



- Constituent College of JSS Science and Technology University
- Approved by A.I.C.T.E
- Governed by the Grant-in-Aid Rules of Government of Karnataka
- Identified as lead institution for World Bank Assistance under TEQIP Scheme



DEPARTMENT OF BIOTECHNOLOGY

List of PhD course work subjects

Sl. No	Subject Code	Subject Name	Credits
1	BTD01	Microbial Biotechnology	4
2	BTD02	Microbiology and Immunology	4
3	BTD03	Cell and Molecular Biology	4
4	BTD04	Process modelling and Simulation	4
5	BTD05	Momentum Transfer and Mechanical Operation	4
6	BTD06	Biochemistry and Enzyme technology	4



- Constituent College of JSS Science and Technology University
- Approved by A.I.C.T.E
- Governed by the Grant-in-Aid Rules of Government of Karnataka
- Identified as lead institution for World Bank Assistance under TEQIP Scheme



MICROBIAL BIOTECHNOLOGY

Subject Code: BTD01

Credit: 4:0 0

UNIT MODULE

Unit: 1. Introduction to Microbial process and Fermentation technology: Isolation, strain improvement, preservation and maintenance of industrially important microorganisms. Design and optimization of fermentation media. Microbial production of ethanol, butanol, Wine, vinegar, citric acid, lactic acid.

Unit: 2. Genetic engineering of microbes: Introduction to microbial biotechnology, General principles and applications of microbial biotechnology. Gene introduction, expression and production of industrially important proteins in bacteria and Yeast, Cloning techniques, expression of cloned genes, recovery and purification of proteins.

Unit: 3. Applications of genetic engineering for the production of vaccines, insecticides and whole cell products: Traditional vaccines and their problems, Impact of Biotechnology on vaccine development, sub unit vaccines, peptide vaccines. Microbial insecticides: *Bacillus thuringiensis*, *Bacillus sphaericus*, *Bacillus popillae* and Baculoviruses. Production of SCP, Bakers Yeast, Mushroom and Biofertilizers.

Unit: 4. Environmental Microbial Technology : Bioleaching; microorganisms in mineral recovery, leaching of iron, sulfur, gold and uranium. Microbial degradation of Xenobiotics, Genetic engineering in control of Industrial pollution, Microorganisms in removal of heavy metals from aqueous effluents, Sewage and waste water Microbiology

Unit: 5. Industrial Microbial Technology

Production of penicillin, streptomycin, tetracyclines, erythromycin, glutamic acid, lysine, tryptophan, cyanocobalamin and riboflavin. Microbial enzymes: amylases, pectinase, lipase, protease, rennet, glucose isomerase, cellulose, penicillinase. Microbial polysaccharides and polymers: Bacterial polysaccharides; structure and role in nature, production of xanthan gum, biosynthesis of polyesters. Flavors, microbial pigments, microbial lipids and fatty acids.

TEXT BOOKS:

1. Alexander N Glazer – Hiroshi Nikaido (2007) Microbial Biotechnology, W H Freeman & Company New York.
2. Michael J. Waites *et. al.* (2001) Industrial Microbiology- Blackwell Sciences limited.

REFERENCE BOOKS:

1. Prescott, Harley and Klein (2013), Microbiology, Mc-Graw- Hill publishers.
2. P.F. Stanbury and A. Whitaker (2008), Principles of fermentation technology, Pergamon Press.



- Constituent College of JSS Science and Technology University
- Approved by A.I.C.T.E
- Governed by the Grant-in-Aid Rules of Government of Karnataka
- Identified as lead institution for World Bank Assistance under TEQIP Scheme



MICROBIOLOGY AND IMMUNOLOGY

Subject Code: BTD02

Credit: 4:0 0

Unit module

Unit-1: Microscopic and pure culture techniques

Microscopic Examination: Bright-field Microscopy, Dark-field Microscopy, Phase-Contrast Microscopy, Fluorescence Microscopy, and Electron Microscopy. Microbial Techniques: Pure culture techniques, staining of microorganisms, Enumeration of microorganisms. Characterization of microorganisms Sterilization Techniques: Heat, Steam, Radiation, Filtration and Chemical.

Unit-2: Microbial Physiology & Genetics

Microbial Nutrition: Common nutrient requirements, culture media, Microbial growth: The growth curve, factors affecting growth, measurement of growth. Bacterial genetics: Study of microbial genetics, Inheritance, Bacterial recombination, conjugation, transduction and transformation.

Unit 3: Medical Microbiology

Common Microbial diseases and their control, Bacterial: Typhoid, Tuberculosis, Cholera, Leprosy, Syphilis, and Diarrhea, Viral: AIDS, Hepatitis, SARS, Polio, and Rabies. Fungal: Candidiasis, Mycoses.

Unit 4: Humoral and cell mediated immunity

B- Lymphocytes and their activation, structure and function of immunoglobulins, Immunoglobulin classes and their subclasses, Monoclonal antibodies and their applications, MHC, antigen antibody interactions. Thymus derived lymphocytes (T cells), their types, classification, antigen presenting cells, macrophages, dendritic cells, langerhans cells: their origin and function. Mechanism of T cell activation,

Mechanism of Phagocytosis, immuno suppression and immuno tolerance
Hypersensitivity and allergic reactions, Cytokines and their role in immune response,
macrophage activation and granuloma formation.

Unit 5: Molecular Immunology

Auto antibodies in humans, pathogenic mechanisms, auto immune diseases, auto immune disorder, treatment, AIDS, Biochemistry of Cancer. Stem cell, Bone marrow and kidney transplants. Molecular diagnostics: PCR and RT-PCR based & RFLP based techniques. Gene therapy: types and uses of r-DNA construct for gene therapy, Transgenic mice development.

TEXT BOOKS:

1. Prescott, Harley and Klein, 2004, Microbiology, WCB McGraw-Hill Publishers.
2. Pelczar, Chan and Krieg, 1998, Microbiology, TATA McGraw-Hill Publishers.
3. Goldsby, R.A., Kindt T. J. and Osborne, B.A., 2006, Kuby Immunology, Freeman Publishers.
4. Peter, J. Delvis, Seamus, J. Martin, Denis, R. Burton and Ivan, M. Roitt, 2001, Roitts Essentials of Immunology, Blackwell Publishing.

REFERENCE BOOKS:

1. Stainer, R. L. Ingram, J. L. and Wheelis, M. L. 2007, General Microbiology, Macmillan Press Ltd.
2. Prescott and Dunn, 2006, Industrial Microbiology, WCB McGraw-Hill Publishers
3. Dulsy Fatima and Armugam, N. 2015, Immunology, Saras Publication
4. Paul, W, Lippincott Williams and Wilkins, 2012. Fundamentals of Immunology, Lippincott Publishers.



- Constituent College of JSS Science and Technology University
- Approved by A.I.C.T.E
- Governed by the Grant-in-Aid Rules of Government of Karnataka
- Identified as lead institution for World Bank Assistance under TEQIP Scheme



CELL AND MOLECULAR BIOLOGY

Subject Code: **BTD03**

Credit: 4:0 0

UNIT MODULE

Credits: 4:0:0

UNIT 1: CELL AND ITS ORGANELLES

Introduction to concept of cell, differentiating prokaryotic and eukaryotic cell details: plant and animal cell. Structure and functions of: cell wall and membrane, endoplasmic reticulum, mitochondria, Golgi complex, chloroplast, ribosomes, lysosomes, peroxisomes, cytoskeletal structures - Microtubules, Microfilaments and Intermediate filaments, nucleus and its composition: Nucleoplasm, nucleolus, chromatin material, Chromosomes morphology and packaging of chromatin material.

UNIT 2: CELL DIVISION AND PROGRAMMED CELL DEATH

Cell cycle and its regulation, mitosis and meiosis, programmed cell death, function of caspase protein in cell death, activation of procaspases. Extrinsic and intrinsic signaling pathways in apoptosis.

UNIT 3: Introduction to Genetic material and DNA Replication

Organization of Prokaryotic and Eukaryotic chromosome, DNA as genetic material, Information flow in biological systems: central dogma. Structures and forms of nucleic acids – DNA and RNA. Replication of DNA, Enzymes of DNA replication, structure and function of DNA polymerases, models of replications in prokaryotes and eukaryotes, mechanism of DNA replication.

UNIT 4: Transcription & Translation process

Eukaryotic RNA polymerases, Bacterial RNA polymerase, structure and function of RNA polymerases (prokaryotes & eukaryotes), mechanism of transcription in prokaryotes and eukaryotes, transcription factors, posttranscriptional processing, transcription inhibitors, Mechanism of translation, Post translational modification, inhibitors of translation.

UNIT 5: Gene Expression in Prokaryotes & Eukaryotes

Structure and Classification of genes, Regulation of gene expression in prokaryotes: Operon model, gal, lac, trp Operons; positive versus negative regulation. Regulation of eukaryotic gene expression, transcriptional control, monitoring gene expressions

TEXT BOOKS:

1. David Freifelder, 1993, **Essentials of Molecular Biology** , Jones and Bartlett Publishers.
- 2 Alberts, Lewis, Raff, Roberts and Walter. 1994. **Molecular Biology of the Cell.** Garland Publishing.

REFERENCE BOOKS:

1. Brown.T.A. 2006. **Genomes.** Garland Science Publishers.
2. HarveyLodish, Arnold Berk, Lawrence Zipursky, Paul Matsudaira, David Baltimore
and James Darnell, 1991, **Molecular Cell Biology**, W.H.Freeman and Company Publishers.



- Constituent College of JSS Science and Technology University
- Approved by A.I.C.T.E
- Governed by the Grant-in-Aid Rules of Government of Karnataka
- Identified as lead institution for World Bank Assistance under TEQIP Scheme



PROCESS MODELING AND SIMULATION

Subject Code: BTD04

Credit: 4:0 0

Unit Module

UNIT I- : SOLUTIONS FOR VARIOUS MATHEMATICAL EQUATIONS

Solution for linear equations: Cramer's rule, matrix inversion method, Gauss elimination method, Gauss Jordan elimination method, Jacobi method, Gauss sieedel iterative method. Solution for differential equation: Runge Kutta method. Solutions for integral equations: Simpson's 1/3 rd rule, Simpson's 3/8 rule and Trapezoidal rule. Solutions for polynomial equation: Newton's Raphson method.

UNIT2 MATHEMATICAL MODELS FOR FLUID FLOW AND ENERGY TRANSFER

Mathematical model for continuity equation, Mathematical model for flow through Mathematical model for Steady state heat conduction through hallow cylindrical pipe, Mathematical model for unsteady state steam heating of a liquid, Mathematical model, Mathematical model for double pipe heat exchanger and numerical problems.

UNIT3 -MATHEMATICAL MODELS FOR VARIOUS TYPES OF REACTORS AND SEPERATION TECHNIQUES

Mathematical model for extraction (steady and unsteady state), Mathematical model for distillation, Mathematical model for absorption , mathematical models for Batch and continuous reactors, Mathematical model for evaporators(different effect) and Numerical problems.

UNIT4 -MATHEMATICAL MODELS FOR BIOCHEMICAL REACTIONS AND NOVEL SEPERATIONS

Mathematical model for biochemical reactor, Mathematical model for reverse osmosis, Mathematical model for trickle bed reactor, and Mathematical model for spiral wound membrane module and tubular membrane module, Mathematical model for bubble column reactor and numerical problems

UNIT5 –SIMULATION OF BIOCHEMICAL ENGINEERING SYSTEMS.

Process simulation, Scope of process simulation, Formulation of problem Organization of simulation packages, Professional simulation packages ,HYSIS , HYSIS products, stepwise methodology of HYSIS usage for problems, FLUENT ,structure of program, Capabilities of FLUENT, Using FLUENT an overview, Physical models in FLUENT and introduction to MAT lab.

TEXT BBOOKS

1. J. Dunn, E. Heinzle, J. Ingham, J. E. P. fenosil “Biological Reaction Engineering: Dynamic Modelling Fundamentals with Simulation Examples” WILEY-VCH Verlag GmbH & Co. KGaA, Weinheirn ,2003
2. J.R. Leigh, Modeling and Control of fermentation Processes, Peter Peregrinus, London, Revised edition, 2000

REFERENCE BOOKS:

3. B.V Babu “Process plant simulation “, Oxford university, revised edition 2004.
4. Gaikwad R.W and Dhirendra “Process modeling and simulation - WILEY , Central techno publications 2008



- Constituent College of JSS Science and Technology University
- Approved by A.I.C.T.E
- Governed by the Grant-in-Aid Rules of Government of Karnataka
- Identified as lead institution for World Bank Assistance under TEQIP Scheme



MOMENTUM TRANSFER AND MECHANICAL OPERATIONS

Subject Code: BTD05

Credit: 4:0 0

UNIT MODULE

UNIT 1: INTRODUCTION TO UNIT OPERATIONS

Concepts of Unit Operations and Unit Processes. Units and dimensions. Basic and derived units. Dimensional homogeneity. Dimensionless numbers. Similitude: geometric, dynamic and kinematics criteria. Rayleigh's method, Buckingham's pi theorem. Newtonian and Non Newtonian fluids. Power law model, Maxwell's model and viscous models. Time dependent and time independent models.

UNIT 2: FLUID RHEOLOGY

Fluid Definition. Pressure measurements, manometric equations, different types of monometers. Reynolds number, types of flow. Continuity and Bernoulli's equations, Euler's equation. Flow through circular and non circular conduits. Hagen Poiseuille equation. Losses through pipe and fittings, flow through stagnant fluids. Free and hindered settling, Stoke's law, Newton's law, terminal settling velocity and sedimentation. Flow past immersed bodies- drag, drag coefficient. Kozney-karmen equation. Fluidization.

UNIT 3: FLUID FLOW MEASUREMENT

Pipe and pipe fittings. Flow measurements: Orifice meter, venture meter, Rotometer, pitotube, notches, weirs and other flow measuring techniques. Energy calculations. Pumps: Centrifugal and reciprocating pumps, characteristics of centrifugal and reciprocating pumps. Valves, steam traps, pressure regulators, Pressure gauges. Numerical problems.

UNIT 4: UNIT OPERATIONS-1

Size reduction, sieve analysis. Sedimentation, sedimentation equipment. Mixing: types of mixers, power number and power consumptions in mixing operations.

UNIT 5: UNIT OPERATIONS-2

Sedimentation ,Filtration: filtration equipment, constant rate and constant pressure filtration. Centrifugation: Types of centrifuges and Numerical problems.
Sedimentation

TEXT BOOKS:

1.Elements of Chemical Reaction Engineering by H. S. Fogler, New Jersey, 2009

REFERENCE BOOKS:

1. Elementary Principles Of Chemical Processes by R. M. Felder And R. W. Rousseau, Wiley India Pvt. Ltd., New Delhi., 2010

Coulson And Richardson's Chemical Engineering, Volume 2 by J. M. Coulson, J. F. Richardson, J. R. Backhurst And J. H. Harker, Elsevier India, 2006



- Constituent College of JSS Science and Technology University
- Approved by A.I.C.T.E
- Governed by the Grant-in-Aid Rules of Government of Karnataka
- Identified as lead institution for World Bank Assistance under TEQIP Scheme



BIOCHEMISTRY AND ENZYME TECHNOLOGY

Subject Code: BTD06

Credit: 4:0 0

Unit 1: Amino acid, peptides and proteins: Essential and non-essential amino acids, amino acids building blocks of proteins, classification, structure and properties of amino acids, peptide bonds. Biologically important peptides. Primary, secondary, tertiary and quaternary structures of proteins. Outline of various biological functions of proteins.

Unit 2: Nucleotides and Nucleic acids: Nucleic acid structure, Nucleotides of DNA and RNA, overview of Biosynthesis, bonding, sugar component, ribose puckering, double helix stabilization, different forms of DNA & RNA, its structural intricacies and functional aspect of them.

Unit 3: Carbohydrates: Introduction, classification, examples of monosaccharides, disaccharides, oligosaccharides and polysaccharides, overview of their biosynthesis, various biological functions of carbohydrates, Glycoconjugates: Proteoglycans, Glycoproteins, and Glycolipids Carbohydrates as Informational Molecules: The Sugar Code.

Unit 4: Lipids: Definition and nomenclature of fatty acids and their types, structure and biological functions of various class of lipids – Triacyl glycerol, phospholipids, glycolipids, sphingolipids, terpenoid lipids, steroids, alkyl glyceryl ethers and wax.

Unit 5: Vitamins, Hormones, Enzymes and Coenzymes: Classification, structure and functions of Vitamins. Classification, mechanism of action and functions of Hormones. Enzyme classification with examples Chemical nature and properties of enzyme, mechanism of enzyme action and outline of various biological functions of enzymes. Structure and functions of Coenzymes

Text books:

1. Lehninger Principles of Biochemistry by David L. Nelson, Michael M. Cox, Fifth edition, W.H. Freeman and company ,2009.
2. Biochemistry, by Donald Voet and Judith Voet, Third Edition,Wiley publications,2004.

Reference Book:

1. Biochemistry by J.M. Berg, J.L. Tymoczko and L. Stryer, Fifth edition, W.H. Freeman and company,2002