MATHEMATICS – II (COMMON TO BIO GROUPS)	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVE

- The ability to identify, reflect upon, evaluate and apply different types of information and knowledge to form independent judgments.

UNIT 1 MATRICES 9 Hrs.

Rank of a Matrix – Consistency of linear Algebraic equations – Characteristic equation of a matrix – Eigenvalues and Eigen vectors of a real matrix – Properties of Eigen values and Eigenvectors – Cayley-Hamilton theorem (without proof) – verification – Finding Inverse and Power of a matrix using Cayley-Hamilton Theorem.

UNIT 2 DIFFERENTIAL CALCULUS 9 Hrs.

Definitions – Derivative of standard functions (Results only) – Addition, subtraction, Multiplication and Quotient rules of differentiation – Differentiation of function of function – Logarithmic differentiation – Derivatives of implicit function – Successive differentiation – Partial derivatives (Simple Problems only)

UNIT 3 INTEGRAL CALCULUS 9 Hrs.

Integral of standard functions (Results only) – Integration by the method of substitution – Integration using partial fractions – Integration by parts – Generalization of integration by parts (Bernoulli's formula) – Definite integral – Properties – Simple problems.

UNIT 4 VECTOR CALCULUS 9 Hrs.

Scalar field and Vector field – Differentiation of a vector function – Gradient, Divergence and Curl – Directional Derivative – Identities (without proof) – Irrotational and Solenoidal fields

UNIT 5 THEORY OF SAMPLING AND TESTING OF HYPOTHESIS 9 Hrs.

Test of Hypothesis – Test of significance – Large samples – Z test - Single proportion – Difference of proportions – Single mean – Difference of means – Small samples – Student's t test – Single mean – Difference of means – Test of variance – Fisher's test – Chi square test – Goodness of fit – Independence of attributes.

Max.45 Hrs

COURSE OUTCOMES

On completion of course, student will able to

- CO1 - Identify Cayley Hamilton theorem, consistency of linear algebraic equations and derivative of standard functions. Define rank, eigen values and eigen vectors
- CO2 - Explain the properties of definite integrals, Irrotational and Solenoidal of a vector, gradient and directional derivative of a function and test of hypothesis
- CO3 - Uses of Cayley Hamilton theorem and its verification.
- CO4 - Differentiate various types of functions. Classify test of hypothesis
- CO5 - Evaluate different types of integrals
- CO6 - Construct Goodness of fit and produce inverse and power of the matrix.



Employability



Entrepreneurship



Skill Development

SCSA1102	FUNDAMENTALS OF PYTHON PROGRAMMING	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVES

- To understand why Python is a useful scripting language for developers.
- To learn how to use lists, tuples, and dictionaries in Python programs.
- To learn how to build and package Python modules for reusability.
- To learn how to read and write files in Python.
- To learn how to use exception handling in Python applications for error handling.
- To learn how to design and program Python applications.

UNIT 1 INTRODUCTION

9 Hrs.

History of Python- Introduction to the IDLE interpreter (shell) - Expressions – Data Types - Built-in function - Conditional statements - Iterative statements- Input/output - Compound Data Types - Nested compound statements – Introduction to Object Oriented Concepts.

UNIT 2 FILES AND EXCEPTIONS HANDLING , MODULES, PACKAGES

9 Hrs.

File Operations –Iterators - Exception handling - Regular Expressions- Creating Modules-Import Statement-Introduction to PIP-Installing Packages via PIP-Using Python Packages

UNIT 3 GUI PROGRAMMING

9 Hrs.

GUI Programming in Python - Introduction to GUI library - Layout management - Events and bindings - Fonts – Colours - Canvas - Widgets (frame, label, button, check box, entry, listbox, message, radiobutton, text, spinbox).

UNIT 4 DATABASE AND NETWORK

9 Hrs.

Database (using NoSQL):Connector Module –Cursor – Statements - Exceptions in database. Network connectivity: Socket module - Client – Server – Email – URL Access

UNIT 5 CASE STUDY

9 Hrs.

Web Programming using Python.
Image Processing – Facebook Analysis – Twitter Analysis.

Max.45 Hrs

COURSE OUTCOMES

On completion of course, student will able to

- CO1 - Describe the Numbers, Math functions, Strings, List, Tuples and Dictionaries in Python
- CO2 - Do the decision Making and write functions in Python
- CO3 - Explain how to design GUI Applications in Python and evaluate different database operations
- CO4 - Design and develop Client Server network applications using Python
- CO5 - Design real life situational problems and think creatively about solutions of them.
- CO6 - Apply the best features of mathematics, engineering and natural sciences to program real life problems



Employability



Entrepreneurship



Skill Development

SHSA1101	TECHNICAL ENGLISH	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To enable the students to read and respond to specialized (scientific) materials and to subject areas included for their study.
- To provide an opportunity for students to comprehend and react in oral and written forms to the specialized texts that they read in their respective courses so as to summarise and paraphrase the texts presented in the class.
- To provide opportunities for students to respond to listening and writing tasks by using digital tools
- To enhance 21st century skills like communication, collaboration, critical thinking and creativity through blended learning contexts

UNIT 1 LANGUAGE AT THE WORD LEVEL 9 Hrs.

Listening: Note Taking, Summarising the information related to resume preparation and also in flow chart templates

Speaking: Self Introduction, Talking about likes and dislikes

Reading for global understanding: The content from subject related matter or True Love by Isaac Asimov **Writing:** Formal and informal emails and letters and letter to the editor with current problems and solutions suggested.

Vocabulary: Affixes, technical terms, collocations, ordering words, sequence words, contextual guessing of words

Language Focus: changing one form of speech into another; present tense, signalling words for time and order

Language Lab work: Focus Digital literacy: students join Google classroom/ or class wiki: become familiar with these online tools, by introducing themselves by doing ice breaking activity

UNIT 2 LANGUAGE AT THE SENTENCE LEVEL 9 Hrs.

Listening and Predicting: Listen to the current trends about product sales; arrive at inference about technical and environmental issues

Speaking: Debate on current issues, JAM on current topics

Reading for global comprehension: Identifying topic sentences by reading Short story on Men are Different or content from the subject areas.

Writing: Writing compare/ contrast paragraphs, process descriptive paragraphs and paraphrasing passages to express meaning in own words.

Vocabulary: identifying and framing verbal phrases, prepositions and prepositional phrases from the reading materials suggested

Language focus : Recognizing Past and future tense, Conjunctions and sentence linkers with specific focus on signalling words for Comparison/similar ideas, Contrast/opposite ideas, adjectives/ adverbs for comparisons there by to use in sentences.

Identify clauses, kinds of sentences based on their functions in the passage, Transformation of sentences from one type into the other (Simple, compound, complex), impersonal passive voice.

Language Lab: Digital literacy: Respond to quiz using Google spread sheet, Prepare a quiz on Language focussed areas, sharing links in Google classroom, and collect answers/ respond to survey sheets of their classmates to write compare contrast paragraphs of responses in wikis.

UNIT 3 LANGUAGE AT THE DISCOURSE LEVEL –REPORTING 9 Hrs.

Listening: Listening for gist / to summarize and to find the attitude and tone of the speaker

Speaking: Making Group Presentations based on information gathered by eliciting responses-Preparing a questionnaire, with open ended questions to make a survey about electronic gadgets/ social media/ environmental issues using elements of reasoning to make a presentation in the class.

Reading - Skimming and Scanning to find specific information and preparing notes on Passage on 'Making Effective presentation'

Writing: Framing open ended questions using elements of reasoning. Survey Report: Preparation of and documenting to report the findings. Arranging the sentences in the right order

Vocabulary: Word classification, word associations, paired expressions

Language focus: Subject verb agreement, punctuation, Common errors in spelling, punctuation

Language Lab: Digital literacy: Use interactive power point tools like Prezi, Slideshare to make presentation on the survey report to share link in the Google classroom

UNIT 4 LANGUAGE AT THE DISCOURSE LEVEL - PRODUCT DESCRIPTION 9 Hrs.

Listening: Classifying information related products

Speaking: Group discussion on current topics to arrive at solutions to problems by using elements of reasoning

Reading: Reading to prepare notes, categorising under headings and subheadings by reading Short Extracts from User Manuals. Reading and contextual guessing by reading about products

Writing: Instructions and recommendations, Preparation of User Manual on the electronic products in current usage

Vocabulary: Classification of words, descriptive words about products, definitions, compound nouns

Language: Reported Speech, causatives and double negatives, Tag questions

Language Lab: Digital literacy: Use Padlet/ quia to develop and complete vocabulary tasks created by peers in group work

UNIT 5 LANGUAGE AT THE DISCOURSE LEVEL – CRITICAL THINKING AND CREATING 9 Hrs.

Listening and summarizing: Listening to famous speeches to identify the structure of speeches- Ted Talks/ peer presentations to fill the template

Speaking: Giving impromptu talks, Speech Writing

Reading for Global Understanding: Read technical passages and trends in social media or technological developments to summarise, Read speeches by MS Narayana Murthy ' My Life's Lessons ', Dr APJ Kalam's Speech "Unity of Minds" to identify the structure of Speech

Writing: Essay writing related to the Speeches suggested for reading, besides topic areas covered in all the units, self and peer editing using rubrics

Vocabulary: Homophones/Homonyms, idioms and phrases related to technology

Language focus: Same word acting as different parts of speech

Language Lab: Digital literacy: to create their own Blogs thereby to share their creations, interactive exercises and quizzes make them visible online.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Classify technical words to use them in sentences framing, compose problem solving paragraphs in semi formal letters, use rubrics to self evaluate, listening to take linear notes, reading to infer, predict and to differentiate facts from opinions, guess contextual meaning of words, modify the verbs in present tense, use learnt language in role plays with 80% accuracy
- CO2 - Categorize information based on global understanding of reading materials to prepare notes in graphic format like tables, use cohesive words related to comparing and contrasting by writing short paragraphs based on visual inputs in the form of bar diagrams, pie chart etc; describe process by composing paragraphs, recognize topic sentences and identifying verbal phrases while reading, use prepositions and prepositional phrases, modify the verbs from one form to the other in past and future tenses with 80% accuracy
- CO3 - Generate specific information by using scanning and skimming reading materials, Construct questionnaire to conduct class survey by framing open ended questions to generate data on current issues to make oral presentations and report in written format by using template provided, arrange sentences in the right order by using sentence linkers as clues, revise the written materials by identifying elements of editing, edit errors related to subject verb agreement, punctuation and spelling besides coherence with 70 % accuracy, use reported speech in spoken and written form in class room in reporting contexts, list paired words, word associations by recalling and identifying by noticing them while reading
- CO4 - Paraphrase based on reading to discuss and design products thereby to create and design user manual, identify technical words related to compound nouns to expand and to paraphrase, enact role plays to present the product, discuss facts and opinions of the product in pair and team work, read current topics to summarise in note form , listen to current issues to deduct meaning from the context, choose the right option, define technical words related to the reading materials.
- CO5 - Summarise reading materials, use the ideas while writing essays, take, and differentiate meaning of homonyms and homophones
- CO6 - Demonstrate the ability to work cooperatively in a small group environment, in activities developed for language learning in the classroom/ online for formative assessment purposes, use and develop rubrics for self reflection, apply elements of reasoning skills for critical reading, identify facts and opinions and make judgements independently, develop intellectual courage and perseverance in pair and group work



Employability



Entrepreneurship



Skill Development

SCHA1211	PRINCIPLES AND CALCULATIONS IN CHEMICAL ENGINEERING	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVES

- To develop skills of the Students in the area of Chemical Engineering which will be necessary for certain other course offered in the subsequent semesters.
- To expose the students to various unit operations so as to enable them to improve the design and operation of the bioprocess plant.

UNIT 1 INTRODUCTION TO CHEMICAL ENGINEERING

9 Hrs.

Introduction to chemical engineering sciences and its role in the design & analysis of biological processes, overview of unit operations and processes in the chemical industry. Unit operations, schematic representations of unit operations, Fermentation Process (Ethanol), Agrochemical (Urea), Pharmaceutical (Penicilin). Unit process- alkylation, aromatization, calcination, chlorination, Trans-esterification.

UNIT 2 INTRODUCTION TO PROCESS CALCULATIONS

9 Hrs.

Introduction to chemical engineering, concepts of units and conversion factors, fundamental and derived units, basic chemical calculations, mole, mass, molecular weight, introduction to dimensional analysis, dimensionless numbers, dimensional analysis.

UNIT 3 MATERIAL BALANCES WITHOUT CHEMICAL REACTIONS

9 Hrs.

Material balance without chemical reaction – Distillation, Evaporation, Crystallization, Absorption, Drying, membrane operations and Mixing.

UNIT 4 MATERIAL BALANCES WITH CHEMICAL REACTIONS

9 Hrs.

Material Balance with chemical reaction-limiting reactant, excess reactant, conversion and selectivity. Recycle, purge and bypass operations.

UNIT 5 ENERGY BALANCE AND COMBUSTION

9 Hrs.

Introduction to thermophysics and thermo chemistry, heat capacities of solid, liquid and gases at constant pressure and volume, evaluation of enthalpy, standard heat of reaction, standard heat of combustion and standard heat of formation.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to-

- CO1 - Understanding the flow sheets of any process and symbols in unit operations and processes.
- CO2 - Learn the basic definitions, units, unit systems
- CO3 - Analyzing and converting the values from one-unit system to other unit system.
- CO4 - Understanding the material balance calculations for with and without reaction.
- CO5 - Understanding the energy balance calculations for various reactions.
- CO6 - Material and Energy balance calculations for combined process equipments.



Employability



Entrepreneurship



Skill Development



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School of Bio & Chemical Engineering

Department of Biotechnology

1.1.3 Courses having focus on Employability / Entrepreneurship / Skill Development

M.Tech. - Biotechnology

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Employability



Entrepreneurship



Skill Development

SBTA5101	ADVANCED BIOCHEMISTRY	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVE

- The objective of the course is to provide a deeper insight into advanced understanding of the core principles and topics of Biochemistry, and to enable students to acquire a specialized knowledge and understanding of selected aspects.

UNIT 1 BIOMOLECULES AND METABOLISM

9 Hrs.

Review of Biological Macromolecules: proteins, carbohydrates and nucleic acids, Bioenergetics-Glycolysis, Gluconeogenesis, Pentose Phosphate pathway, Citric Acid Cycle, Oxidative Phosphorylation, Photosynthesis, Fatty Acid Metabolism, Fatty Acid Biosynthesis, Amino Acid Catabolism, DNA Metabolism and RNA Metabolism

UNIT 2 ADVANCED ENZYMOLOGY

9 Hrs.

Theory of enzymatic catalysis, classification, specificity, concept of active site and enzyme substrate complex, Mechanism of enzyme action. Effect of different factors affecting enzyme activity, transition state theory, Arrhenius equation, Determination of energy of activation, Enzyme kinetics and inhibition. Role of enzymes in regulation of metabolism, allosteric enzymes and their kinetics. Immobilized enzymes.

UNIT 3 TRANSPORT BIOCHEMISTRY

9 Hrs.

Biomembranes and their classification based on cellular organelles; physico-chemical properties of different biological membranes. Membrane components – lipids, their distribution and organization; proteins, intrinsic and extrinsic, their arrangement; carbohydrates, their function. Various membrane movements; transport of biomolecules across membrane. Role of membrane in cellular metabolism, cell recognition and cell-to-cell interaction; signal transduction. Biochemistry of transmission of nerve impulse through nervous system.

UNIT 4 PESTICIDE BIOCHEMISTRY

9 Hrs.

Entry and distribution of different classes of pesticides in plants and animals. Pesticide metabolism – microsomal oxidation, cytochrome P450 interaction, extramicrosomal metabolism, enzymatic conjugation. Metabolism of different classes of pesticides involving different enzyme systems. Biochemistry of toxic action of pesticides.

UNIT 5 PLANT BIOCHEMISTRY

9 Hrs.

Phytohormones and their mode of action, signal transduction. Biochemistry of seed development and germination, Biochemistry of fruit ripening. Biochemistry and significance of secondary metabolites – cyanogenic glycosides, glucosinolates, phenolic compounds, steroids and terpenoids, alkaloids; their role in plant defense system. Plant defense response, antimicrobial molecules; genes for resistance, hypersensitive response and cell death; systemic and acquired resistance.

COURSE OUTCOMES

- CO1 - To describe the synthesis of proteins, lipids, nucleic acids, and carbohydrates and their role in metabolic pathways along with their regulation.
- CO2 - To understand the classification, structure, function, mechanism of action and kinetics of enzyme.
- CO3 - To demonstrate the structural organization of biomembrane and its role in transportation.
- CO4 - To explore the fixation and biochemical pathways of pesticide in living systems.
- CO5 - To demonstrate role of plant hormones, secondary metabolites and bio chemical mechanism behind the plant growth.
- CO6 - The overall goal of this course is for the student to gain a knowledge of biochemical concepts and techniques which will be necessary for future scientific endeavors.



Employability



Entrepreneurship



Skill Development

SBTA5102	MICROBIOLOGY AND MICROBIAL BIOTECHNOLOGY	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVE

- To provide sound knowledge on the world of microbes, their survival strategies, processes and applications of microbial products.

UNIT 1 MICROBIAL CLASSIFICATION AND STRUCTURE

9 Hrs.

Classical and modern methods and concepts; Domain and Kingdom concepts in classification of microorganisms; Criteria for classification; Molecular methods – Denaturing Gradient Gel Electrophoresis (DGGE), Temperature Gradient Gel Electrophoresis (TGGE), Amplified rDNA Restriction Analysis and Terminal Restriction Fragment Length Polymorphism (T-RFLP) in assessing microbial diversity; 16S rDNA sequencing. Ultrastructure of Archaea (Methanococcus); Eubacteria (E.coli); Unicellular Eukaryotes (Yeast) and viruses (Bacterial, Plant, Animal and Tumor viruses).

UNIT 2 MICROBIAL GROWTH AND CONTROL

9 Hrs.

Culture media. Isolation and identification of microbes, culture techniques. Preservation of cultures Microbial growth: Growth kinetics, Thermal death kinetics, Batch, fed-batch, continuous culture, synchronous growth, yield constants methods of growth estimation, stringent response, death of a bacterial cell.; Physical and chemical methods for the control of microbes. Sterilization

UNIT 3 MICROBIAL INTERACTION

9 Hrs.

Microbial interaction -Symbiosis (Nitrogen fixation and ruminant symbiosis); Antagonism (Pathogenesis) Microbes and Nutrient cycles; Microbial communication system- Quorum sensing, Biofilms; Microbial fuel cells; Prebiotics and Probiotics; Vaccines, Multidrug resistance-Mechanism and Example. Extremophiles (with classical example from each group).

UNIT 4 INDUSTRIAL APPLICATIONS

9 Hrs.

Basic principles in bioprocess technology; Media Formulation; Sterilization- Batch and continuous sterilization systems; Primary and secondary metabolites; Biotechnologically important products; Extracellular enzymes exopolymers; Bioprocess control and monitoring variables such as temperature, agitation, pressure, pH. Environmental application of microbes; Ore leaching; Toxic waste removal; soil remediation.

UNIT 5 MICROBIAL PROCESSES

9 Hrs.

Microbial processes-production, optimization, screening, strain improvement; factors affecting down stream processing and recovery; Representative examples of ethanol, organic acids, Antibiotics; Enzyme Technology production, recovery, stability and formulation of bacterial and fungal enzymes-amylase, protease, penicillinacylase, glucose isomerase; Immobilised. Enzyme and Cell -application, biotransformations-steroids, antibiotics, alkaloids

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Instruct the classical and modern microbial classification methods.
- CO2 - Elucidate the structure of bacteria, fungi and viruses.
- CO3 - Explain the methods of microbial growth and control.
- CO4 - Describes the physiology of microbial interactions.
- CO5 - Identify the basic principles of industrial and environmental applications of microbes.
- CO6 - Demonstrate the microbial processes in industrially important products production.



Employability



Entrepreneurship



Skill Development

SBTA5103	IMMUNOTECHNOLOGY	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVE

- To provide a deeper insight into advanced understanding of the core principles and topics of Immunology, and to enable students to acquire a specialized knowledge and understanding of different techniques used in Immunology and their applications.

UNIT 1 OUTLINES OF IMMUNOLOGY

9 Hrs.

History of immunology, Types of immunity - Innate and acquired immunity, specificity, immunological memory of immune system. Erythropoiesis, of Cell lineage of immune cells—Primary and secondary lymphoid organs – bone marrow, thymus, spleen, lymph nodes, CALT, MALT. Types of immune cells, B-lymphocytes, T-lymphocytes, macrophages, dendritic cells, cell mediated immunity and lymphokine activated killer cells, Programmed cell death –Regulation of PCD; clonal nature of the immune response - clonal selection theory.

UNIT 2 ANTIGENS, ANTIBODIES AND COMPLEMENTS

9 Hrs.

Antigens and antigenicity: Types, structure and requirements for immunogenecity. haptens, adjuvants, cross reactivity. Immunoglobulin: structure, function and biological properties of Ig classes – organization and expression of immunoglobulin genes – Generation of antibody : effector functions of antibodies. Monoclonal Antibody – production and applications, Complement – activation; classical, alternate and lectin pathways; biological role of complement activation.

UNIT 3 IMMUNE RESPONSES

9 Hrs.

Development, Selection, Signaling, Function and activation of B cell; Receptor / coreceptors, Signaling, Development and Selection of T cell; Phagocytosis, MHC – structure and functions of class I and Class II MHC molecules; antigen processing and presentation – cytosolic and endocytic pathways; cytokines – action, regulation and signal transduction; cell mediated mechanisms – PCD – fas / perforin – granzyme mediated pathways; inflammation – inflammatory response and mediators.

UNIT 4 APPLIED IMMUNOLOGY

9 Hrs.

Hypersensitivity - immediate and delayed type hypersensitivity reactions. Forms of Immunity – autoimmune processes, transplantation immunity, Tumor immunology, Immunological tolerance and immunosuppression. Immune deficiency diseases. Immunotherapy of infectious diseases; Immunological mechanisms involved in the pathogenesis of tumor, AIDS, Tuberculosis and malaria; Types and principles of immunization; Natural and artificial immunotherapy.

UNIT 5 IMMUNOTECHNIQUES

9 Hrs.

Diagnostic tools in immunology: agglutination, precipitation, ELISA, RIA, SDS-PAGE, immune blot, immunofluorescence, Immunodiffusion, Immuno electron microscopy, immunoelectrophoresis, Isoelectric Focussing, FACS, Lymphocyte Transformation Test, complement mediated hemolysis, T-cell cloning methods, VDRL slide test. LAL test.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Introduce different components of immunity, immune system, development and maturation of
- CO2 - Provide an idea about antigen and antibodies
- CO3 - Give a detailed insight into the molecular basis of immunoglobulin synthesis
- CO4 - Identify the effector mechanism of immune response like phagocytosis, complement pathway
- CO5 - Illustrate the adverse effect of immune response like autoimmunity and hypersensitivity **Max.45 Hrs.**
- CO6 - Employ antigen antibody interaction to conduct different immunological and serological tests in the laboratory.



Employability



Entrepreneurship



Skill Development

SBTA5104	PRINCIPLES OF CHEMICAL ENGINEERING	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVE

- To acquire a specialized knowledge and understanding the factors which influence the production process and the role of physical and chemical parameters in metabolite production

UNIT 1 MATERIAL AND ENERGY BALANCE**9 Hrs.**

Introduction to engineering calculations, stoichiometry, material balance, stoichiometry of growth and product formation, energy balance without reaction, with cell culture and product formation.

UNIT 2 FLUID FLOW AND MIXING**9 Hrs.**

Classification of fluids, viscosity-measurement and significance, Rheology of fermentation broths, mixing equipments, assessing effectiveness of mixing, power requirement for mixing, scale up of mixing systems.

UNIT 3 HEAT TRANSFER**9 Hrs.**

Mechanism of heat transfer, General equipments of heat transfer, heat transfer between liquids, thermal boundary layer, heat transfer coefficients calculation, design equation for heat transfer systems.

UNIT 4 MASS TRANSFER**9 Hrs.**

Ficks law of binary diffusion, Temperature and pressure dependence of diffusivities, Theory of diffusion in gases at low density, Theory of diffusion in binary liquids, Theory of diffusion on colloidal suspensions, Theory of diffusion in polymers, Convective mass transport, Maxwell stefan's equation for multicomponent diffusion in gases at low density, Unicomponent and Equimolal diffusion in gases and liquids.

UNIT 5 HOMOGENOUS REACTIONS**9 Hrs.**

Basic reaction theory, Reaction thermodynamics, reaction rate and kinetics, effect of temperature on reaction, rate, calculation of reaction rate, order and rate constant from experimental data, introduction to ideal reactor

COURSE OUTCOMES

On completion of the course, the student will be able to

- CO1 - Explore to energy and material balance
- CO2 - Understand the concept of fluids flow and mixing in bioreactor
- CO3 - Appraising the role of heat transfer in metabolite production
- CO4 - Evaluating mass transfer in metabolite production
- CO5 - Optimizing the rate of the reaction
- CO6 - Design the reactor and reaction for the maximum yield of metabolites



Employability



Entrepreneurship



Skill Development

SBTA5201	ADVANCED MOLECULAR BIOLOGY AND GENETIC ENGINEERING	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVE

- The course provided a deep insight on to the various techniques involved in manipulation of DNA for its exhaustive use in the field of gene characterization, modification, cloning and transgenesis.

UNIT 1 INTRODUCTION TO GENETIC ENGINEERING AND CLONING STRATEGIES**9 Hrs.**

Milestones in genetic engineering. Special molecular tools used in genetic engineering. Preparation of DNA: Isolation and purification of DNA and genes, modification of cut ends and ligation of transgene. Gene transfer techniques: physical, Chemical and biological methods. Integrative DNA transfer- Agrobacterium Ti and Ri plasmids, Protoplast fusion and organelle engineering. Expression and Characterization of transgene: genomic level, transcript level and translational level.

UNIT 2 ADVANCED MOLECULAR BIOLOGY TECHNIQUES- I**9 Hrs.**

Hybridization techniques: Southern, Northern, Western, South western and North western. PCR Techniques: Different types including real time (syber green and Taqman chemistry). DNA fingerprinting: basic genetic principle. Single locus and multilocus DNA fingerprinting: Variable Number of Tandem repeats (VNTRs) Minisatellite sequences, Short Tandem Repeats (STRs) Micro Satellite Sequences, RFLP, RAPD, ISSR, AFLP. Genome mapping: Direct mapping, indirect mapping.

UNIT 3 ADVANCED MOLECULAR BIOLOGY TECHNIQUES II**9 Hrs.**

DNA sequencing; Maxam and Gilbert chemical degradation method, Sanger and Coulson's enzymatic chain termination method, Next generation sequencing, Pyrosequencing, High throughput sequencing DNA foot printing, Chromosome Walking, Chromosome Jumping. Techniques for differential gene expression: DDRT and SSH. Isolation of genes and full length cDNA: 5' and 3' RACE basic technique and comparison with RLM RACE. Gene Silencing Techniques; Antisense RNA technology, Micro RNA- ShRNA, siRNA, technology; Construction of siRNA vectors. Site directed mutagenesis.

UNIT 4 GENETICALLY MODIFIED ORGANISMS**9 Hrs.**

Application of genetic engineering in food (golden rice and other improved nutritional qualities), agriculture (herbicide resistance, salt/draught tolerance, insect resistance (Bt. protein), designer flowers), aquaculture (giant salmon), medicine (xenotransplantation and gene therapy), industry and environment (plants as bioreactors, vaccines, plantibodies, bioplastics and oil eating bacteria). Engineering novel traits in plants by antisense technology and RNAi technology, Creation of Transgenic plants- Seed terminator technology. Transgenic animals- Gene therapy. Transgenic microbes: Genetic manipulation of microorganisms. Transgenic organisms and Metabolic Engineering. Site direct mutagenesis.

UNIT 5 HAZARDS AND IMPACT OF GMOs**9 Hrs.**

Negative impacts of genetic engineering and Present controversies on genetically modified organisms (GMOs). Biosafety Considerations: Biological risks, ethical issues, economic issues, legal issues. Biosafety regulations, norms for the release of genetically engineered organisms.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Review the methods for analyses of gene expression at different levels
- CO2 - Evaluate the pros and cons of the different gene mapping techniques
- CO3 - Describe the methods for silencing the gene expression
- CO4 - Summarize the application of genetic engineering techniques in the field of medicine and transgenesis
- CO5 - Comment on the controversies on the use of GMO in Bioremediation, medicine, agriculture
- CO6 - Examine and evaluate the biosafety regulations and legal issues on the use of GMO



Employability



Entrepreneurship



Skill Development

SBTA5202	ENZYME AND PROTEIN ENGINEERING	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVES

- To make Students learn structural and functional relationships in proteins and altering their structure in order to function 'better'.
- To provide basic knowledge of enzyme technology and use of enzymes as tools in industry, agriculture and medicine

UNIT 1 PROTEIN STABILITY AND FOLDING

9 Hrs. Overview

of protein structure, Higher level structure, Protein stability, Mechanism of protein folding (types, level, thermodynamics, Anfinsen's dogma & Levinthal paradox & kinetics), Folding Rate, Molten globule; Techniques for studying of protein folding; Location and functions of Molecular chaperones, chaperonin and co-chaperons, HSP chaperone system in Ecoli & Human; Proteasomes and proteasome mediated protein degradation; Protein folding errors: Alzheimer's, prions and Mad Cow (BSE, CJD), Cystic Fibrosis and cancer. Polyketides and non-ribosomal peptides

UNIT 2 ENZYMES AND APPLICATIONS

9 Hrs.

Production and purification of crude enzyme extracts from plant, animal and microbial sources; methods of characterization of enzymes; development of enzymatic assays. Techniques for Immobilization of enzymes and Overview of applications of immobilized enzyme system. Abzymes and their applications Enzyme electrodes, biosensors and their applications in industry, healthcare and environment, ELISA, EMIT

UNIT 3 PROTEIN ENGINEERING

9 Hrs.

Introduction to steps of Protein design and Engineering, protein splicing and its application; Solid phase peptide synthesis, Production of Novel Proteins; Random and site directed mutagenesis, Methods for Expressing Recombinant Proteins; Characterization of Proteins structure: Crystallography and X-Ray Diffraction, Spectroscopy (UV-VIS, NMR and Fluorescence Spectroscopy) and Calorimetric Methods.

UNIT 4 COMPUTATIONAL METHODS IN PROTEIN ENGINEERING

9 Hrs.

Non canonical aminoacids in protein science and engineering, Fidelity mechanisms of the aminoacyl-tRNA synthetases, engineering with unnatural amino acid analogs, choice of protein scaffold for protein engineering, Application of molecular modeling and structure predictions to protein engineering, mechanical calculations and geometry optimization, De novo protein design, Energy status of a protein molecule. protein databases.

UNIT 5 APPLICATIONS OF PROTEIN ENGINEERING

9 Hrs. Alterations

of substrate specificity and stereoslectivity of lipases and esterases, cofactor and substrate engineering for metabolic engineering and gene therapy, Combinational manipulation of polyketides and non-ribosomal peptides; structure based engineering of PHA synthase enzymes and monomer supplying enzymes, Bioengineering of sequence repetitive polypeptides, application of protein folding to design new drug

COURSE OUTCOMES

Max.45 Hrs.

On completion of the course, the student will be able to

- CO1 - Provide an essential knowledge in protein folding and structure-functional insights of proteins.
- CO2 - Demonstrate the principles of isolation and purification of enzymes from various sources
- CO3 - Offer understanding on enzyme applications, targets of protein engineering and protein engineering approaches.
- CO4 - Gain knowledge of several biophysical techniques used for analysis of secondary, tertiary and quaternary structure, as well as of screening methods used for selection of novel protein variants with improved properties
- CO5 - Provide insights of the methods including use of non-natural amino acids, bioinformatics and molecular evolution to develop useful proteins with enhanced properties.
- CO6 - Comprehend various methods involved in enzyme technology and their commercial applications.



Employability



Entrepreneurship



Skill Development

SBTA5203	FERMENTATION AND DOWNSTREAM PROCESSING	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVE

- To understand and improve the knowledge on fermentation technology, growth kinetics, fermenter control process and various downstream process techniques.

UNIT 1 INTRODUCTION TO FERMENTATION PROCESS

9 Hrs.

The range of fermentation processes – Bacteria and fungi isolation techniques, Strain, culture collection management, Inoculum preparation, Scale up of the inoculum for Bacteria and fungi – Sterilization, Batch and Continuous sterilization of medium, Filter sterilization, Aseptic operation.

UNIT 2 MICROBIAL GROWTH KINETICS

9 Hrs.

Bacterial growth kinetics, Monod model, primary and secondary metabolites. Continuous culture, Comparison of Continuous

Batch and continuous culture. Design of a fermenter – ancillary equipment fermenter / Bioreactor types.

UNIT 3 INSTRUMENTATION AND CONTROL

9 Hrs.

Fermentation control systems – manual and automatic control in fermentation processes. Architecture of Fermentation systems, temperature measurement and control, flow measurement and control, pressure measurement and control, measurement of pH and dissolved oxygen and concentration sensors, Computer applications in fermentation technology. Artificial neural network.

UNIT 4 DOWNSTREAM PROCESSING

9 Hrs.

Separation and recovery of fermented products- sedimentation, foam separation, precipitation, filtration, centrifugation, flocculation, coagulation- cell disruption –physical and chemical methods, liquid - liquid extraction - solvent recovery, two phase aqueous extraction, supercritical fluid extraction.

UNIT 5 PURIFICATION PROCESSES

9 Hrs.

Membrane separation processes, crystallization, drying, whole broth processing, Chromatography - Adsorption Chromatography, gel permeation, Affinity Chromatography, High performance liquid. Chromatography. Lyophilization.

Max.45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Introduce basic knowledge on fermentation process.

CO2 - Discuss about various types medium sterilization.

CO3 - understand instrument and control system.

CO4 - Understand the knowledge of various primary isolation techniques.

CO5 - Evaluate an appropriate technique for novel downstream processing and its applications

CO6 - Compare diverse biomolecules technique and principle of various chromatography techniques and its resolution



Employability



Entrepreneurship



Skill Development

SCCA9501	INDUSTRY 4.0	L	T	P	Credits	Total Marks
		3	0	0	2	100

UNIT 1 TRANSFORMING TECHNOLOGIES IN BIOENGINEERING**7 Hrs.**

Establishment of smart biotechnology factory, Artificial intelligence in Bioprocess technology, Omics – Big data analysis through automation, 3D bio printing for tissue engineering. Simulation tools, RSM and Box model. Cyber physical system based telemedicine, diagnosis and therapeutics through real time biosensors. Bionanotechnology. Intellectual Property rights (IPR): Case Studies.

UNIT 2 ADVANCEMENTS IN SUSTAINABLE BUILT ENVIRONMENT**7 Hrs.**

Introduction – Technological developments in Architectural, Engineering and Construction (AEC) - Building Information Modelling (BIM) using Cloud computing technology and Internet of things (IoT) – Unmanned Aerial Vehicles, sensors – Additive manufacturing in construction – Concrete 3D printing - Materials used - Lightweight and functionally graded structures - Net Zero Energy buildings, Bioswales, Biofiltration pond, Ecosan systems- Recent developments in Waste water Management, Air pollution control, waste disposal - Integration of energy, water and environmental systems for a sustainable development- Emerging Technologies: Robot Highway- Vertical farming - Intellectual Property rights: Case studies

UNIT 3 SMART MANUFACTURING**8 Hrs.**

Smart factories and interconnection, Smart Manufacturing – automation systems, Additive Manufacturing, Smart grids, Micro Electro Mechanical Systems (MEMS), Stealth technology, Metal Finishing, Self propelled vehicles, e mobility, Green fuels, drones – unmanned aerial vehicles(UAVs), aerodynamics. Robotic Automation and Collaborative Robots – Augmented reality and haptics, engineering cybernetics and artificial intelligence (AI), Disruptive Technologies – Frugal Innovations – Emerging Technologies - Autonomous Robots, Swam Robot, Modular Robotics, Space craft, Intellectual Property Rights (IPR): Case Studies.

UNIT 4 SMART WORLD**8 Hrs.**

Smart Sensors and IIOT, Smart grid, Hybrid renewable energy systems, Electronics in Smart city, Integration of Sensors in Robots and Artificial Intelligence, 5G Technology, Communication protocols, Human-Machine Interaction, Virtual Reality, Quantum Computing: Changing trends in transistor technology: Processor, Emerging Trends: Deep Space, Swarm Robots, Cyborg, Geofencing, Pervasive Computing, Intellectual Property Rights-Case Studies.

UNIT 5 CYBER PHYSICAL SYSTEMS**8Hrs.**

Introduction to Cyber Physical Systems (CPS), Architecture of CPS, Data science and technology for CPS, Prototypes of CPS, Emerging applications in CPS including social space, crowd sourcing, healthcare and human computer interactions, Industrial Artificial Intelligence, Deep Learning, Gamification, Networking systems for CPS applications, Wearable cyber physical systems and applications, Domain applications of CPS: Agriculture, Infrastructure, Disaster management, Energy, Transportation, Intellectual Property Rights (IPR) : Case Studies.

Max. 45 Hrs.**TEXT / REFERENCE BOOKS**

1. William D. Callister, "Materials Science and Engineering, An Introduction, John Wiley and Sons Inc., Singapore, 2001.
2. V. Raghavan, "Physical Metallurgy: Principle and Practice, Prentice Hall India Pvt Ltd, 2006.
3. Flavio Craveiro, Jose Pinto Duarte, Helena Bartolo and Paulo Jorge Bartolo, "Additive manufacturing as an enabling technology for digital construction: A perspective on Construction 4.0", Automation in Construction, Vol.103, pp.251-267, 2019.
4. Klaus Schwab, "Fourth Industrial Revolution", Random House USA Inc, New York, USA, 2017.
5. Oliver Grunow, "SMART FACTORY AND INDUSTRY 4.0. The current state of Application Technologies", StudyLab Publications, 2016.

SBTA5301	NANOTECHNOLOGY AND NANOBIOTECHNOLOGY	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVES

- Basic structure, function and application of diverse nanomaterials.

UNIT 1 INTRODUCTION TO NANOTECHNOLOGY

9 Hrs.

History, development and generations of nanotechnology, MEMS and NEMS, Application of nanoscience & nanotechnology. Properties of nanomaterials, characterization methods-Diverse nanomaterials, CNTs, fullerenes, quantum dots.

UNIT 2 FABRICATION METHODS

9 Hrs.

Top down and bottom up methods, self assembly, lithography methods. Principle, working mechanism, instrumentation and application of diverse lithography methods. Synthesis of nanomaterials-physical, chemical & biological methods

UNIT 3 NANOPARTICLES

9 Hrs.

Overview of nano structures in protein and nucleic acids – cellular nano- structures – cell –surface layers- bio molecular motors- Actin fibers-Microbial nano particles – bacterial nano magnetosomes-bacterial cell –surface layer (S-layer), Bacteriorhodopsin Biological nanopores and nanocontainer – protein nanopores- liposome nano- containers, biopolymer nano containers – Nano capsules- application in Drug and gene target delivery.

UNIT 4 NANOMATERIALS

9 Hrs.

DNA – protein conjugative nano structures – oligonucleotide- enzyme conjugates, non covalent DNA – streptavidine conjugates, DNA- gold nano conjugates- Introduction to bioelectronics and biosensing devices-nano circuitry.

UNIT 5 APPLICATIONS AND TOXICITY OF NANOMATERIALS

9 Hrs.

Nano analytics- Nano Lab- on- Chip devices – Micro contact printing- DNA array – Nano molecular labels- Quantum Dots, protein labels, Molecular Beacons-Nanotoxicity, environmental and biological toxicity assessments.

Max.45 Hrs

COURSE OUTCOMES

On completion of the course, the student will be able to

- CO1 - Understand basic principles of nano and micro system.
- CO2 - Study the routes for the nanomaterial synthesis.
- CO3 - Explore the nanotechnology principles in nanodevices design and applications.
- CO4 - Familiar with the specific interactions of biological molecules in nano devices development.
- CO5 - Determine the toxicity assessment and application of nanotechnology.
- CO6 - Establish nanopinciples for the welfare of society



Employability



Entrepreneurship



Skill Development

SBTA5302	PLANT AND ANIMAL BIOTECHNOLOGY	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVES

- To give an understanding on the application of biotechnology in Agriculture.
- To familiarize the students with the concepts in plant and animal tissue culture and their transformation techniques.

UNIT 1 PLANT GENOMES AND PLANT TISSUE CULTURE**9 Hrs.**

Definition, Structure and organization of plant genome, Chloroplast and Mitochondrial genome, Totipotency, Plasticity and cytodifferentiation, Culture environment, Plant Tissue culture media and its components, Methods of sterilization, Different types of cultures -Shoot, callus, cell suspension and protoplast cultures, Factors affecting in vitro culture, Organogenesis, Micropropagation (Clonal Propagation), Somatic embryogenesis and synthetic seeds.

UNIT 2 TISSUE CULTURE TECHNIQUES**9 Hrs.**

embryo rescue techniques and importance of embryo culture, In vitro pollination and fertilization, Production of haploid plant through Androgenesis and Gynogenesis, Protoplast isolation and culture techniques, somatic hybridization and production of somatic hybrids and cybrids, Selection systems for somatic hybrids / cybrids and their characterization, Cause and use of somoclonal variations, In vitro production of secondary metabolites cell suspension, root and hairy root cultures, Importance of germplasm conservation and methods.

UNIT 3 PLANT TRANSFORMATION TECHNIQUES AND PRODUCTION OF TRANSGENIC PLANTS**9 Hrs.**

Genetic Transformation methods for production of transgenic plants (Direct, Indirect) with special emphasis on chloroplast transformation, protoplast transformation methods and normal methods using particle bombardment. Methodologies adopted in the following transgenic plants- increased shelf life of fruits (Flavr savr tomatos), increased biomass production (nif gene transfer) nutritional enhancements (Vitamins, proteins), Production of genetically modified plants for herbicide resistance (round up crops), pest resistance (Bt and other resistance gene candidates), stress tolerance (salt and draught), and horticultural quality (Designer flowers), Molecular farming for therapeutic protein (Plantibodies, Plantigens, Edible Vaccines), Protection of intellectual property (Seed terminator technology). Application of nanotechnology in agriculture.

UNIT 4 INTRODUCTION TO CELL LINES**9 Hrs.**

Celllines and their Types, Primary and secondary cell culture, Transformation, Immortalization, Maintenance of cell lines, Characterization of cell line: Media preparation and preservation, Measurement of cell growth: Direct observation, Enzyme assays and nucleic acid assays, Histological studies: Slide preparation, Nuclear and cytoplasmic staining.

UNIT 5 APPLICATION AND SAFETY REGULATIONS**9 Hrs.**

Stem cell culture and its types, Embryogenic stem cells and their application, Cryopreservation of gametes and embryos (Animal and Human), invitro fertilization, and embryo transfer. Microinsemination-PZD, ICSI, SUZI, MESA. Transgenic animal: methods of gene delivery-Application of transgenic animals, Safety regulation for transgenic animals, Current issues related to transgenic animals.

Max.45 Hrs.**COURSE OUTCOMES**

On completion of the course, student will be able to

- CO1 - Understand basic techniques in plant and animal tissue culture.
- CO2 - Apply modern techniques in plant tissue culture.
- CO3 - Explain the structure and organization of plant genome.
- CO4 - Identify suitable genetic transformation techniques for plants, animals and their applications.
- CO5 - Analyze the impact of transgenic plants.



Employability



Entrepreneurship



Skill Development

SBTA7009	ENVIRONMENTAL BIOTECHNOLOGY	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVES

- To provide an awareness on different types of pollution and provide insight into advanced techniques available for treatment.
- To enable students to gain knowledge about alternate sources of energy.

UNIT 1 ENVIRONMENTAL POLLUTION

9 Hrs.

Concept of Environmental Pollution; Origin of pollution; Classification and nature of Environmental Pollutants; Major sources; Impacts of Environmental Pollution at local regional and global level Concept of Pollution; (Air pollution, Water Pollution, Soil Pollution), Major pollutants and their sources, , episodes and disasters; Effects of air pollution on human health, animals, plants, material and climate;

UNIT 2 MICROBES AND ENVIRONMENT

9 Hrs.

Role of microorganisms in natural system and artificial system; Influence of Microbes on the Earth's Environment and Inhabitants; Ecological impacts of microbes; Symbiosis (Nitrogen fixation and ruminant symbiosis); Microbes and Nutrient cycles; Microbial communication; Quorum sensing system; Quorum sensing

UNIT 3 POLLUTION CONTROL TECHNOLOGIES

9 Hrs.

Control of Air pollution: Biofilters and Bioscrubbers for treatment of industrial waste, Water pollution: Aerobic digestion, Anaerobic digestion, Denitrification, Anoxic digestion, the activated sludge process, Design and modeling of activated sludge processes, Aerobic digestion, Design of a trickling biological filter, Design of anaerobic digester, industrial waste management, e-waste radioactive and nuclear power waste management- Solid waste management.

UNIT 4 BIOREMEDIATION

9 Hrs.

Bioremediation; In situ and Ex situ bioremediation; Constrains and priorities of bioremediation; Evaluating Bioremediation. Biodegradation: Microbiology of degradation and its mechanism, Factors affecting process of biodegradation; Bioaugmentation, Biosorption, Bioleaching, Metabolic pathways for Biodegradation for specific organic pollutants. Xenobiotics: Persistence and biomagnification of xenobiotic molecules; Microbial interactions with xenobiotics; Phase I and Phase II reactions; Cyt P 450 mediated reactions; Use of microbes (bacteria and fungi) and plants in biodegradation and Biotransformation.

UNIT 5 BIOENERGY

9 Hrs.

Alternate Source of Energy-Biocomposting, Vermiculture, Biofertilizers, Organic farming, Biofuels, Biomineralization, Bioethanol and Biohydrogen, Bioelectricity through microbial fuel cell, energy management and safety.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Introduces pollution and its effects.
- CO2 - Provides information about the role of microorganisms in the environment.
- CO3 - Exposes the students to various pollution control technologies available.
- CO4 - Explains Bioremediation and biodegradation in detail.
- CO5 - Elucidates biodegradation process and mechanism.
- CO6 - Discusses different alternate source of energy.



Employability



Entrepreneurship



Skill Development

SBTA7013	FOOD AND NUTRACEUTICALS	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVE

- To explore the bio sources for extraction of nutraceutical.

UNIT I INTRODUCTION TO NUTRACEUTICAL**9 Hrs.**

Organizational elements, classification of nutraceuticals, dietary supplements, fortified foods, functional foods and Phyto nutraceuticals. Scope involved in the industry, Indian and global scenario

UNIT II NUTRACEUTICALS OF PLANT AND ANIMAL ORIGIN**9 Hrs.**

Plant secondary metabolites, classification and sub-classification - Alkaloids, phenols, Terpenoids. Extraction and purification, applications with specific examples with reference to skin, hair, eye, bone, muscle, heart, brain, liver, kidney, general health and stimulants. Concept of cosmeceuticals and aquaceuticals. Animal metabolites - Sources and extraction of nutraceuticals of animal origin. Examples: chitin, chitosan, glucosamine, chondroitin sulphate and other polysaccharides of animal origin, uses and applications in preventive medicine and treatment.

UNIT III MICROBIAL AND ALGAL NUTRACEUTICALS**9 Hrs.**

Concept of prebiotics and probiotics - principle, mechanism, production and technology involved, applications - examples of bacteria used as probiotics, use of prebiotics in maintaining the useful microflora - extraction from plant sources. Symbiotic for maintaining good health. Algae as source of omega - 3 fatty acids, antioxidants and minerals - extraction and enrichment.

UNIT IV BIOTECHNOLOGY IN PHYTO NUTRACEUTICALS**9 Hrs.**

Role of medicinal and aromatic plants in nutraceutical industry – propagation - conventional and tissue culture, cultivation, post harvest technology and strategies for crop improvement, development of high yielding lines and yield enhancement, plant genomics and metabolomics. Biofortification and nutritional enhancement. GM foods with enhanced nutraceutical properties. Golden rice, GM Tomatoes.

UNIT V PRODUCT DEVELOPMENT AND CLINICAL TRIALS**9 Hrs.**

Activity screening, formulations of energy drinks, bars, sports drinks, fortified products, geriatric products, veterinary products, immune boosters, bioavailability, bioequivalence; use of animal models and pre-clinical and clinical trials. Basic Principles of toxicology – oral toxicity, sub-acute, acute toxicity and chronic toxicity. Toxic dose, toxic-kinetics, LD50, dose-response relationships, local v/s systemic toxicity, antagonism and synergism.

Max. 45 Hrs**COURSE OUTCOMES**

On completion of the course, student will be able to

- CO1 - Classify the nutraceutical components.
- CO2 - Explore the plant and animal source for nutraceutical compound.
- CO3 - Investigate the microbial and algal source for nutrient value compound.
- CO4 - Role of biotechnology in production of nutraceutical compound.
- CO5 - Summarize the nutraceutical development process and clinical trials.
- CO6 - Construct the biotechnology process for the production of nutraceutical compound from bio-origin.



Employability



Entrepreneurship



Skill Development

SMTA5103	APPLIED MATHEMATICS	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVE

- Analytical, logical thinking and conclusions based on quantitative information will be the main objective of learning this subject.

UNIT 1 MATRIX THEORY**9 Hrs.**

QR decomposition – Eigenv values using shifted QR algorithm - Singular Value Decomposition – Pseudo inverse- Least square approximations.

UNIT 2 CALCULUS OF VARIATIONS**9 Hrs.**

Concept of Functionals - Euler's equation – Functional dependent on first and higher order derivatives – Functionals on several dependent variables – Iso-perimetric problems – Variational problems with moving boundaries.

UNIT 3 MULTIVARIATE ANALYSIS**9 Hrs.**

Multiple Regression Analysis - Principal Component Analysis – Canonical Correlation Analysis – Factor Analysis – Discriminant Analysis – Cluster Analysis (No Derivations).

UNIT 4 NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS**9 Hrs.**

Euler's method – Modified Euler's method – Runge - Kutta Method of fourth order – Runge - Kutta method of simultaneous first order differential equation – Runge - Kutta method of second order differential equation – Predictor -Corrector methods : Milne's & Adam-Bashforth methods.

UNIT 5 NUMERICAL SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS**9 Hrs.** Classification

of PDE – Elliptic equations: Solution of Laplace equation by Liebmann's Iteration process, Poisson equation – Parabolic equation : Bender Schmidt Method, Crank Nicholson Difference Method – Solution for Hyperbolic equation

Max.45 Hrs**COURSE OUTCOMES**

On completion of the course, student will be able to

- CO1 - Defining the concepts of Matrix Theory and its applications.
- CO2 - Learning the concepts of calculus of variations.
- CO3 - Understanding the concept of multivariate analysis.
- CO4 - Evaluation of Eigen values and Pseudo inverse of a matrix.
- CO5 - Applying various numerical techniques in solving problems in ODE's and PDE's.
- CO6 - Produce the solutions of ODE and PDE by numerical methods



Employability



Entrepreneurship



Skill Development



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1.1.3 Courses having focus on Employability / Entrepreneurship / Skill Development

B.Sc. - Biotechnology

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Employability



Entrepreneurship



Skill Development

SBBA1103	CELLBIOLOGY	L	T	P	Credits	TotalMarks
		3	0	0	3	100

COURSE OBJECTIVES

Cell biology is the study of the structure and function of prokaryotic and eukaryotic cells. In this course the students will learn different areas of cellular biology including the structure and functions of cell, its organelles, synthesis and function of macromolecules such as carbohydrate, protein, lipid, DNA & RNA; membrane structure and function; bioenergetics; cellular communication; and microscopic techniques to understand the cell structure.

UNIT 1 FUNDAMENTALS OF CELL STRUCTURE

9 Hrs.

Discovery of cells; Basic properties of cells; Different classes of cells – Prokaryotic and eukaryotic cells. Cell division: Cell cycle; mitosis; meiosis, binary fission.

UNIT 2 CELLULAR MEMBRANES AND MATRICES

9 Hrs.

Chemical composition and fluidity of membranes; dynamic nature of membranes; transportation across cell membrane; membrane potentials; extracellular matrices – structure and function; cytoskeleton – structure and function.

UNIT 3 CELLULAR ORGANELLES IN ENERGY METABOLISM

9 Hrs.

Mitochondria – structure and function; Chloroplast – structure and function. Structure of nucleus – nuclear membrane, nucleolus, chromatin, structure of nucleic acids

UNIT 4 CELLULAR ORGANELLES IN METABOLISM

9 Hrs.

Endoplasmic reticulum – smooth & rough; function of endoplasmic reticulum; Golgi complex – structure and function; Ribosomes – Types, structure and function; Morphology and functions of peroxisomes and glyoxisomes; Plant cell vacuoles..

UNIT 5 TRANSPORT ACROSS CELL MEMBRANE

9 Hrs.

Passive and active transports, Permeases, Sodium -potassium pumps, Ca²⁺ ATPase pump, ATP dependant proton pumps, co-transport, symport, antiport, Endocytosis and Exocytosis. Introduction to intra and extra cellular products of medicinal use.

Max. 45 Hours

COURSE OUTCOMES:

- CO1: Learn the structure and functions of cells
- CO2: Understand the cell cycle process
- CO3: Familiarize the cellular components in detail
- CO4: Understand the role of cellular components in metabolism
- CO5: Understand the various processes involved in animal and plant developments
- CO6- Demonstrate the importance of cell membrane in transport process.



Employability



Entrepreneurship



Skill Development

SBBA1102`	FUNDAMENTALS OF MICROBIOLOGY	L	T	P	Credits	TotalMarks
		3	0	0	3	100

COURSE OBJECTIVES

This course is aimed give an understanding about the basics of microbiology dealing types of microbes, classification & characterization

UNIT 1 HISTORY OF MICROBIOLOGY

9 HRS.

History and scope of Microbiology, Spontaneous generation - Biogenesis theory - Contribution of Leeuwenhoek, Louis Pasteur, Robert Koch, Edward Jenner, Paul Ehrlich and Flemming.

UNIT 2 MICROSCOPY

9 HRS.

Microscope- Principles, working mechanism and application - Simple and compound microscope - Dark field -Phase contrast, Fluorescence, SEM and TEM.

UNIT 3 STAINING METHODS

9 HRS.

Structure and organization of bacterial cell, Gram positive and Gram-negative bacterial cell wall. Types of Staining - Simple, Differential (Gram's, AFB), Special - Capsular staining (negative), Spore. LPCB, KOH mount.

UNIT 4 STERILIZATION METHODS

9 HRS

Sterilization and Disinfection- principles -methods of sterilization- physical methods - Dry heat- Moist heat- Radiation. Filtration (Membrane and HEPA). Chemical sterilization- Chemical agents- mode of action- phenol coefficient test- sterility testing.

UNIT 5 MICROBIAL MEDIA

9 HRS.

Culture and media preparation - solid and liquid. Types of media- Semi synthetic, Synthetic, Enriched, Enrichment, Selective and Differential media. Pure culture techniques – Tube dilution, Pour, Spread, Streak plate. Anaerobic culture technique Wright's Tube, Roll tube method, Anaerobic Jar.

Max. 45 Hours

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 – Define the basic concepts of microbiology.

CO2 – Summarize the principle and working mechanism of simple and compound microscopes.

CO3 – Describe the various staining techniques used in microbiology

CO4 – Explain cellular organization of various microorganisms

CO5 – Classify various microorganisms on the basis of staining techniques.

CO6 – Discuss various culture media and plating techniques for growing the microorganisms



Employability



Entrepreneurship



Skill Development

SBBA1203	INTRODUCTION TO BIOCHEMISTRY	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

This course is aimed to give an understanding of the basics of biochemistry dealing with carbohydrates, Amino acids, Lipids, nucleic acid, and vitamins

UNIT1CARBOHYDRATES

9 Hrs.

Carbohydrate–Definition, Classification, biological significance, structure of glucose, digestion and absorption of carbohydrates.

UNIT2PROTEINS

9 Hrs.

Amino acids–structure, classification (Essential and non-essential, protein and non-protein amino acids). Proteins–definition, classification and structure (primary, secondary, tertiary and quaternary).

UNIT3LIPIDS

9 Hrs.

Lipids–definition, classification and biological significance. Structure, properties and functions of fatty acids.

UNIT4NUCLEICACIDS

9 Hrs.

Nucleic acids–Structure of DNA and its functions. Different forms of DNA. Different types of RNA and its functions.

UNIT5VITAMINS

9 Hrs.

Vitamins–Source, biological function, daily requirement and deficiency symptoms of fat-soluble vitamins (A, D, E and K) and water-soluble vitamins (Ascorbic acid, thiamine, riboflavin, pyridoxine, niacin, pantothenic acid, lipoic acid, biotin, folic acid and vitamin B12).

Max. 45 Hours

COURSE OUTCOMES

On completion of the course, the student will be able to

CO1 – Define the structure, properties, and roles of carbohydrates.

CO2 – Discuss the structure, chemical properties, and biological importance of amino acids.

CO3 – Describe the classification, structure, and biological importance of proteins.

CO4 – Classify the nature and roles of lipids in the biological system.

CO6 – Discuss the structure and forms of DNA with types of RNA.

SBBA1201	IMMUNOLOGY	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

To know the fundamentals of innate and acquired Immunity. To understand how immune system fights and combats the infection and diseases. To get an insight about the principle mechanism of Immunity.

UNIT 1 IMMUNITY

9 Hrs

History of Immunology – Host-parasite relationship – Immunity – Innate and acquired Immunity – Humoral and Cell-mediated Immunity.

UNIT 2 IMMUNE CELLS

9 Hrs

Structure, Functions and Properties of: Immune Cells – Stem cell, T cell, B cell, NK cell, Macrophage, Neutrophil, Eosinophil, Basophil, Mast cell, Dendritic cell; and Immune Organs – Bone Marrow, Thymus, Lymph Node, Spleen, GALT, MALT, CALT

UNIT 3 ANTIGENS

9 Hrs

Antigens – Types, properties – Immunoglobulins – Structure, types and Functions, Antigenic determinants on antibodies (Isotypic, allotypic, idiotypic); VDJ rearrangements; Complement – Classical and alternative pathways.

UNIT 4 ANTIBODY

9 Hrs

Monoclonal antibodies, Antigen – Antibody reactions: Agglutination – Precipitation – Complement fixation – Immunofluorescence – ELISA, RIA.

UNIT 5 AUTOIMMUNITY, HYPERSENSITIVITY AND TRANSPLANTATION

9 Hrs

Autoimmunity: Hypersensitivity reactions – Antibody mediated – Type I, Type II and Type III – cell mediated – Type IV; Transplantation immunology; Tumor immunology

Max. 45 Hours

COURSE OUTCOMES

On completion of the course, the student will be able to

CO1 – develop knowledge on *how human immune cells combat an infection*

CO2 – evaluate the role of different immune cells

CO3 – *analyze how human immune cells combat an infection.*

CO4 – apply the methods to detect an immune reaction.

CO5 – *have a strong understanding of the mechanism behind allergy and hypersensitivity*

CO6 – outline the concepts of immunity and its significance in fighting a disease



Employability



Entrepreneurship



Skill Development

SBBA1202	INTERMEDIARY METABOLISM	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

This course aims at understanding the essential metabolic functions of the organism as well as consumption and storage of energy intermediary metabolism of main biomolecules and its regulatory mechanisms.

UNIT 1 BASIC THERMODYNAMICS

9 Hrs.

Anabolism – catabolism, Enthalpy, Entropy, free energy, forward and reverse reaction equilibrium state

UNIT 2 CARBOHYDRATE METABOLISM

9 Hrs.

Glycolysis, TCA cycle and its energy production. Glycogen metabolism: Glycogenesis and Glycogenolysis, Alternative pathways: HMP pathway, gluconeogenesis

UNIT 3 LIPID METABOLISM

9 Hrs.

Fatty acid oxidation – α , β , ω oxidation. Biosynthesis of saturated and unsaturated fatty acids. Metabolism of cholesterol, triglycerides.

UNIT 4 PROTEIN METABOLISM

9 Hrs.

Ketogenic and Glucogenic amino acids metabolism. Deamination, Transamination and De novo, Urea cycle.

UNIT 5 NUCLEIC ACID METABOLISM & ENERGY PRODUCTION

9 Hrs.

Biosynthesis and degradation of purine and pyrimidine nucleotides. Mitochondrial Electron Transport Chain: Oxidative phosphorylation

Max. 45 Hours

COURSE OUTCOMES

On completion of the course, the student will be able to

CO1 – develop knowledge on basic thermodynamics.

CO2 – understand the carbohydrate metabolism and its regulatory mechanism

CO3 – understand the lipid metabolic process

CO4 – understand the protein metabolism

CO5 – have a strong understanding of the synthesis, metabolism of nucleic acids

CO6 – Outline the concepts of important biochemical pathways involving energy metabolism



Employability



Entrepreneurship



Skill Development

SBBA1302	INTRODUCTION TO MOLECULAR BIOLOGY & GENETICS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- This course provides you with further knowledge associated with molecular biology and inheritance at the molecular, cellular and phenotypic levels.

UNIT 1 INTRODUCTION

9 Hrs.

Introduction and History of Microbial Genetics. DNA as a Genetic material. Physical structure and Chemical composition of DNA – RNA and its types RNA as a Genetic material. DNA Replication – Types and Experimental proof of replication – Enzymes involved in DNA replication

UNIT 2 CENTRAL DOGMA

9 Hrs.

Prokaryotic Transcription, Translation. Genetic code – Regulation of gene expression in prokaryotes – lac Operon. Gene transfer mechanisms – Transformation, conjugation and Transduction. Plasmid – Characteristics and types.

UNIT 3 MENDELIAN GENETICS

9 Hrs.

Mendel's work on transmission of traits, Genetic Variation, Molecular basis of Genetic Information. Interrelation between the cell structure and the genetics function, Mitosis, Meiosis (explaining Mendel's ratios).

UNIT 4 INHERITANCE

9 Hrs.

Principles of Inheritance, Chromosome theory of inheritance, Laws of Probability, Pedigree analysis, Incomplete dominance and codominance, Multiple alleles, Lethal alleles, Epistasis, Pleiotropy, Environmental effects on phenotypic expression, sex-linked inheritance. Linkage and crossing over, Cytological basis of crossing over, Molecular mechanism of crossing over, Recombination frequency as a measure of linkage intensity, two factor and three factor crosses, Interference and coincidence, Somatic cell genetics – an alternative approach to gene mapping.

UNIT 5 MUTATION

9 Hrs.

Mutation – types of mutation – Molecular basis of mutation – Mutagenesis, Detection of mutants – Ames test, DNA repair mechanisms. Molecular basis of Mutations in relation to UV light and chemical mutagens, Detection of mutations: CLB method, Attached X method, DNA repair mechanisms.

Max. 45 Hours

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Study the detail of genetic material of our living system-DNA replication, transcription and translation and explain how they relate to each other.

CO2 - Understand the Basic of DNA replication in prokaryotes and eukaryotes.

CO3 - Study the details of gene organization and mechanisms of control the gene expression in various organisms.

CO4 - Understand the applications of molecular biology in the modern world.

CO5 - Through this course the students are exposed to importance of biological macromolecules

CO6 - Understanding the molecular aspects of the biology.

SBBA1301	GENETIC ENGINEERING	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- The course aims to give an understanding on the fundamentals of r-DNA technology and thereby a deep understanding about deliberate manipulation of genetic material for the benefit of mankind.
- It also aims to understand the possible dangers in doing the same without much of fore thoughts.

UNIT1 rDNATECHNOLOGY AND TOOLS INVOLVED IN GENETIC MANIPULATIONS

9 Hrs.

Introduction to rDNA technology- pros and cons of genetic engineering. Restriction modification system, Restriction enzymes- function, classification (Based on recognition and restriction sequence: -type I, II and III; based on buffer salt concentration: - low, medium and high; based on pattern of restriction: -sticky (5' and 3') and blunt end cutters). Other DNA modifying enzymes and its functions/uses in r-DNA technology (DNA Polymerases, Klenow fragment, Ligase, S1 Nuclease, Mung Bean nuclease, Alkaline Phosphatase, Terminal Transferase, Polynucleotide kinases, alkaline Phosphatases (CIP, SAP and TAP), RNase A, RNase H, DNase 1, Exonucleases, Reverse Transcriptase)

UNIT2 BIOLOGY OF CLONING VECTORS

9 Hrs.

Ideal features of vectors; Plasmids (Types, copy number, properties, origin of replication and incompatibility group, plasmid amplification), bacteriophages eg λ (Life cycle, genome organization, feasibility as a cloning vehicle), Types of Cloning Vectors (structure and general features of General Purpose cloning vectors, shuttle vectors), Examples of cloning vectors (pBR322, pUC series of vectors, λ insertional and replacement vectors), derivatives of phages and plasmids (cosmids, phagemids, phasmids) cloning vectors for large DNA fragments using YACs, PACs and BACs.

Unit-3 INTRODUCTION TO r-DNATECHNOLOGY

9 Hrs.

General strategies for isolation of genomic and plasmid DNA; Strategies for isolation of gene of interest (restriction digestion, PCR), Creation of r-DNA (Restriction Digestion, modification of vector and insert, linker, adaptors, homopolymer tailing, ligation), PCR Cloning, Selectable and screenable markers, reporter genes.

UNIT4 GENE TRANSFER TECHNIQUES

9 HRS.

Selection of host and vector, Host Organisms and its genotypes- Prokaryotic and eukaryotic systems, Methods of gene transfer- Physical (micro injection, gene gun/biolistic, electroporation), Chemical (Calcium chloride, Calcium phosphate precipitation method, liposome mediated) and Biological methods (*Agrobacterium* and viral).

UNIT5 IDENTIFICATION OF GENETIC TRANSFORMANTS AND THEIR APPLICATIONS

9 Hrs.

Methods for clone identification-direct screening (insertional inactivation of marker gene, visual screening methods), indirect screening (PCR and hybridization- based techniques-colony PCR/ hybridization and dot blot hybridization), hybridization techniques - Southern blotting, Northern blotting, Western blotting. Examples of Transgenic plants and animals, current status of commercial r-dna products, Bio-safety measures and regulations for rDNA work

Max.45 Hours

Course outcomes

- On completion of the course, student will be able to
- CO1- introduce the concept of tools used in genetics
 - CO2 -understand the structural organization of vectors; plasmids
 - CO3- explore the rearrangements and anomalies in genetic material
 - CO4 -describe the mutations and repair
 - CO5 -study the genetic gene transfer techniques
 - CO6 –understand the genetic transformation techniques

SBBA1303	CONCEPTS IN BIOTECHNOLOGY	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

This course aims at making the students understand the basics of biotechnology and its various fields

UNIT 1 BIOTECHNOLOGY:AN OVERVIEW

9 Hrs.

What is Biotechnology? – an interdisciplinary pursuit, old Vs new biotechnology, scope and importance, commercial potential, public perception of Biotechnology, Biotechnology in India and Global. Branches of biotechnology.

UNIT 2 ANIMAL & PLANT BIOTECHNOLOGY

9 Hrs.

Biotechnology methods of crop improvement- plant tissue culture. Transgenic plants, applications of transgenic plants, transgenesis, transgenic animals,

UNIT 3 INDUSTRIAL BIOTECHNOLOGY

9 Hrs.

Isolation and screening of micro-organisms, Bioreactors, food and beverage fermentation, production of antibiotics (β -lactum antibiotic), vitamin B12, Enzyme- amylase, protease, Biotransformation, SCP and its economical implications.

UNIT 4 MEDICAL BIOTECHNOLOGY

9 Hrs.

Conventional vaccines, recombinant vaccines, DNA vaccines, monoclonal antibodies and their applications, interferons, drug designing, genetherapy, forensic medicine applications in human genetic research.

UNIT 5 ENVIRONMENTAL BIOTECHNOLOGY AND BIOETHICS

9 Hrs.

Novel and better bioinsecticides. Biofertilizers, Biodegradation of Xenobiotic compounds. Legal aspects genetically manipulated organisms and environment, biosafety, Social, moral and Ethical Considerations, IPR.

COURSE OBJECTIVES

Max. 45 Hours

On completion of the course, the students will be able to

CO1 - Explain the current scenario about biotechnology

CO2 - Describes the biotechnological methods in crop development and transgenic animal production

CO3 - Highlighting the application of industrial biotechnology

CO4 - Demonstrate the healthcare application of biotechnology

CO5 - Implementation of biotechnology in the protection of environment

CO6 - Discuss the ethical issues of biotechnology



Employability



Entrepreneurship



Skill Development

SBBA1304	ANALYTICAL TECHNIQUES	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

This course aims at understanding the principle and application of various instruments used in Biotechnology industries.

UNIT1 MICROSCOPY

9 Hrs.

Bright field and dark field microscopy, Fluorescence Microscopy, Phase contrast Microscopy, Confocal Microscopy, Electron Microscopy (Scanning and Transmission Electron Microscopy) and Micrometry.

UNIT 2 LAB EQUIPMENT

9 Hrs.

Autoclave , Hot air oven , Incubator , Water Bath , Laminar air flow, BOD incubator, Centrifuges – Bench top , High speed , Ultra centrifuge, density gradient centrifugation . pH meter , Conductivity meter, Lyophilizer , McIntosh anaerobic jar , Biosensor, Metabolic shaker.

UNIT 3 CHROMATOGRAPHY AND ELECTROPHORESIS

9 Hrs.

Principles and applications of Chromatography – Paper, Thin layer, Column, Ion-exchange, Gas and HPLC – Principle and applications of native polyacrylamide gel electrophoresis, SDS- polyacrylamide gelelectrophoresis, 2D gel electrophoresis, Isoelectric focusing, Zymogram preparation and Agarose gelelectrophoresis..

UNIT –IV PHOTOMETRY

9 Hrs.

Colorimetry, Turbidometry, Spectrometry – UV & Visible spectrophotometer. Flame photometry- Micronutrient analysis.

UNIT BIOCHEMISTRY ANALYSIS

9 Hrs.

Biochemical calculations-preparations of Molar solutions - Buffers- Phosphate, Acetate, TE, TAE- calculation of Normality, PPM- Ammonium sulphate precipitation.

Max. 45 Hours

COURSE OUTCOMES

On completion of the course, the student will be able to

- CO1 – Explain in detail about microscopic techniques
- CO2 – Discuss the different analytical instruments used in laboratories
- CO3 – Understand various chromatographic methods
- CO4 – Describe Photometric techniques
- CO5 – Understand various analytic methods in biochemistry
- CO6 – Demonstrate the biochemical calculation used to prepare buffers

SBBA1401	ENVIRONMENTAL AND AGRICULTURAL BIOTECHNOLOGY	L	T	P	Credits	TotalMarks
		3	0	0	3	100

COURSE OBJECTIVE

The primary objective is to exploit biotechnology principles for the sustained environment and agriculture

UNIT1 ENVIRONMENT AND WASTE TREATMENT PROCESS

9 Hrs.

Basic concepts of Environment and ecosystem- Effluents and sewage- Sewage treatment processes- Physical, chemical and biological. Biological processes for domestic and industrial waste water treatments: Aerobic system –activated sludge processes-Trickling filters– biological filters-fluidized bed reactors (FBR)

UNIT2 WASTE MANAGEMENT

9 Hrs.

Anaerobic biological treatment – contact digestion – packed column reactors - Methanogenesis. Methanogenic, acetogenic, and fermentative bacteria – technical process conditions, Solid waste management-Landfills, composting, earthworm treatment, recycling and processing of organic residues. Hazardous wastes: source management and safety.

UNIT3 BIODEGRADATION OF PESTICIDES

9 Hrs.

Biodegradation of xenobiotic compounds, organisms involved in degradation of chlorinated hydrocarbons, substituted simple aromatic compounds, polyaromatic hydrocarbons, pesticides, surfactants and microbial treatment of oil pollution.

UNIT4 MICROBIAL LEACHING AND BIOREMEDIATION

9 Hrs.

Microbial leaching and mining: Extraction of metals from ores; recovery of metals from solutions. Microbial petroleum extraction; Microbial desulfurization of coal wasteland; Uses and management; bioremediation and bio restoration of contaminated lands. -Phytoremediation– bioventing–and biosparging – liquid phase.

UNIT5 BIOFERTILIZERS AND SUSTAINABLE ORGANIC AGRICULTURE

9 Hrs.

Bioinoculant Technology - Bioinoculants- various types- biofertilizer, bio-manures and biopesticides-their importance in sustainable agriculture - organic farming and environmental health Historical development of Bioinoculants technology-Biofertilizers-Bacteria, fungi and algal biofertilizers.

Max. 45 Hours

COURSE OUTCOMES

On completion of the course, the student will be able to

CO1-Understanding the importance of various waste water treatment process

CO2-Bioprocess of domestic and industrial effluent and its environmental impact towards ecosystem

CO3- Understand the use of microbial species to clean up soil and contaminated groundwater

CO4-Understanding how pesticides are turned into useful products through various bioprocess methods

CO5-How to restore or bring back the contaminated lands to its near original state through diverse microorganisms

CO-6 Understanding how biofertilizers improve the soil nutrients in promoting the plant growth

SBBA1402	BASIC INDUSTRIAL BIOTECHNOLOGY	L	T	P	Credits	TotalMarks
		3	0	0	3	100

COURSE OBJECTIVE

- The importance of microorganism in industries and product its application

UNIT1 INTRODUCTION TO INDUSTRIAL BIOPROCESS

9 Hrs.

Fermentation- Bacterial, Fungal and Yeast, Biochemistry of fermentation. Traditional and Modern Biotechnology- Abrief survey of organisms, processes, products. Basic concepts of Upstream and Downstream processing in Bioprocess, Process flow sheeting-block diagrams, pictorial representation.

UNIT2 PRODUCTION OF METABOLITES

9 Hrs.

Primary Metabolites- Production of commercially important primary metabolites like organic acids, amino acids and alcohols. Secondary Metabolites- Production processes for various classes of secondary metabolites: Antibiotics, Vitamins and Steroids.

UNIT3 DEGRADATION OF POLLUTANTS

9 Hrs.

Microbes role in degradation of pollutants, genetically modified microorganism-super bugs, advantage of biodegradation than the conventional method.

UNIT4 PRODUCTION OF ENZYMES AND OTHER BIOPRODUCTS

9 Hrs.

Production of Industrial Enzymes, Biopesticides, Biofertilizers, Biopreservatives, Biopolymers Biodiesel. Cheese, Beer,SCP&Mushroomculture.

UNIT5 PRODUCTION MODERN BIOTECHNOLOGY PRODUCTS

12Hrs.

Production of recombinant proteins having therapeutic and diagnostic applications, vaccines. Bioprocess strategies in Plant Cell and Animal Cell culture.

Max.45 Hours

COURSE OUTCOMES

On completion of the course, the student will be able to

- CO1-How microorganism, enzymes and natural sources are used to produce cost effective energy and consumer needs especially life-saving medicines.
- CO2-Importance of primary and secondary metabolites that are directly or not directly involved in normal growth of the organism
- CO3-How microbial organism transform the substance through various processes
- CO4-The industrial importance of biopreservatives, biopolymers, biodiesel and biopesticides.
- CO5- Fundamental understanding of protein cloning and over expression in ecoli.
- CO6- Exposure to various bioprocess methods and laboratory techniques



Employability



Entrepreneurship



Skill Development

SBBA1403	FOOD BIOTECHNOLOGY	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

UNIT1 MICROORGANISMS IN FOOD

9 Hrs.

Bacteria, fungi & yeast, role and significance. Enzymes in food preparation. Food carcinogens & mutagen (N-Nitrosamines, Acrylamide & their mode of action).

UNIT2 NUTRITIONAL BOOSTS AND FLAVOR ENHANCERS

9 Hrs.

Antioxidants. Food colors (natural & artificial food colourants). Food flavoring agents. Properties & function of Emulsifiers & Stabilizers in food. Food Sweeteners-Saccharine, Acesulfame, Aspartame & Sucralose).

UNIT3 FOOD BORNE DISEASES AND CONTROL

9 Hrs.

Food borne diseases. Food Allergens. Microbiological Examination of surfaces, Air Sampling, Metabolically Injured Organisms, Enumeration and Detection of Food-borne Organisms. Bioassay and related Methods.

UNIT4 FERMENTATION

9 Hrs.

Fermented food: pickles, yogurt, cheese, Beverages: Beer, wine and distilled spirits.

UNIT5 FOOD PRESERVATION

9 Hrs.

Food Preservation. Principles Underlying the Destruction of Microorganisms by Irradiation, Radiation, Radappertization, Radicidation, and Radurization of Foods. Stability Food Preservation with Low Temperatures, Food Preservation with High Temperatures, Preservation of Foods by Drying.

Max. 45 Hours

COURSE OUTCOMES

On completion of the course, the student will be able to

CO1- Learning cultures to make food from yeast to cheese and probiotics

CO2- Understanding fermentation engineering and fermentations to make food ingredients

CO3- Basic analytical techniques for identifying microorganisms in food

CO4- Fermentations to make enzymes for the food industry

CO5- From the sink to the river, from biowaste to mushrooms and methane

CO6-Advanced research techniques on identifying artificial food colorants, food safety and sampling methods

SBBA1404	ENZYME TECHNOLOGY	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

The primary objective is to provide the theory and knowledge relevant to the enzymology principles including fundamental properties of enzymes, enzyme catalytic mechanisms and enzyme kinetics.

UNIT1 INTRODUCTION TO ENZYMES

9 Hrs.

Nature and function of enzymes, Enzyme nomenclature, classification of enzymes, mechanisms of catalysis -Acid base catalysis, electrostatic catalysis, covalent catalysis and enzyme catalysis. Role of co-enzymes and co-factors.

UNIT2 ENZYME KINETICS

9 Hrs..

Michaelis - Menton kinetics, determination of K_m , Lineweaver Burke plot, Eadie - Hofstee plot, Hanes-Woolf plot. Turnover number, Enzyme inhibition -Types of enzyme inhibition, competitive inhibition, uncompetitive inhibition, non-competitive inhibition, Irreversible inhibition and inactivation kinetics. Multisubstrate enzyme catalysed reaction.

UNIT3 ENZYME IMMOBILIZATION

9 Hrs.

Classification of enzyme immobilization, physical and chemical techniques for enzyme immobilization -adsorption, matrix entrapment, encapsulation, cross-linking, covalent bonding, advantages and disadvantages, Application of immobilized enzymes, mass transfer effect on immobilization, properties of immobilized enzymes.

UNIT4 ENZYME SPECIFICITY AND EXTRACTION

9 Hrs.

Types of specificity, Active site- Fischer hypothesis and Koshland hypothesis, Extraction of soluble enzymes, membrane bound enzymes, purification procedures, criteria of purity.

UNIT5 CLINICAL AND INDUSTRIAL APPLICATIONS OF ENZYMES

9 Hrs.

Application of enzymes in medicine and industry – Assay of plasma enzyme, enzyme biosensors, design of enzyme electrodes, Synzymes, Abzymes, Enzymes in genetic engineering.

Max. 45 Hours

COURSE OUTCOMES

On completion of the course, the student will be able to

- CO1- understanding the diverse range of reactions to predict the metabolism of living organisms
- CO2- learning enzyme immobilization through various chemical and physical laboratory techniques
- CO3- separation, extraction and purification of soluble membrane bound enzymes
- CO4- industrial applications of enzyme, especially pharmaceuticals
- CO5- expose to various enzyme kinetics methods, its reaction rate and inhibition.
- CO6- basic understanding of nomenclature, mechanism and classification of various enzymes

SBBA4001	BIOETHICS, BIOSAFETY AND IPR	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

To understand importance of bioethics and biosafety and to understand legal social and economic impacts of biotechnology.

To understand regulatory guidelines and their importance. To understand importance of patent and to understand procedure to apply for patent.

To understand procedure of assessment of biosafety for biotech foods and to understand ethical implications of biotechnology.

UNIT 1 ETHICS AND BIOETHICS

9 Hrs.

Definition of ethics and Bioethics, Ethics in Biotechnology (positive and negative effects with classical examples - Rice with Vitamin A, No-till Agriculture, cotton without insecticide, reduced need for fertilizer, biological pest control, slow ripening fruits and controlled ripening, fast growing trees and fishes.

UNIT 2 GENETICALLY ENGINEERED ORGANISMS

9 Hrs.

Awareness education on genetically engineered organism - Transgene instability, gene flow, resistance/ tolerance of target organism, increase weedlessness, risks and uncertainty associated with Biotechnology. Containment levels and their impact on Environment- Containment- definition, types of containment, summary of recommended Biosafety levels for infectious agents, detail checklist-premises and lab equipment, Animal facilities, environment.

UNIT 3 GOOD LABORATORY PRACTICES, INTELLECTUAL PROPERTIES AND PATENTS

9 Hrs.

Gene technology laboratory. GLP and Bioethics- introduction, national Good Laboratory Practices (GLP), the GLP authority functions, Good Laboratory Practices- necessity, aspiration and responsibility. Procedure to apply patent, other intellectual properties viz copy rights, Rights, Plant breeder's rights, trade secrets/ trade symbol etc. WTO, TRIPS, PCT and GATT. IPR problems and its hindrance.

UNIT 4 GOOD CLINICAL PRACTICES

9 Hrs.

Ethics in clinical trials and Good Clinical Practices (GCP) - Definition of clinical trials and GCP, general information about clinical trials, need to conduct clinical trials, faces of clinical trials, institutional set ups for conducting clinical trials, ethics in clinical Biotechnology

Max. 45 Hours

Course Outcomes:

On completion of the course, student will be able to

CO1 – Describe various ethical issues

CO2 – Understand the role of ethics in genetic laboratory

CO3 – Recognize different levels of biosafety measures

CO4 – Explain the good laboratory practices to follow in a genetic laboratory

CO5 – Demonstrate various good clinical practices and its role in clinical trials

CO6 – Explore various levels of biosafety measures to follow in a laboratory



Employability



Entrepreneurship



Skill Development

SHSA1104	GENERAL ENGLISH – I	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES:

To develop, in learners, the four basic skills of listening, reading, speaking, and writing, through an integrated approach. To improve the comprehension and expression of oral and written ideas in English.

Unit 1 DRESS IN COMMUNICATION**9 Hrs.**

Speaking - Rhetorical analysis and Group Discussion. Reading for details and Global Comprehension - Dress in communication, I have a Dream Speech by Martin Luther King and The Justice Peace by Hilaire Belloc. Critical Thinking: Asking Questions, Analyzing Assumptions and Biases. Vocabulary: Expressions and markers. Collocations – Identifying collocations by reading prose passages mentioned in the unit one. Language Focus: Determiners, Parts of Speech Writing: Paragraph writing based on hints given on topics like 'My dream for my family/ country', 'importance of clothing for communication, 'social inequality in society', 'Judge the Book by its Cover- Can we judge people by their appearance?

Unit 2 AN INCONVENIENT TRUTH**9 Hrs.**

Speaking: Debate on the topics related to Environmental issues and Discrimination in Society . Reading for details and Global Comprehension on An Inconvenient Truth, A Different History by Kamala Das and Sujata Bhatt. Critical Thinking: Identifying Facts and Opinions, Distinguish a main idea in text from a subordinate idea. Examine views on a controversial issue and consider one's own biases and personal interest. 'Vocabulary: Collocations, Useful words to express point of view. Language focus- Tenses, Conjunctions and discourse markers Writing- Responding to Slogans, Campaign Leaflet and Writing Film Review , Letter writing

UNIT 3 A SPEECH BY N R NARAYANA MURTHY**9 Hrs.**

Speaking: Giving Impromptu speeches- Welcome address and Vote of Thanks. Reading for details and Global Comprehension- A Speech by NR Narayana Murthy and Digging by Seamus Heaney Critical Thinking: Asking ' wh ' questions Questions, Making informed decisions based on evidence, Examining Evidence by citing evidence from the textbook or lecture to support a position. Vocabulary - Word association, onomatopoeic words. Language focus: Sentence Function and Sentence Kinds Writing: Writing email , Writing Diary Entry

Unit 4 AFTER TWENTY YEARS**9 Hrs.**

Listening: For details and Overall Idea, Speaking: Informal Speech, Reading for details and Global Comprehension- After Twenty Years by Jamila and After Twenty Years by O Henry Writing: Problem solving paragraph writing. Letter to the editor with solutions to current problems related to areas covered in the course Critical Thinking: Problem Solving selecting effective solutions for overcoming obstacles or constraints by explaining why it is the most effective of the possible solutions. Vocabulary : Phrasal Verbs Language Focus Types of sentences -simple, compound and complex. Language Focus: Subject verb Agreement

Unit 5 I LOVE YOU MOM**9 Hrs.**

Listening for details Speaking- Greeting , thanking , apologising, offering condolences by doing Role plays Reading for details and Global Comprehension- I Love you Mom by Joanna Fuchs and Prose passage on ' I Love You Mom'. Writing: Writing restaurant review, argumentative writing. Vocabulary: Phrasal Verbs , Synonyms and Antonyms Critical Thinking : Argumentation provides a well-articulated and detailed argument

Max. 45 hours**TEXT BOOKS:**

P Bhaskaran Nair, C Radha Krishna Pillai, Geetha Rajeevan, CLN Prakash, Nadhini Nayar Reflections - An Anthology of Prose, Poetry and Fiction (2015) Foundation Books, Chennai . Foundation Books. ISBN 978-93- 85386-008

References:

Sen S, Mahendra et al. (2015) Communication and Language Skills . Foundation books. Chennai

SHS1210	GENERAL ENGLISH – II	L	T	P	Credits	Total Marks
		3	0	0	3	100

OBJECTIVES OF THE COURSE:

The paper provides opportunities for students to read and respond to representations of current issues through texts that present themes and topics that are familiar, insightful and informative. The thrust is on preparing students to effectively communicate by applying reflective thinking practices. Students will have an opportunity to improve their vocabulary related to immediate environment, practice speaking skills by discussing about issues based on reading texts, read texts that include everyday problems that provide opportunities to develop problem solving skills in cooperative learning situations, develop writing skills by summarising substance of a poems, letters and composition of dialogues and paragraphs.

UNIT 1 UNITY OF MINDS - A P J ABDUL KALAM

9Hrs.

Listening for details, Speaking - making a presentation, Reading for details and Global Comprehension Unity of Minds by APJ Abdul Kalam -Vocabulary Binomials Writing: Writing compare contrast paragraphs by representing data given in pie chart, Tables; Writing Speeches. Vocabulary : Binomials, Affixes Language Focus : Active and Passive Voice, Punctuation. Critical Thinking : Comparing & Contrasting presenting information by including important characteristics on which the items should be compared or contrasted

UNIT 2 LEAVE THIS CHANTING AND SINGING AND TELLING OF BEADS BY RABINDRANATH TAGORE AND ENGINE TROUBLE BY R K NARAYANAN

9 Hrs.

Listening for details Speaking: Giving impromptu speech based on topics given in the class for clarifying one's point of view. Reading for Comprehension and for overall idea -Leave this Chanting and Singing and Telling of Beads by Rabindranath Tagore and Engine Trouble by R K Narayanan, Vocabulary : Archaic words, phrases Writing: Language Focus Imperatives. Writing: Writing Instructions and recommendations based on quotations given as prompts, writing an advertisement Critical Thinking: Expressing point of view

UNIT 3 THE HAPPY PRINCE BY OSCAR WILDE

9 Hrs.

Speaking Telephonic conversation, Drama In the class based on the story prescribed Reading for details and Global Comprehension The Happy Prince by Oscar Wilde Language Focus: Adjective- degrees of Comparison, Functional and personal Nouns Vocabulary : positive and negative connotations. Writing: Letter writing- personal letters Critical Thinking Self-regulation: Continuing improvement in thinking, involving monitoring one's cognitive process and correcting errors and biases as needed.

UNIT 4 TWO GENTLEMEN OF VERONA BY A J CRONIN

9 Hrs.

Listening for Overall information of 'Anthem for Doomed Youth' by Wilfred Owen Speaking: Making requests and suggestions. Reading for details Two Gentlemen of Verona by A J Cronin, Vocabulary: Simile, metaphor, adjectives to describe people and their personalities. Idioms. Writing: Writing recommendations; Narratives based on prompts on plot and characters. Critical Thinking: identifying the subject of the investigation and presenting a well-articulated solution to the confusions or contradictions associated with the situation based on listening speaking tasks in the class. Creative writing - stories and poems Language Focus: Reported Speech

UNIT 5 THE AVENGER BY ANTON CHEKHOV

9 Hrs.

Listening for specific details Speaking using imagination. Reading to identify factual and inferential information Writing: Imaginative writing by predicting. Vocabulary : Countable forms and meaning, foreign nouns and framing of plurals. Language focus: Modal verbs, use of would. Critical Thinking: Deductive reasoning- generating a valid prediction or conclusion by articulating the relationship between the prediction or conclusion

Max. 45 hours

TEXT / REFERENCE BOOKS:

1. P Bhaskaran Nair, C Radha Krishna Pillai, Geetha Rajeevan, CLN Prakash, Nadhini Nayar Reflections - An Anthology of Prose, Poetry and Fiction (2015) Foundation Books, Chennai. Foundation Books. ISBN 978-93- 85386-008
2. Sen S, Mahendra etal. (2015) Communication and Language Skills. Foundation books. Chennai
3. <https://designteachengage.wisc.edu/course-activities-learner-interaction/sdc-activity-types-active-learning/>
4. <https://www.uen.org/rubric/previewRubric.html?id=1219>
5. <https://www.diigo.com/profile/Teachonlineuw?query=%22Critical+Thinking%22+rubric>



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B.Sc. - Microbiology

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Employability



Entrepreneurship



Skill Development

SMBA1101	GENERAL MICROBIOLOGY	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

This course is aimed give an understanding about the basics of microbiology dealing types of microbes, classification & characterization

UNIT 1 HISTORY AND CLASSIFICATION

9 Hrs.

History and scope of Microbiology, Spontaneous generation - Biogenesis theory - Contribution of Leeuwenhoek, Louis Pasteur, Robert Koch, Edward Jenner, Paul Ehrlich and Sir Alexander Flemming. Germ theory of disease. Binomial Nomenclature, Whittaker's five kingdom and Carl Woese's three kingdom classification systems and their utility. Difference between prokaryotic and eukaryotic microorganisms

UNIT- 2 MICROSCOPY AND STAINING

9 Hrs.

Microscope- Principles, working mechanism and application - Simple and compound microscope -Dark field -Phasecontrast, Fluorescence, SEM and TEM. Structure and organization of bacterial cell, Gram positive and Gram negative bacterial cell wall. Types of Staining - Simple, Differential (Gram's, AFB), Special - Capsular staining (negative), Spore. LPCB, KOH mount

UNIT- 3 SUBCELLULAR STRUCTURES

9 Hrs

Microbial cell : Ultrastructure of bacteria, subcellular structures and cell envelope – slime, capsule, cell wall, pili, flagella, cell inclusions, biosynthesis of bacterial cell wall, cell membrane – Bio-membrane, liposomes – membrane transport – diffusion, active and passive transport and osmoregulation.

UNIT-4 STERILIZATION

12 Hrs.

Sterilization and Disinfection- principles -methods of sterilization- physical methods - Dry heat- Moistheat- Radiation.Filtration (Membrane and HEPA). Chemical sterilization- Chemical agents- mode of action- phenol coefficient test- sterility testing.

UNIT- 5 MEDIA AND TECHNIQUES

12 Hrs.

Culture and media preparation - solid and liquid. Types of media- Semi synthetic, Synthetic, Enriched, Enrichment, Selective and Differential media. Pure culture techniques – Tube dilution, Pour, Spread, Streak plate. Anaerobic culture technique Wright's Tube, Roll tube method, Anaerobic Jar.

Max.

45 Hours

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 – Define the basic concepts of microbiology.
- CO2 – Summarize the principle and working mechanism of simple and compound microscopes.
- CO3 – Describe the various staining techniques used in microbiology
- CO4 – Explain cellular organization of various microorganisms
- CO5 – Discuss various sterilization methods.
- CO6 – Discuss various culture media and plating techniques for growing the microorganisms

SMBA1102	BASIC BIOCHEMISTRY	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

This course is aimed give an understanding about the basics of biochemistry dealing carbohydrates, Amino acids, Lipids, nucleic acid and vitamins

UNIT 1 CARBOHYDRATES

9 Hrs.

Carbohydrate – Definition, Classification, biological significance, structure of glucose, digestion and absorption of carbohydrates.

UNIT 2 PROTEIN

9 Hrs.

Amino acids–structure,classification (Essential and non-essential, protein and non-protein amino acids). Proteins– definition, classification and structure (primary, secondary, tertiary and quaternary).

UNIT 3 LIPIDS

9 Hrs.

Lipids–definition,classificationandbiologicalsignificance. Structure, propertiesandfunctions offatty acids.

UNIT 4 NUCLEIC ACIDS

9 Hrs.

Nucleicacids–Structure of DNA and its functions. Different forms of DNA. Different types of RNAandits functions.

UNIT 5 VITAMINS

9 Hrs.

Vitamins–Source,biological function,daily requirement and deficiency symptoms offat soluble vitamins (A,D,E and K) and water soluble vitamins (Ascorbic acid, thiamine, riboflavin, pyridoxine, niacin, pantothenic acid, lipoic acid, biotin, folic acid and vitamin B12).

Max. 45 Hours

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 – Define the structure, properties and roles of carbohydrates.

CO2 – Discuss the structure, chemical properties and biological importance of amino acids.

CO3 – Describe the classification, structure and biological importance of proteins.

CO4 – Classify the nature and roles of lipids in biological system.

CO5 – Describe the structure and fundamentals of nucleic acids with respect to its biological significance.

CO6 – Discuss the structure and forms of DNA with types of RNA.

CO7 - Explain the source and biological functions of vitamins.

CO8 - Distinguish the water soluble vitamins with fat soluble vitamins.

SMBA1201	BASIC CELL BIOLOGY	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

Cell biology is the study of the structure and function of prokaryotic and eukaryotic cells. In this course the students will learn different areas of cellular biology including the structure and functions of cell, its organelles, synthesis and function of macromolecules such as carbohydrate, protein, lipid, DNA & RNA; membrane structure and function; bioenergetics; cellular communication; and microscopic techniques to understand the cell structure.

UNIT 1 FUNDAMENTALS OF CELL STRUCTURE

9 Hrs.

Discovery of cells; Basic properties of cells; Different classes of cells – Prokaryotic and eukaryotic cells. Cell division: Cell cycle; mitosis; meiosis, binary fission.

UNIT 2 CELLULAR MEMBRANES AND MATRICES

9 Hrs.

Chemical composition and fluidity of membranes; dynamic nature of membranes; transportation across cell membrane; membrane potentials; extracellular matrices – structure and function; cytoskeleton – structure and function.

UNIT 3 CELLULAR ORGANELLES IN ENERGY METABOLISM

9 Hrs.

Mitochondria – structure and function; Chloroplast – structure and function. Structure of nucleus – nuclear membrane, nucleolus, chromatin, structure of nucleic acids

UNIT 4 CELLULAR ORGANELLES IN METABOLISM

9 Hrs.

Endoplasmic reticulum – smooth & rough; function of endoplasmic reticulum; Golgi complex – structure and function; Ribosomes – Types, structure and function; Morphology and functions of peroxisomes and glyoxisomes; Plant cell vacuoles..

UNIT 5 TRANSPORT ACROSS CELL MEMBRANE

9 Hrs.

Passive and active transports, Permeases, Sodium -potassium pumps, Ca²⁺ ATPase pump, ATP dependant proton pumps, co-transport, symport, antiport, Endocytosis and Exocytosis. Introduction to intra and extra cellular products of medicinal use.

Max. 45 Hours

COURSE OUTCOMES:

- CO1: Learn the structure and functions of cells
- CO2: Understand the cell cycle process
- CO3: Familiarize the cellular components in detail
- CO4: Understand the role of cellular components in metabolism
- CO5: Understand the various processes involved in animal and plant developments
- CO6- Demonstrate the importance of cell membrane in transport process.

SBBA1201	IMMUNOLOGY	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

To know the fundamentals of innate and acquired Immunity. To understand how immune system fights and combats the infection and diseases. To get an insight about the principle mechanism of Immunity.

UNIT 1 IMMUNITY

9 Hrs

History of Immunology – Host-parasite relationship – Immunity – Innate and acquired Immunity – Humoral and Cell-mediated Immunity.

UNIT 2 IMMUNE CELLS

9 Hrs

Structure, Functions and Properties of: Immune Cells – Stem cell, T cell, B cell, NK cell, Macrophage, Neutrophil, Eosinophil, Basophil, Mast cell, Dendritic cell; and Immune Organs – Bone Marrow, Thymus, Lymph Node, Spleen, GALT, MALT, CALT

UNIT 3 ANTIGENS

9 Hrs

Antigens – Types, properties – Immunoglobulins – Structure, types and Functions, Antigenic determinants on antibodies (Isotypic, allotypic, idiotypic); VDJ rearrangements; Complement – Classical and alternative pathways.

UNIT 4 ANTIBODY

9 Hrs

Monoclonal antibodies, Antigen – Antibody reactions: Agglutination – Precipitation – Complement fixation – Immunofluorescence – ELISA, RIA.

UNIT 5 AUTOIMMUNITY, HYPERSENSITIVITY AND TRANSPLANTATION

9 Hrs

Autoimmunity: Hypersensitivity reactions – Antibody mediated – Type I, Type II and Type III – cell mediated – Type IV; Transplantation immunology; Tumor immunology

Max. 45 Hours

COURSE OUTCOMES

On completion of the course, the student will be able to

CO1 – develop knowledge on *how human immune cells combat an infection*

CO2 – evaluate the role of different immune cells

CO3 – *analyze how human immune cells combat an infection.*

CO4 – apply the methods to detect an immune reaction.

CO5 – *have a strong understanding of the mechanism behind allergy and hypersensitivity*

CO6 – outline the concepts of immunity and its significance in fighting a disease



Employability



Entrepreneurship



Skill Development

SBBA1202	INTERMEDIARY METABOLISM	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

This course aims at understanding the essential metabolic functions of the organism as well as consumption and storage of energy intermediary metabolism of main biomolecules and its regulatory mechanisms.

UNIT 1 BASIC THERMODYNAMICS

9 Hrs.

Anabolism – catabolism, Enthalpy, entropy, free energy, forward and reverse reaction equilibrium state

UNIT 2 CARBOHYDRATE METABOLISM

9 Hrs.

Glycolysis, TCA cycle and its energy production. Glycogen metabolism: Glycogenesis and Glycogenolysis, Alternative pathways: HMP pathway, gluconeogenesis

UNIT 3 LIPID METABOLISM

9 Hrs.

Fatty acid oxidation – α , β , ω oxidation. Biosynthesis of saturated and unsaturated fatty acids. Metabolism of cholesterol, triglycerides.

UNIT 4 PROTEIN METABOLISM

9 Hrs.

Ketogenic and Glucogenic amino acids metabolism. Deamination, Transamination and Decarboxylation, Urea cycle.

UNIT 5 NUCLEIC ACID METABOLISM & ENERGY PRODUCTION

9 Hrs.

Biosynthesis and degradation of purine and pyrimidine nucleotides. Mitochondrial Electron Transport Chain: Oxidative phosphorylation
Max. 45 Hours

COURSE OUTCOMES

On completion of the course, the student will be able to

CO1 – develop knowledge on basic thermodynamics.

CO2 – understand the carbohydrate metabolism and its regulatory mechanism

CO3 – understand the lipid metabolic process

CO4 – understand the protein metabolism

CO5 – have a strong understanding of the synthesis, metabolism of nucleic acids

CO6 – Outline the concepts of important biochemical pathways involving energy metabolism



Employability



Entrepreneurship



Skill Development

SBBA1302	INTRODUCTION TO MOLECULAR BIOLOGY & GENETICS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

This course provides you with further knowledge associated with molecular biology and inheritance at the molecular, cellular and phenotypic levels.

UNIT 1 INTRODUCTION

9 Hrs.

Introduction and History of Microbial Genetics. DNA as a Genetic material. Physical structure and Chemical composition of DNA– RNA and its types RNA as a Genetic material. DNA Replication – Types and Experimental proof of replication – Enzymes involved in DNA replication

UNIT 2 CENTRAL DOGMA

9 Hrs.

Prokaryotic Transcription, Translation. Genetic code – Regulation of gene expression in prokaryotes – lac Operon. Gene transfer mechanisms – Transformation, conjugation and Transduction. Plasmid – Characteristics and types.

UNIT 3 MENDELIAN GENETICS

9 Hrs.

Mendel's work on transmission of traits, Genetic Variation, Molecular basis of Genetic Information. Interrelation between the cell structure and the genetics function, Mitosis, Meiosis (explaining Mendel's ratios).

UNIT 4 INHERITANCE

9 Hrs.

Principles of Inheritance, Chromosome theory of inheritance, Laws of Probability, Pedigree analysis, Incomplete dominance and codominance, Multiple alleles, Lethal alleles, Epistasis, Pleiotropy, Environmental effects on phenotypic expression, sex-linked inheritance. Linkage and crossing over, Cytological basis of crossing over, Molecular mechanism of crossing over, Recombination frequency as a measure of linkage intensity, two factor and three factor crosses, Interference and coincidence, Somatic cell genetics – an alternative approach to gene mapping.

UNIT 5 MUTATION

9 Hrs.

Mutation – types of mutation – Molecular basis of mutation – Mutagenesis, Detection of mutants – Ames test, DNA repair mechanisms. Molecular basis of Mutations in relation to UV light and chemical mutagens, Detection of mutations: CLB method, Attached X method, DNA repair mechanisms.

Max. 45 Hours

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Study the detail of genetic material of our living system-DNA replication, transcription and translation and explain how they relate to each other.

CO2 - Understand the Basic of DNA replication in prokaryotes and eukaryotes.

CO3 - Study the details of gene organization and mechanisms of control the gene expression in various organisms.

CO4 - Understand the applications of molecular biology in the modern world.

CO5 - Through this course the students are exposed to importance of biological macromolecules

CO6 - Understanding the molecular aspects of the biology.

SBBA1303	CONCEPTS IN BIOTECHNOLOGY	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

This course aims at making the students understand the basics of biotechnology and its various fields

UNIT 1 BIOTECHNOLOGY: AN OVERVIEW

9 Hrs.

What is Biotechnology? – an interdisciplinary pursuit, old Vs new biotechnology, scope and importance, commercial potential, public perception of Biotechnology, Biotechnology in India and Global. Branches of biotechnology.

UNIT 2 ANIMAL & PLANT BIOTECHNOLOGY

9 Hrs.

Biotechnology methods of crop improvement- plant tissue culture. Transgenic plants, applications of transgenic plants, transgenesis, transgenic animals,

UNIT 3 INDUSTRIAL BIOTECHNOLOGY

9 Hrs.

Isolation and screening of micro-organisms, Bioreactors, food and beverage fermentation, production of antibiotics (β -lactum antibiotic), vitamin B12, Enzyme- amylase, protease, Biotransformation, SCP and its economical implications.

UNIT 4 MEDICAL BIOTECHNOLOGY

9 Hrs.

Conventional vaccines, recombinant vaccines, DNA vaccines, monoclonal antibodies and their applications, interferons, drug designing, genetherapy, forensic medicine applications in human genetic research.

UNIT 5 ENVIRONMENTAL BIOTECHNOLOGY AND BIOETHICS

9 Hrs.

Novel and better bioinsecticides. Biofertilizers, Biodegradation of Xenobiotic compounds. Legal aspects genetically manipulated organisms and environment, biosafety, Social, moral and Ethical Considerations, IPR.

COURSE OBJECTIVES

Max. 45 Hours

On completion of the course, the students will be able to

CO1 - Explain the current scenario about biotechnology

CO2 - Describes the biotechnological methods in crop development and transgenic animal production

CO3 - Highlighting the application of industrial biotechnology

CO4 - Demonstrate the healthcare application of biotechnology

CO5 - Implementation of biotechnology in the protection of environment

CO6 - Discuss the ethical issues of biotechnology



Employability



Entrepreneurship



Skill Development

SBBA1304	ANALYTICAL TECHNIQUES	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

This course aims at understanding the principle and application of various instruments used in Biotechnology industries.

UNIT1 MICROSCOPY

9 Hrs.

Bright field and dark field microscopy, Fluorescence Microscopy, Phase contrast Microscopy, Confocal Microscopy, Electron Microscopy (Scanning and Transmission Electron Microscopy) and Micrometry.

UNIT 2 LAB EQUIPMENT

9 Hrs.

Autoclave, Hot air oven, Incubator, Water Bath, Laminar air flow, BOD incubator, Centrifuges – Bench top, High speed, Ultra centrifuge, density gradient centrifugation, pH meter, Conductivity meter, Lyophilizer, McIntosh anaerobic jar, Biosensor, Metabolic shaker.

UNIT 3 CHROMATOGRAPHY AND ELECTROPHORESIS

9 Hrs.

Principles and applications of Chromatography – Paper, Thin layer, Column, Ion-exchange, Gas and HPLC – Principle and applications of native polyacrylamide gel electrophoresis, SDS- polyacrylamide gelelectrophoresis, 2D gel electrophoresis, Isoelectric focusing, Zymogram preparation and Agarose gelelectrophoresis..

UNIT -IV PHOTOMETRY

9 Hrs.

Colorimetry, Turbidometry, Spectrometry – UV & Visible spectrophotometer. Flame photometry- Micronutrient analysis.

UNIT BIOCHEMISTRY ANALYSIS

9 Hrs.

Biochemical calculations-preparations of Molar solutions - Buffers- Phosphate, Acetate, TE, TAE- calculation of Normality, PPM- Ammonium sulphate precipitation.

Max. 45 Hours

COURSE OUTCOMES

On completion of the course, the student will be able to

- CO1 – Explain in detail about microscopic techniques
- CO2 – Discuss the different analytical instruments used in laboratories
- CO3 – Understand various chromatographic methods
- CO4 – Describe Photometric techniques
- CO5 – Understand various analytic methods in biochemistry
- CO6 – Demonstrate the biochemical calculation used to prepare buffers



Employability



Entrepreneurship



Skill Development

SMBA1401	MEDICAL BACTERIOLOGY	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

This course aims at understanding important medically important bacteria its mode of infection, pathogenesis prophylaxis and treatment.

UNIT 1 INFECTION

9 Hrs.

Infection-Sources of infection, method of transmission of infection, Factors predisposing to microbial pathogenicity, Types of infectious diseases. Normal Microbial flora of human body. Gram-positive pathogens *Staphylococcus*, *Streptococcus*, *Corynebacterium*, *Clostridium*.

UNIT 2 GRAM NEGATIVE PATHOGENS

9 Hrs.

Gram negative pathogens- *Neisseria*, *E.coli*, *Klebsiella*, *Proteus*, *Salmonella*, *Shigella*, *Vibrio*, *Yersinia*.

UNIT 3 ACID FAST BACTERIS

9 Hrs.

Acid fast bacteria-*Mycobacterium tuberculosis* and *M.lepreae*.

UNIT 4 SPIROCHETES

9 Hrs.

Spirochetes-*Leptospira*, *Treponema*.

UNIT 5 OTHER MEDICALLY IMPORTANT ORGANISMS

9 Hrs.

Mycoplasma, *Chlamydia*, *Helicobacter* and *Campylobacter*. Other important anaerobic pathogens.

Max. 45 Hours

COURSE OUTCOMES

On completion of the course, the student will be able to

CO1 – Understand the concept of infections and various factors associated to it

CO2 – Describe different Gram negative pathogenic microorganisms

CO3 – Discuss about the acid fast bacilli *Mycobacterium*

CO4 – Describe the different bacterial genus belonging to spirochetes phylum

CO5 – Explain several organisms that have medical significance and diseases caused by them

CO6 - Demonstrate the role of microorganism in causing disease.



Employability



Entrepreneurship



Skill Development

SMBA1402	MEDICAL VIROLOGY	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

This course aims at understanding important medically important virus its mode of infection, pathogenesis prophylaxis and treatment.

UNIT 1 GENERAL CONCEPTS

9 Hrs.

General Concepts: Virus history, Diversity, shapes, sizes and components of genomes. Isolation and purification of viruses and components.

UNIT 2 INFECTION

9 Hrs.

Consequences of virus infection to animals and human. Viral infection: affect on host macromolecules. Viral infection: establishment of the antiviral state. Viruses counter attack mechanisms.

UNIT 3 CLASSIFICATION

9 Hrs.

Classification of viruses and nomenclatures.

Positive strand RNA viruses- Picornaviruses. Flaviviruses- West Nile virus and Dengue virus. Coronaviruses- SARS pathogenesis

Negative strand RNA viruses Paramyxoviruses. Orthomyxoviruses: Influenza pathogenesis and Bird flu. Rhabdoviruses: Rabies pathogenesis.

UNIT 4 RNA VIRUS

9 Hrs.

dsRNA viruses- Reoviruses. Retroviruses: structure, classification, life cycle; reverse transcription. Retroviruses: HIV, viral pathogenesis and AIDS.

UNIT 5 DNA VIRUS

9 Hrs.

Small DNA viruses: parvo- and polyomaviruses. Large DNA viruses: Herpes-ado-, and poxviruses. Miscellaneous viruses.

Max. 45 Hours

COURSE OUTCOMES

On completion of the course, the student will be able to

CO1 – Explain the basic concepts of virology

CO2 – Understand the viral infections and factors associated to it

CO3 – Outlie the classification of viruses

CO4 – Discuss in detail about the RNA viruses

CO5 – Understand DNA viruses

CO6 – Demonstrate various viruses and disease caused by it.



Employability



Entrepreneurship



Skill Development

SMBA1403	MEDICAL MYCOLOGY	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

This course aims at understanding important medically important fungi its mode of infection, pathogenesis prophylaxis and treatment.

UNIT 1 CLASSIFICATION

9 Hrs.

General characteristics and classification of fungi - Morphology & reproduction of fungi–Pathogenesis of fungal infections
Isolation & identification of fungi

UNIT 2 YEAST

9 Hrs.

Yeasts and yeast like fungi of medical importance including Candida. - Cryptococcus, Malassezia, Trichosporon, Geotrichum, Saccharomyces etc. Mycelial fungi of medical importance including Aspergillus, Zygomycetes, Pseudoallescheria, Fusarium, Piedra, other dematiaceous hyphomycetes and other hyalohyphomycetes etc.

UNIT 3 DIMORPHIC FUNGI

9 Hrs.

Dimorphic fungi including Histoplasma, Blastomyces, Coccidioides, Paracoccidioides, Sporothrix, Penicillium marneffei etc. - Dermatophytes

UNIT 4 FUNGI DISEASES

9 Hrs.

Fungi causing mycetoma, keratomycosis & otomycosis.- Pneumocystis jirovecii infection - Rhinosporidium seeberi & Loboia loboii - Actinomycetes & Nocardia.

UNIT 5 COMMON LAB CONTAMINANTS

9 Hrs.

Common laboratory fungal contaminants- Mycetism & mycotoxicosis - Antifungal agents & in vitro antifungal susceptibility tests.
- Hypersensitivity to fungi

Max. 45 Hours

COURSE OUTCOMES

On completion of the course, the student will be able to

- CO1 – Understand the fungal classification and infections caused by them
- CO2 – Explain Yeasts and their medical importance
- CO3 – Explain the concept of fungal dimorphism and organisms that exhibit it
- CO4 – Describe various fungal diseases and the organisms responsible for that
- CO5 – Discuss about the fungal contaminants that are seen in laboratories
- CO6 – Demonstrate the use of various antifungal agents



Employability



Entrepreneurship



Skill Development

MBA1404	PHYCOLOGY AND MEDICAL PARASITOLOGY	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

This course aims at understanding important medically important parasite its mode of infection, pathogenesis prophylaxis and treatment. To understand the Algal diversity.

UNIT 1 CLASSIFICATION

9 Hrs.

Algae in diversified habitats (terrestrial, fresh water, marine) thallus organization, cell ultrastructure, reproduction (vegetative, asexual, sexual) criteria for classification of algae: pigments, reserve food, flagella, modern classification.

UNIT 2 CLASSIFICATIONS & APPLICATIONS

9 Hrs.

Salient features of protochlorophyta, chlorophyta, charophyta, xanthophyta, Bacillariophyta, phaeophyta and Rhodophyta with special reference to Microcystis, Hydrodictyon, Chara, Draparnaldiopsis, Sargassum, Dictyota, Batrachospermum. Algal blooms, algal biofertilizers; algae as food, feed and use in industry.

UNIT 3 PARASITOLOGY

9 Hrs.

Parasitology – General Concepts – Introduction to Parasitology, Classification – Host parasite relationship. Laboratory techniques in parasitology-Blood–Thick and thin smear, Faeces–Examination for ova and cyst.

UNIT 4 PROTOZOOLOGY

9 Hrs.

Protozoology: Pathogenic mechanisms, Disease transmissions, their life cycles and Lab Diagnosis of the following- *Entamoebahistoltylica*, *Plasmodium vivax*, *Plasmodium falciparum*, *Leishmaniadonovani*, *Giardia lamblia*, *Trichomonasvaginalis*, *Balantidium coli*, *Toxoplasma gondii* and *Cryptosporidium parvum*.

UNIT 5 HELMINTHOLOGY

9 Hrs.

Helminthology: Classification, Cestodes – *Taeniasolium*, *T. saginata*, *T. echinococcus*, trematodes – *Schistosomahaematobium*, *Fasciola hepatica*, Nematodes – *Ascaris*, *Anchylostoma*, *Trichuris*, *Enterobius* and *Wuchereria*- their life cycle, Transmission, pathogenicity and Lab Diagnosis.

Max. 45 Hours

COURSE OUTCOMES

On completion of the course, the student will be able to

- CO1 – Classify different algae in variety of habitats
- CO2 – Understand the applications of algae and harmful algal blooms
- CO3 – Understand the basic concepts of parasitology
- CO4 – Classify protozoans and the diseases caused by them
- CO5 – Discuss helminths, their classification and infections caused by them
- CO6 – Demonstrate the life cycle of various parasites

SBBA4002	MEDICAL LABORATORY TECHNIQUES	L	T	P	CREDITS	TOTAL MARKS
		3	0	0	3	100

COURSE OBJECTIVES

The main purpose of the program is to provide the students with the good knowledge of the basic techniques used in the laboratory.

UNIT 1 DISEASES AND ITS AGENTS

9 Hrs.

Bacterial, Viral, Fungal and Protozoan Diseases of various human body systems, Disease associated clinical samples for diagnosis.

UNIT 2 CLINICAL TRIALS

9 Hrs.

Collection of clinical samples (oral cavity, throat, skin, Blood, CSF, urine and faeces) and precautions required. Method of transport of clinical samples to laboratory and storage.

UNIT 3 STAINING TECHNIQUES

9 Hrs.

Examination of sample by staining - Gram stain, Ziehl-Neelson staining for tuberculosis, Giemsa stained thin blood film for malaria Preparation and use of culture media - Blood agar, Chocolate agar, Lowenstein-Jensen medium, MacConkey agar, Distinct colony properties of various bacterial pathogens.

UNIT 4 ASSAYS

9 Hrs.

Serological Methods - Agglutination, ELISA, immunofluorescence, Nucleic acid based methods - PCR, Nucleic acid probes

UNIT 5 DISEASE PREDICTION

9 Hrs.

Typhoid, Dengue and HIV, Swine flu Testing for Antibiotic Sensitivity in Bacteria Importance, Determination of resistance/sensitivity of bacteria using disc diffusion method, Determination of minimal inhibitory concentration (MIC) of an antibiotic by serial double dilution method.

Max. 45 hours

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 – Describe the various techniques used in medical laboratories.

CO2 – Understand the application of laboratory techniques in disease diagnosis

CO3 – Explore various infectious agents and the diseases caused by it

CO4 – Explain the protocols for disease diagnosis

CO5 – Demonstrate each technique and inference of test results

CO6 – Gain knowledge on infectious diseases.

SHSA1104	GENERAL ENGLISH – I	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES:

To develop, in learners, the four basic skills of listening, reading, speaking, and writing, through an integrated approach. To improve the comprehension and expression of oral and written ideas in English.

Unit 1 DRESS IN COMMUNICATION**12 Hrs.**

Speaking - Rhetorical analysis and Group Discussion. Reading for details and Global Comprehension - Dress in communication, I have a Dream Speech by Martin Luther King and The Justice Peace by Hilaire Belloc. Critical Thinking: Asking Questions, Analyzing Assumptions and Biases. Vocabulary: Expressions and markers. Collocations – Identifying collocations by reading prose passages mentioned in the unit one. Language Focus: Determiners, Parts of Speech Writing: Paragraph writing based on hints given on topics like 'My dream for my family/ country', 'importance of clothing for communication, 'social inequality in society', 'Judge the Book by its Cover- Can we judge people by their appearance?

Unit 2 AN INCONVENIENT TRUTH**12 Hrs.**

Speaking: Debate on the topics related to Environmental issues and Discrimination in Society . Reading for details and Global Comprehension on An Inconvenient Truth, A Different History by Kamala Das and Sujata Bhatt. Critical Thinking: Identifying Facts and Opinions, Distinguish a main idea in text from a subordinate idea. Examine views on a controversial issue and consider one's own biases and personal interest. 'Vocabulary: Collocations, Useful words to express point of view. Language focus- Tenses, Conjunctions and discourse markers Writing- Responding to Slogans, Campaign Leaflet and Writing Film Review , Letter writing

UNIT 3 A SPEECH BY N R NARAYANA MURTHY**12 Hrs.**

Speaking: Giving Impromptu speeches- Welcome address and Vote of Thanks. Reading for details and Global Comprehension- A Speech by NR Narayana Murthy and Digging by Seamus Heaney Critical Thinking: Asking ' wh ' questions Questions, Making informed decisions based on evidence, Examining Evidence by citing evidence from the textbook or lecture to support a position. Vocabulary - Word association, onomatopoeic words. Language focus: Sentence Function and Sentence Kinds Writing: Writing email , Writing Diary Entry

Unit 4 AFTER TWENTY YEAR**12 Hrs.**

Listening: For details and Overall Idea, Speaking: Informal Speech, Reading for details and Global Comprehension- After Twenty Years by Jamila and After Twenty Years by O Henry Writing: Problem solving paragraph writing. Letter to the editor with solutions to current problems related to areas covered in the course Critical Thinking: Problem Solving selecting effective solutions for overcoming obstacles or constraints by explaining why it is the most effective of the possible solutions. Vocabulary : Phrasal Verbs Language Focus Types of sentences -simple, compound and complex. Language Focus: Subject verb Agreement

Unit 5 I LOVE YOU MOM**12 Hrs.**

Listening for details Speaking- Greeting , thanking , apologising, offering condolences by doing Role plays Reading for details and Global Comprehension- I Love you Mom by Joanna Fuchs and Prose passage on ' I Love You Mom'. Writing: Writing restaurant review, argumentative writing. Vocabulary: Phrasal Verbs , Synonyms and Antonyms Critical Thinking : Argumentation provides a well-articulated and detailed argument

Max Hours.60**TEXT BOOKS:**

1. P Bhaskaran Nair, C Radha Krishna Pillai, Geetha Rajeevan, CLN Prakash, Nadhini Nayar Reflections - An Anthology of Prose, Poetry and Fiction (2015) Foundation Books, Chennai . Foundation Books. ISBN 978-93- 85386-008.
References:
2. Sen S, Mahendra et al. (2015) Communication and Language Skills . Foundation books. Chennai

SHSA1210	GENERAL ENGLISH – II	L	T	P	Credits	Total Marks
		3	0	0	3	100

OBJECTIVES OF THE COURSE:

The paper provides opportunities for students to read and respond to representations of current issues through texts that present themes and topics that are familiar, insightful and informative. The thrust is on preparing students to effectively communicate by applying reflective thinking practices. Students will have an opportunity to improve their vocabulary related to immediate environment, practice speaking skills by discussing about issues based on reading texts, read texts that include everyday problems that provide opportunities to develop problem solving skills in cooperative learning situations, develop writing skills by summarising substance of a poems, letters and composition of dialogues and paragraphs.

UNIT 1 UNITY OF MINDS - A P J ABDUL KALAM

9Hrs.

Listening for details, Speaking - making a presentation, Reading for details and Global Comprehension Unity of Minds by APJ Abdul Kalam - Vocabulary Binomials Writing: Writing compare contrast paragraphs by representing data given in pie chart, Tables; Writing Speeches. Vocabulary : Binomials, Affixes Language Focus : Active and Passive Voice, Punctuation. Critical Thinking : Comparing & Contrasting presenting information by including important characteristics on which the items should be compared or contrasted

UNIT 2 LEAVE THIS CHANTING AND SINGING AND TELLING OF BEADS BY RABINDRANATH TAGORE AND ENGINE TROUBLE BY R K NARAYANAN

9 Hrs.

Listening for details Speaking: Giving impromptu speech based on topics given in the class for clarifying one's point of view. Reading for Comprehension and for overall idea -Leave this Chanting and Singing and Telling of Beads by Rabindranath Tagore and Engine Trouble by R K Narayanan, Vocabulary : Archaic words, phrases Writing: Language Focus Imperatives. Writing: Writing Instructions and recommendations based on quotations given as prompts, writing an advertisement Critical Thinking: Expressing point of view

UNIT 3 THE HAPPY PRINCE BY OSCAR WILDE

9 Hrs.

Speaking Telephonic conversation, Drama In the class based on the story prescribed Reading for details and Global Comprehension The Happy Prince by Oscar Wilde Language Focus: Adjective- degrees of Comparison, Functional and personal Nouns Vocabulary : positive and negative connotations. Writing: Letter writing- personal letters Critical Thinking Self-regulation: Continuing improvement in thinking, involving monitoring one's cognitive process and correcting errors and biases as needed.

UNIT 4 TWO GENTLEMEN OF VERONA BY A J CRONIN

9 Hrs.

Listening for Overall information of 'Anthem for Doomed Youth' by Wilfred Owen Speaking: Making requests and suggestions. Reading for details Two Gentlemen of Verona by A J Cronin, Vocabulary: Simile, metaphor, adjectives to describe people and their personalities. Idioms. Writing: Writing recommendations; Narratives based on prompts on plot and characters. Critical Thinking: identifying the subject of the investigation and presenting a well-articulated solution to the confusions or contradictions associated with the situation based on listening speaking tasks in the class. Creative writing - stories and poems Language Focus: Reported Speech

UNIT 5 THE AVENGER BY ANTON CHEKHOV

9 Hrs.

Listening for specific details Speaking using imagination. Reading to identify factual and inferential information Writing: Imaginative writing by predicting. Vocabulary : Countable forms and meaning, foreign nouns and framing of plurals. Language focus: Modal verbs, use of would. Critical Thinking: Deductive reasoning- generating a valid prediction or conclusion by articulating the relationship between the prediction or conclusion

Max. 45 hours

TEXT / REFERENCE BOOKS:

- P Bhaskaran Nair, C Radha Krishna Pillai, Geetha Rajeevan, CLN Prakash, Nadhini Nayar Reflections - An Anthology of Prose, Poetry and Fiction (2015) Foundation Books, Chennai . Foundation Books. ISBN 978-93- 85386-008
- Sen S, Mahendra etal. (2015) Communication and Language Skills . Foundation books. Chennai
- <https://designatechengage.wisc.edu/course-activities-learner-interaction/sdc-activity-types-active-learning/>
- <https://www.uen.org/rubric/previewRubric.html?id=1219>
- <https://www.diigo.com/profile/Teachonlineuw?query=%22Critical+Thinking%22+rubric>



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School of Bio & Chemical Engineering

Department of Biotechnology

1.1.3 Courses having focus on Employability / Entrepreneurship / Skill

Development

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Employability



Entrepreneurship



Skill Development

SBCA1101	BIOMOLECULES	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

➤ . To ensure students to gain knowledge about the structure, properties and functions of biomolecules.

UNIT 1 CARBOHYDRATES**9 Hrs.**

Carbohydrates – Definition, classification. Structure and chemical properties of glucose. Structure, properties and biological functions of monosaccharides (glucose, fructose), disaccharides (maltose, lactose, sucrose), oligosaccharides and polysaccharides

UNIT 2 AMINO ACIDS**9 Hrs.**

Amino acids – Structure, classification and chemical properties. pKa and titration curve of amino acids. Peptides, peptide bond, biologically important peptides. Proteins – classification and biological importance. Primary, secondary, tertiary and quaternary structure of proteins. Denaturation and precipitation by salts, isoelectric pH.

UNIT 3 LIPIDS 9 Hrs.

Lipids – definition, nomenclature of fatty acids. Biological significance and classification of lipids. Simple lipids: triglycerides, waxes, steroids, prostaglandins. Compound lipids: Phospholipids, sphingolipids, glycolipids and lipoproteins. Properties of lipids (Reichert-Meisel value, iodine number, saponification value, acid number).

UNIT 4 NUCLEIC ACIDS 9 Hrs.

Nucleic acids – purines and pyrimidines. Nucleosides and nucleotides. Polynucleotides: DNA and RNA, biological significance. Structure and forms of DNA. Types of RNA. Denaturation and Renaturation

UNIT 5 VITAMINS**9 Hrs.**

Vitamins – Source, biological function, daily requirement and deficiency symptoms of fat soluble vitamins (A, D, E and K) and water soluble vitamins (Ascorbic acid, thiamine, riboflavin, pyridoxine, niacin, pantothenic acid, lipoic acid, biotin, folic acid and vitamin B12).

Max. 45 Hours**COURSE OUTCOMES**

On completion of the course, student will be able to

CO1 – Define the structure, properties and roles of carbohydrates.

CO2 – Discuss the structure, chemical properties and biological importance of amino acids.

CO3 – Describe the classification, structure and biological importance of proteins.

CO4 – Classify the nature and roles of lipids in biological system.

CO5 – Describe the structure and fundamentals of nucleic acids with respect to its biological significance.

CO6 – Discuss the structure and forms of DNA with types of RNA.

CO7 - Explain the source and biological functions of vitamins.

CO8 - Distinguish the water soluble vitamins with fat soluble vitamins.

SBBA1102	FUNDAMENTALS OF MICROBIOLOGY	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

➤ This course is aimed give an understanding about the basics of microbiology dealing types of microbes, classification & characterization

UNIT 1 INTRODUCTION TO MICROBIOLOGY

9 Hrs.

History and scope of Microbiology, Spontaneous generation - Biogenesis theory - Contribution of Leeuwenhoek, Louis Pasteur, Robert Koch, Edward Jenner, Paul Ehrlich and Flemming.

UNIT 2 MICROSCOPE

9 Hrs.

Microscope- Principles, working mechanism and application - Simple and compound microscope - Dark field -Phase contrast, Fluorescence, SEM and TEM.

UNIT 3 STRUCTURAL ORGANISATION OF THE CELL

9 Hrs.

Structure and organization of bacterial cell, Gram-positive and Gram-negative bacterial cell wall. Types of Staining - Simple, Differential (Gram's, AFB), Special - Capsular staining (negative), Spore. LPCB, KOH mount.

UNIT 4 STERILIZATION METHODS

9 Hrs.

Sterilization and Disinfection- principles -methods of sterilization- physical methods - Dry heat- Moist heat- Radiation. Filtration (Membrane and HEPA). Chemical sterilization- Chemical agents- mode of action- phenol coefficient test- sterility testing.

UNIT 5 MEDIA AND ITS TYPES

9 Hrs.

Culture and media preparation - solid and liquid. Types of media- Semi synthetic, Synthetic, Enriched, Enrichment, Selective and Differential media. Pure culture techniques – Tube dilution, Pour, Spread, Streak plate. Anaerobic culture technique Wright's Tube, Roll tube method, Anaerobic Jar.

Max. 45 Hours

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 – Define the basic concepts of microbiology.
- CO2 – Summarize the principle and working mechanism of simple and compound microscopes.
- CO3 – Describe the various staining techniques used in microbiology
- CO4 – Explain cellular organization of various microorganisms
- CO5 – Classify various microorganisms on the basis of staining techniques.
- CO6 – Discuss various culture media and plating techniques for growing the microorganisms

SMBA1201	BASIC CELL BIOLOGY	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

Cell biology is the study of the structure and function of prokaryotic and eukaryotic cells. In this course the students will learn different areas of cellular biology including the structure and functions of cell, its organelles, synthesis and function of macromolecules such as carbohydrate, protein, lipid, DNA & RNA; membrane structure and function; bioenergetics; cellular communication; and microscopic techniques to understand the cell structure.

UNIT 1 FUNDAMENTALS OF CELL STRUCTURE

9 Hrs.

Discovery of cells; Basic properties of cells; Different classes of cells – Prokaryotic and eukaryotic cells. Cell division: Cell cycle; mitosis; meiosis, binary fission.

UNIT 2 CELLULAR MEMBRANES AND MATRICES

9 Hrs.

Chemical composition and fluidity of membranes; dynamic nature of membranes; transportation across cell membrane; membrane potentials; extracellular matrices – structure and function; cytoskeleton – structure and function.

UNIT 3 CELLULAR ORGANELLES IN ENERGY METABOLISM

9 Hrs.

Mitochondria – structure and function; Chloroplast – structure and function. Structure of nucleus – nuclear membrane, nucleolus, chromatin, structure of nucleic acids

UNIT 4 CELLULAR ORGANELLES IN METABOLISM

9 Hrs.

Endoplasmic reticulum – smooth & rough; function of endoplasmic reticulum; Golgi complex – structure and function; Ribosomes – Types, structure and function; Morphology and functions of peroxisomes and glyoxisomes; Plant cell vacuoles..

UNIT 5 TRANSPORT ACROSS CELL MEMBRANE

9 Hrs.

Passive and active transports, Permeases, Sodium -potassium pumps, Ca²⁺ ATPase pump, ATP dependant proton pumps, co-transport, symport, antiport, Endocytosis and Exocytosis. Introduction to intra and extra cellular products of medicinal use.

Max. 45 Hours

COURSE OUTCOMES:

- CO1- Learn the structure and functions of cells
- CO2- Understand the cell cycle process
- CO3- Familiarize the cellular components in detail
- CO4- Understand the role of cellular components in metabolism
- CO5- Understand the various processes involved in animal and plant developments
- CO6- Demonstrate various cellular organelles and its role in cell metabolism

SBCA1301	MOLECULAR BIOLOGY I	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

- Molecular Biology I is an introductory course deals with the fundamental principles of DNA structure, organization and its function in both prokaryotes and eukaryotes.

-

- **UNIT 1 BASIC CONCEPTS IN MOLECULAR BIOLOGY**

9 Hrs

- History of significant discoveries in Molecular Biology. Central dogma – DNA as genetic material. Evidence to prove DNA as genetic material- Griffith's transforming principle; Avery, McLeod and McCarty's experiment; Hershey and Chase experiment. Chargaff's law. Watson and Crick model of DNA (B form). Other different forms of DNA- A, Z. Physical Properties of DNA- Denaturation, Renaturation, hyper and hypochromic effect, Cot curve significance.

UNIT 2 DNA REPLICATION**9 HRS.**

Meselson-Stahl's experiment to prove semi-conservative model of replication. DNA replication in prokaryotes and eukaryotes. Types of DNA polymerases, enzymes and proteins associated with DNA replication. Mechanism of replication- Initiation, Elongation and Termination. Other modes of replication: rolling circle replication, D-loop mechanism.

UNIT 3 GENETIC CODE AND TRANSCRIPTION**9 HRS.**

Genetic code properties; initiation and termination codon; Wobble hypothesis. Transcription in prokaryotes and eukaryotes. RNA polymerases; mechanism of transcription- initiation, elongation and termination. Types of RNA – rRNA, mRNA, tRNA, snRNA. Post transcriptional modifications; 5' capping and poly A tailing. RNA splicing- Splicing pathways and Spliceosome. Concept of Alternate Splicing.

UNIT 4 PROTEIN SYNTHESIS**9 HRS.**

Translation in prokaryotes and eukaryotes. Mechanism of translation; initiation, elongation and termination. Co and post translational modifications of proteins. Import in to nucleus.

UNIT 5 GENE REGULATION**9 HRS.**

Regulation of gene expression- regulatory proteins, promoters, enhancers. Operon concept- negative and positive regulation- Lac, Trp, Ara operon- structure and function.

Max. 45 Hours**COURSE OUTCOMES**

On completion of the course, student will be able to

CO1 - Study the detail of genetic material of our living system-DNA replication, transcription and translation and explain how they relate to each other.

CO2 - Understand the Basic of DNA replication in prokaryotes and eukaryotes.

CO3 - Study the details of gene organization and mechanisms of control the gene expression in various organisms.

CO4 - Understand the applications of molecular biology in the modern world.

CO5 - Through this course the students are exposed to importance of biological macromolecules

CO6 - Understanding the molecular aspects of the biology.



Employability



Entrepreneurship



Skill Development

SBCA1302	ENZYMES	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

➤ The objective of the course is to provide a deeper insight into the fundamentals, classification, structure, function and kinetics of enzymes. Also know about current applications and future potential of enzymes.

UNIT 1 INTRODUCTION TO ENZYMES**9 Hrs.**

Historical perspective, Nomenclature and Classification of Enzymes – Properties of Enzymes, Enzyme Activity and Units, Specific Activity, Catalytic Power and Specificity, Lock and Key Theory, Induced Fit Model, Transition State and Strain Theory of Enzyme Action.

UNIT 2 ENZYME KINETICS AND INHIBITION**9 Hrs.**

Relationship between initial velocity and substrate concentration, steady state kinetics, equilibrium constant, monosubstrate reactions. Michaelis-Menten equation, Lineweaver-Burk plot, Eadie-Hofstee, Hanes-Woolf, and Cornish-Bowden Plots – K_m and V_{max} , K_{cat} and turnover number, Effect of pH, temperature and metal ions on the activity of enzyme, Bi-substrate Reactions, Enzyme Inhibition, Irreversible, Reversible, Competitive, Uncompetitive – Mixed and Non-Competitive inhibition, graphical analysis.

UNIT 3 ENZYMATIC CATALYSIS & COENZYMES**9 Hrs.**

Acid-Base Catalysis, Covalent Catalysis, Metal ion Catalysis, Electrostatic Catalysis, Catalysis through Proximity and Orientation effects, Catalysis by Transition State Binding. Catalysis in Model Enzymes – Ribonuclease A – Chymotrypsin, Carbonic anhydrase – Carboxypeptidase A, Lysozyme. Coenzymes – NAD(P)⁺, FMN & FAD, CoA-SH, TPP, PLP, Biotin, THF, Methylcobalamin, Structure & Function.

UNIT 4 ENZYME REGULATION AND PURIFICATION**9 Hrs.**

Product inhibition, feedback control, enzyme induction and repression and covalent modification. Allosteric regulation. Enzyme isolation and purification, Preliminary and Advanced techniques.

UNIT 5 APPLICATIONS OF ENZYMES**9 Hrs.**

Immobilized enzymes, methods and applications in industry, medicine, Isoenzymes, properties and physiological significance (lactate dehydrogenase). Application of enzymes in diagnostics (SGPT, SGOT, creatine kinase, alkaline and acid phosphatases), enzyme immunoassay (HRPO), enzyme therapy (Streptokinase).

COURSE OUTCOMES**Max. 45 Hours**

On completion of the course, student will be able to

CO1- Students will learn basics of enzymology and will be familiar with important terms of enzymology

CO2- Study the theoretical and practical aspects of kinetics will provide the importance and utility of enzyme kinetics towards modern application.

CO3-Familiar with overview and scope of enzymes in food, pharmaceutical and chemical industries and thus this study will provide simple and easy method of implementation.

CO4- Ideas on Processing, Production and Purification of enzymes at an industrial scale

CO5- It helps the students to learn the significant features of the biochemical catalysts.

CO6- understand the methodology involved in assessing the enzyme activity and mechanism of enzyme action.



Employability



Entrepreneurship



Skill Development

SBCA1303	BIOPHYSICAL CHEMISTRY	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

- Developing of general understanding how physical laws govern biological processes.
- Acquire basic knowledge about how physical methods can be applied to understand biological processes.

UNIT 1 WATER**9 Hrs.**

Structure and interactions, water as solvent, proton mobility, acid-base reactions, pH and buffers, isoelectric pH. Importance of buffers in biological systems (cytosol and blood).

UNIT 2 THERMODYNAMICS**9 Hrs.**

First law of thermodynamics, basic concepts of entropy and second law of thermodynamics, free energy changes, standard free energy change and its relation to equilibrium constant. Oxidation – reduction reactions in biological systems.

UNIT 3 CELL MEMBRANE AND TRANSPORT MECHANISMS**9 Hrs.**

Structure, principles of membrane organization, membrane models, membrane protein types and its functions, Transport through cell membrane, active and passive transport systems, Ping - pong mechanism for transport of diffusion, Macromolecules across the Plasma Membrane, Role of Intercellular spaces in transport process, Homocellular, Transcellular, Intracellular transport, Irreversible thermodynamic treatment of membrane transport.

UNIT 4 BIOMOLECULAR INTERACTIONS**9 Hrs.**

Electrostatic charges and molecular expansion, hydrophobic forces, dispersion force interaction, Multiple equilibria and various types of binding processes in biological system. Hydrogen ion titration curve, Thermodynamics of biopolymers, Vant's Hoff's law of osmotic pressure, Theory of osmotic pressure and semipermeability, Behaviour of cells and molecular weight determination from osmotic pressure measurements, Significance of osmosis in biology..

UNIT 5 TECHNIQUES FOR THE STUDY OF MACROMOLECULAR STRUCTURE**9 Hrs.**

Analytical Ultracentrifugation : Sedimentation velocity and equilibrium, determination of molecular weights, Micro calorimetry (DSC and ITC) and its application. Circular Dichroism spectroscopy, UV, visible and Fluorescence spectroscopy, X-ray Diffraction, Nuclear Magnetic Resonance (NMR), Mass Spectrometry.

COURSE OUTCOMES**Max. 45 Hours**

On completion of the course, student will be able to

CO 1: Understand the fundamental principles and thermodynamics that drive biomolecules.

CO:2: Emphasize profound knowledge on cell structure, function and dynamics of inter-intra cellular processes.

CO 3: Explore various basic and advanced sophisticated biochemical and biophysical techniques for analyzing macromolecules

CO 4: Comprehend clear understanding on various cellular metabolic pathway mechanism and its applications in biological system.

CO 5: The application of mathematical tools to calculate thermodynamic.

CO 6: The students familiar about the inorganic halogen compounds, coordination compounds and transition elements.



Employability



Entrepreneurship



Skill Development

SBCA3001	NUTRITIONAL BIOCHEMISTRY	L	T	P	CREDITS	TOTAL MARK
		3	0	0	3	100

COURSE OBJECTIVES

This course provides introduction to biochemistry of macro- and micronutrients with a brief focus on medical aspects of nutrient deficiencies and metabolism

UNIT 1 CONCEPTS OF FOOD AND NUTRITION

9 Hrs.

Basic food groups- energy yielding, body building and functional foods. Units of energy. Calorific and nutritive value of foods. Measurement of calories by bomb calorimeter. Basal metabolic rate (BMR) - definition, determination of BMR and factors affecting BMR. Respiratory quotient (RQ) of nutrients and factors affecting the RQ. SDA- definition and determination.

UNIT 2 ELEMENTS OF NUTRITION

9 Hrs.

Physiological role and nutritional significance of carbohydrates, lipids and proteins, Evaluation of proteins by nitrogen balance method - Biological value of proteins – Digestibility Coefficient, Biological Value, Protein Energy Ratio and Net Protein Utilization. Protein energy malnutrition- Kwashiorkor and Marasmus. Clinical manifestations and management. Obesity (elementary details)

UNIT 3 VITAMINS

9 Hrs.

Balanced diet, example of a low and high cost balanced diet – for infants, children, adolescents, adults and elderly people. Role of dietary fiber. Vitamins- definition and types of vitamins. Sources, requirement, biological functions, deficiency symptoms of thiamine, riboflavin, niacin, pyridoxine, pantothenic acid, folic acid, biotin, cyanocobalamine, vitamins C,A,D,E and K. Hypervitaminosis.

UNIT 4 MINERALS

9 Hrs.

Minerals- sources, requirement, physiological functions, deficiency and toxicity of calcium, sodium, potassium, iron, magnesium, chromium, cobalt, copper, manganese, molybdenum, selenium, iodine and zinc.

UNIT 5 HUMAN RIGHTS

9 Hrs.

Introduction- definition, scope and need for study of human rights and relations. Categories- civil and political rights, economic relations and social relations. Institutions : International and National- United Nations Human Rights Commission, State Human Rights Commission. International Convention on civil and political rights. International, convention on economic and social rights. National Human Rights Act- National Commission for minorities, SC/ST and Women, Students activity- assignment, case study, term paper.

COURSE OUTCOMES

MAX. 45 HOURS

On completion of the course, student will be able to

CO1 – Familiarize with various nutritional sources

CO2 – Understand the important role each nutrients in metabolism

CO3 – Identify various types of micro and macro nutrients

CO4 – Discuss importance of nutrients and its role in disease

CO5 – Explain different types of minerals

CO6 – Apply the nutritional requirements and its importance in human rights



Employability



Entrepreneurship



Skill Development

SBCA1402	INTERMEDIARY METABOLISM I	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

➤ This course aims at understanding the essential metabolic functions of the organism as well as consumption and storage of energy intermediary metabolism of main biomolecules and its regulatory mechanisms.

UNIT 1 THERMODYNAMIC PRINCIPLES

9 Hrs.

Laws of Thermodynamics, Enthalpy, enthalpy free energy, forward and reverse reaction equilibrium state, oxidation and reduction, redox reactions, redox potential. Anabolism – catabolism. High energy compounds.

UNIT 2 METABOLIC PRINCIPLES

9 Hrs.

Structure, Functions, and Properties of Immune Cells – Stem cell, T cell, B cell, NK cell, Macrophage, Neutrophil, Eosinophil, Basophil, Mast cell, Dendritic cell; and Immune Organs – Bone Marrow, Thymus, Lymph Node, Spleen, GALT, MALT, CALT

UNIT 3 PHOTOSYNTHESIS

9 Hrs.

Photophosphorylation: Cyclic and Non-cyclic photophosphorylation. Central photochemical event. Light-driven electron flow, ATP synthesis by photophosphorylation

UNIT 4 CARBOHYDRATE METABOLISM

9 Hrs.

Glycolysis and oxidation of pyruvate, Pentose phosphate pathway, Glycogen metabolism: Glycogenesis and glycogenolysis, glyoxalate shunt, fatty acid synthesis and oxidation, gluconeogenesis - illustrations, regulation, and energetics.

UNIT 5 ENERGY PRODUCTION

9 Hrs.

Tricarboxylic acid cycle, the convergence of all metabolic pathways into TCA, Respiratory chain in mitochondria, chemiosmotic theory, oxidative phosphorylation, uncouplers, transport systems in inner mitochondrial membrane, calculation of ATP yield during oxidation of glucose and fatty acids

Max. 45 Hours

COURSE OUTCOMES

On completion of the course, the student will be able to

CO1 – develop knowledge on how biomolecules perform complex metabolic functions.

CO2 – evaluate the energy metabolism and its regulatory mechanism

CO3 – analyze complex biochemical pathways of energy production

CO4 – will be able to illustrate important metabolic pathways of organisms

CO5 – have a strong understanding of the structure and essential functions of biomolecules

CO6 – outline the concepts of immunity and its significance in fighting a disease



Employability



Entrepreneurship



Skill Development

SBCA1401	MOLECULAR BIOLOGY II	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

➤ To provide sound knowledge on the gene organisation, structure, function and important molecular functions of prokaryotic and eukaryotic cells.

UNIT 1 ORGANIZATION OF DNA IN PROKARYOTES AND EUKARYOTIC CHROMOSOME.**9 Hrs.**

Prokaryotic Genomes - Physical organization of bacterial genomes .Structure of the bacterial nucleoid. Eukaryotic genome organization- DNA binding histones, nucleosome, solenoid, chromatin. Eukaryotic genomes contain both non repetitive and repetitive DNA sequences- satellite DNA. Human genome has fewer genes than expected. Mitochondrial DNA organization.

UNIT 2 MUTATION AND REPAIR**9 Hrs.**

Mutagenesis, Mutations, and Mutants- Terminology, Types of Mutations and their Notation, Biochemical Basis of Mutants, Mutagenesis, Mutational Hot Spots, Reversion. Errors in DNA replication and it's repair. Direct reversal of DNA damage. Base excision repair and nucleotide excision repair. Repair by homologous recombination.

UNIT 3 GENETIC RECOMBINATION**9 Hrs.**

Genetic Recombination Between Homologous DNA Sequences: Recombination in bacterial transformation. Types of Recombination- Site-specific & illegitimate recombination. Breakage and Rejoining and Heteroduplexes, Branch migration. Mismatch Base Pairs and Their Resolution. Models for Homologous Recombination- Holliday junctions, RecA, RecBCD, RuvAB functions

UNIT 4 TRANSPOSABLE ELEMENTS**9 Hrs.**

Transposable Elements: An Overview of Transposition, Insertion sequences, Types of bacterial Transposons, Transposition, Replication of a transposon during transposition between two plasmids, The Cointegrate as an Intermediate in transposition of Tn3, Deletions and Inversions Caused by Transposons, Role of IS elements in Hfr Formation. Transposable Elements in Eukaryotes- Retroposons, retrotransposons .Limitation of Transposition.

UNIT 5 MOLECULAR BIOLOGY OF CANCER**9 Hrs.**

Cell cycle regulation and cancer. Activation of oncogenes, Inactivation of tumor suppressor genes, Inappropriate expression of micro RNAs in cancer, Chromosomal rearrangements and cancer, Viruses and cancer, Chemical carcinogenesis

Max. 45 Hours**COURSE OUTCOMES**

On completion of the course, the student will be able to

CO1 – compare and contrast the general principles of gene organization in both prokaryotic and eukaryotic organisms.

CO2 – have an understanding of molecular pathways involved in DNA mutation and repair

CO3 – explain the underlying mechanism of DNA recombination

CO4 – analyze the consequences of DNA transposition

CO5 – will predict how a mutation to the anticodon sequence of a tRNA or a promoter sequence would alter its function.

CO6 – relate the properties of cancerous cells to mutational changes in gene function



Employability



Entrepreneurship



Skill Development

SBCA1403	BASIC IMMUNOLOGY	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

➤ To know the fundamentals of innate and acquired immunity. To understand how the immune system fights and combats infection and diseases. To get an insight into the principle mechanism of immunity.

UNIT 1 HISTORY OF IMMUNOLOGY

9 Hrs.

History of Immunology – Host-parasite relationship – Immunity – Innate and acquired immunity – Humoral and Cell-mediated immunity.

UNIT 2 PROPERTIES OF IMMUNE CELLS

9 Hrs.

Structure, Functions, and Properties of Immune Cells – Stem cell, T cell, B cell, NK cell, Macrophage, Neutrophil, Eosinophil, Basophil, Mast cell, Dendritic cell; and Immune Organs – Bone Marrow, Thymus, Lymph Node, Spleen, GALT, MALT, CALT

UNIT 3 ANTIGENS AND ANTIBODIES

9 Hrs.

Differentiation and classification of T-cells and B-cells, antigen processing and presentation, Antigens – Types, properties – Immunoglobulins – Structure, types and Functions, Antigenic determinants on antibodies (Isotypic, allotypic, idiotypic); VDJ rearrangements; Complement – Classical and alternative pathways

UNIT 4 MONOCLONAL ANTIBODIES

9 Hrs.

Monoclonal antibodies, Antigen- Antibody reactions: Agglutination – Precipitation – Complement fixation – Immunofluorescence – ELISA, RIA.

UNIT 5 CELL MEDIATED IMMUNITY

9 Hrs.

Autoimmunity: Hypersensitivity reactions – Antibody-mediated – Type I, Type II and Type III – cell-mediated - Type IV; Transplantation immunology; Tumor immunology

Max. 45 Hours

COURSE OUTCOMES

On completion of the course, the student will be able to

CO1 – develop knowledge on *how human immune cells combat an infection*

CO2 – evaluate the role of different immune cells

CO3 – *analyze how human immune cells combat an infection.*

CO4 – apply the methods to detect an immune reaction.

CO5 – *have a strong understanding of the mechanism behind allergy and hypersensitivity*

CO6 – outline the concepts of immunity and its significance in fighting a disease

SBBA4002	MEDICAL LABORATORY TECHNIQUES	L	T	P	CREDITS	TOTAL MARKS
		3	0	0	3	100

COURSE OBJECTIVES

The main purpose of the program is to provide the students with the good knowledge of the basic techniques used in the laboratory.

UNIT 1 DISEASES AND ITS AGENTS

9 Hrs.

Bacterial, Viral, Fungal and Protozoan Diseases of various human body systems, Disease associated clinical samples for diagnosis.

UNIT 2 CLINICAL TRIALS

9 Hrs.

Collection of clinical samples (oral cavity, throat, skin, Blood, CSF, urine and faeces) and precautions required. Method of transport of clinical samples to laboratory and storage.

UNIT 3 STAINING TECHNIQUES

9 Hrs.

Examination of sample by staining - Gram stain, Ziehl-Neelson staining for tuberculosis, Giemsa stained thin blood film for malaria Preparation and use of culture media - Blood agar, Chocolate agar, Lowenstein-Jensen medium, MacConkey agar, Distinct colony properties of various bacterial pathogens.

UNIT 4 ASSAYS

9 Hrs.

Serological Methods - Agglutination, ELISA, immunofluorescence, Nucleic acid based methods - PCR, Nucleic acid probes

UNIT 5 DISEASE PREDICTION

9 Hrs.

Typhoid, Dengue and HIV, Swine flu Testing for Antibiotic Sensitivity in Bacteria Importance, Determination of resistance/sensitivity of bacteria using disc diffusion method, Determination of minimal inhibitory concentration (MIC) of an antibiotic by serial double dilution method.

Max hours 45 hours

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 – Describe the various techniques used in medical laboratories.
- CO2 – Understand the application of laboratory techniques in disease diagnosis
- CO3 – Explore various infectious agents and the diseases caused by it
- CO4 – Explain the protocols for disease diagnosis
- CO5 – Demonstrate each technique and inference of test results
- CO6 – Gain knowledge on infectious diseases.



Employability



Entrepreneurship



Skill Development

SHS1104	GENERAL ENGLISH – I	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES:

To develop, in learners, the four basic skills of listening, reading, speaking, and writing, through an integrated approach. To improve the comprehension and expression of oral and written ideas in English.

Unit 1 DRESS IN COMMUNICATION**9 Hrs.**

Speaking - Rhetorical analysis and Group Discussion. Reading for details and Global Comprehension - Dress in communication, I have a Dream Speech by Martin Luther King and The Justice Peace by Hilaire Belloc. Critical Thinking: Asking Questions, Analyzing Assumptions and Biases. Vocabulary: Expressions and markers. Collocations – Identifying collocations by reading prose passages mentioned in the unit one. Language Focus: Determiners, Parts of Speech Writing: Paragraph writing based on hints given on topics like 'My dream for my family/ country', 'importance of clothing for communication, 'social inequality in society', 'Judge the Book by its Cover- Can we judge people by their appearance?'

Unit 2 AN INCONVENIENT TRUTH**9 Hrs.**

Speaking: Debate on the topics related to Environmental issues and Discrimination in Society . Reading for details and Global Comprehension on An Inconvenient Truth, A Different History by Kamala Das and Sujata Bhatt. Critical Thinking: Identifying Facts and Opinions, Distinguish a main idea in text from a subordinate idea. Examine views on a controversial issue and consider one's own biases and personal interest. 'Vocabulary: Collocations, Useful words to express point of view. Language focus- Tenses, Conjunctions and discourse markers Writing- Responding to Slogans, Campaign Leaflet and Writing Film Review , Letter writing

UNIT 3 A SPEECH BY N R NARAYANA MURTHY**9 Hrs.**

Speaking: Giving Impromptu speeches- Welcome address and Vote of Thanks. Reading for details and Global Comprehension- A Speech by NR Narayana Murthy and Digging by Seamus Heaney Critical Thinking: Asking ' wh ' questions Questions, Making informed decisions based on evidence, Examining Evidence by citing evidence from the textbook or lecture to support a position. Vocabulary - Word association, onomatopoeic words. Language focus: Sentence Function and Sentence Kinds Writing: Writing email , Writing Diary Entry

Unit 4 AFTER TWENTY YEARS**9 Hrs.**

Listening: For details and Overall Idea, Speaking: Informal Speech, Reading for details and Global Comprehension- After Twenty Years by Jamila and After Twenty Years by O Henry Writing: Problem solving paragraph writing. Letter to the editor with solutions to current problems related to areas covered in the course Critical Thinking: Problem Solving selecting effective solutions for overcoming obstacles or constraints by explaining why it is the most effective of the possible solutions. Vocabulary : Phrasal Verbs Language Focus Types of sentences -simple, compound and complex. Language Focus: Subject verb Agreement

Unit 5 I LOVE YOU MOM**9 Hrs.**

Listening for details Speaking- Greeting , thanking , apologising, offering condolences by doing Role plays Reading for details and Global Comprehension- I Love you Mom by Joanna Fuchs and Prose passage on ' I Love You Mom'. Writing: Writing restaurant review, argumentative writing. Vocabulary: Phrasal Verbs , Synonyms and Antonyms Critical Thinking : Argumentation provides a well-articulated and detailed argument

Max. 45 hours**TEXT BOOKS:**

P Bhaskaran Nair, C Radha Krishna Pillai, Geetha Rajeevan, CLN Prakash, Nadhini Nayar Reflections - An Anthology of Prose, Poetry and Fiction (2015) Foundation Books, Chennai . Foundation Books. ISBN 978-93- 85386-008 References: Sen S, Mahendra et al. (2015) Communication and Language Skills . Foundation books. Chennai

SHS1210	GENERAL ENGLISH – II	L	T	P	Credits	Total Marks
		3	0	0	3	100

OBJECTIVES OF THE COURSE:

The paper provides opportunities for students to read and respond to representations of current issues through texts that present themes and topics that are familiar, insightful and informative. The thrust is on preparing students to effectively communicate by applying reflective thinking practices. Students will have an opportunity to improve their vocabulary related to immediate environment, practice speaking skills by discussing about issues based on reading texts, read texts that include everyday problems that provide opportunities to develop problem solving skills in cooperative learning situations, develop writing skills by summarising substance of a poems, letters and composition of dialogues and paragraphs.

UNIT 1 UNITY OF MINDS - A P J ABDUL KALAM

9Hrs.

Listening for details, Speaking - making a presentation, Reading for details and Global Comprehension Unity of Minds by APJ Abdul Kalam -Vocabulary Binomials Writing: Writing compare contrast paragraphs by representing data given in pie chart, Tables; Writing Speeches. Vocabulary : Binomials, Affixes Language Focus : Active and Passive Voice, Punctuation. Critical Thinking : Comparing & Contrasting presenting information by including important characteristics on which the items should be compared or contrasted

UNIT 2 LEAVE THIS CHANTING AND SINGING AND TELLING OF BEADS BY RABINDRANATH TAGORE AND ENGINE TROUBLE BY R K NARAYANAN

9 Hrs.

Listening for details Speaking: Giving impromptu speech based on topics given in the class for clarifying one's point of view. Reading for Comprehension and for overall idea -Leave this Chanting and Singing and Telling of Beads by Rabindranath Tagore and Engine Trouble by R K Narayanan, Vocabulary : Archaic words, phrases Writing: Language Focus Imperatives. Writing: Writing Instructions and recommendations based on quotations given as prompts, writing an advertisement Critical Thinking: Expressing point of view

UNIT 3 THE HAPPY PRINCE BY OSCAR WILDE

9 Hrs.

Speaking Telephonic conversation, Drama In the class based on the story prescribed Reading for details and Global Comprehension The Happy Prince by Oscar Wilde Language Focus: Adjective- degrees of Comparison, Functional and personal Nouns Vocabulary : positive and negative connotations. Writing: Letter writing- personal letters Critical Thinking Self-regulation: Continuing improvement in thinking, involving monitoring one's cognitive process and correcting errors and biases as needed.

UNIT 4 TWO GENTLEMEN OF VERONA BY A J CRONIN

9 Hrs.

Listening for Overall information of 'Anthem for Doomed Youth' by Wilfred Owen Speaking: Making requests and suggestions. Reading for details Two Gentlemen of Verona by A J Cronin, Vocabulary: Simile, metaphor, adjectives to describe people and their personalities. Idioms. Writing: Writing recommendations; Narratives based on prompts on plot and characters. Critical Thinking: identifying the subject of the investigation and presenting a well-articulated solution to the confusions or contradictions associated with the situation based on listening speaking tasks in the class. Creative writing - stories and poems Language Focus: Reported Speech

UNIT 5 THE AVENGER BY ANTON CHEKHOV

9 Hrs.

Listening for specific details Speaking using imagination. Reading to identify factual and inferential information Writing: Imaginative writing by predicting. Vocabulary : Countable forms and meaning, foreign nouns and framing of plurals. Language focus: Modal verbs, use of would. Critical Thinking: Deductive reasoning- generating a valid prediction or conclusion by articulating the relationship between the prediction or conclusion

Max. 45 hours

TEXT / REFERENCE BOOKS:

P Bhaskaran Nair, C Radha Krishna Pillai, Geetha Rajeevan, CLN Prakash, Nadhini Nayar Reflections - An Anthology of Prose, Poetry and Fiction (2015) Foundation Books, Chennai. Foundation Books. ISBN 978-93- 85386-008

Sen S, Mahendra et al. (2015) Communication and Language Skills. Foundation books. Chennai

<https://designteachengage.wisc.edu/course-activities-learner-interaction/sdc-activity-types-active-learning/>

<https://www.uen.org/rubric/previewRubric.html?id=1219>

<https://www.diigo.com/profile/Teachonlineuw?query=%22Critical+Thinking%22+rubric>

SBCA1202	BASICS OF COMPUTERS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

- To familiarize in MS Office applications and C programming. To learn the basic concepts of computer hardware.

UNIT 1 INTRODUCTION TO COMPUTERS

9 Hrs.

Introduction to Computer Hardware – Processors – Assembling a Personal Computer – Hard disk partitioning – Installing Hardware Drivers – Installation of Operating System

UNIT 2 WORD PROCESSING

9 Hrs.

Word Processor – Introduction – Alignments – Formats – Table - Mail Merge – Spell Check – Grammar – Macros

UNIT 3 SPREAD SHEETS

9 Hrs.

Spread Sheet – Introduction – Cells – Cell Formats – Auto Fill – Pivot Table – Formulas – Conditional Formatting – Sort – Filter – Data Validation – Charts - Macros

UNIT 4 PRESENTATION

9 Hrs.

Presentation – Introduction – Master Slide – Format – Insert Images – Videos – Graphs – OLE – Animation – Hyper Links- Introduction to Online Tools – Online Forms – Online Storage – Collaboration – Calendar

UNIT 5 INTRODUCTION TO ALGORITHMS

9 Hrs.

Introduction: Algorithms, Pseudocodes & flowcharts, Overview of C, features of C, Structure of C program, Compilation & execution of C program. Identifiers, variables, expression, keywords, data types, constants, scope and life of variables, and local and global variables. Operators: & Type conversion in expressions. Basic input/output and library functions: Single character input/output i.e. getch(), getchar(), getche() & putchar(). Formatted input/output: printf() and scanf(). Control structures and functions- Arrays and strings- storage classes and pointers, Memory management

Max. 45 Hours

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Conceptually understand the various components of computer architecture.

CO2 - Upon completion of this course, the students will be able to:

CO3 - Understand the concepts, structure, types and design of operating Systems

CO4 - Knowledge of computer equipment, including both hardware and software.

CO5 - Use word-processing software (MS-Word), spreadsheet software (MS-Excel) and presentation software (MS-PowerPoint) to solve basic information systems problems.

CO6 - Read, understand and trace the execution of programs written in C language



Employability



Entrepreneurship



Skill Development