JSS MAHAVIDYAPEETHA

JSS SCIENCE & TECHNOLOGY UNIVERSITY, MYSURU

SRI JAYACHAMARAJENDRA COLLEGE OF ENGINEERING, MYSURU

M.TECH PROGRAMME IN

BIOTECHNOLOGY

SCHEME I TO IV SEMESTER: 2017-2018

&

SYLLABUS I TO IV SEMESTER: 2017-2018

DEPARTMENT OF BIOTECHNOLOGY

Scheme of Teaching and Examination for M.Tech (Biotechnology)

JSS MAHAVIDYAPEETHA

JSS SCIENCE & TECHNOLOGY UNIVERSITY

SRI JAYACHAMARAJENDRA COLLEGE OF ENGINEERING MYSORE

DEPARTMENT OF BIOTECHNOLOGY

Scheme of Teaching and Examination for M.Tech (Biotechnology)

SEMESTER	CREDITS
I	28.0
II	28.0
III	18.0
IV	26.0
TOTAL	100.0

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Scheme of Teaching and Examination for M.Tech (Biotechnology)

I Semester

Sub code	Name of the subject	Teaching Department	Credits				Contact hours	Marks			Exam duration in hrs
			L	T	P	Total		CIE	SEE	Total	
BTM 110	Frontiers in Biotechnology	Biotechnology	5	-	-	5	5	50	50	100	03
BTM 120	Engineering Principles of Biotechnology	Biotechnology	4	1	-	5	6	50	50	100	03
BTM 130	Structure and Functions of Biomolecules	Biotechnology	5	-	-	5	5	50	50	100	03
BTM 140	Immunology and Infection Biology	Biotechnology	5	-	-	5	5	50	50	100	03
BTM 150	Bioprocess Optimization and Control	Biotechnology	4	-	1	5	6	50	50	100	03
BTM160L	Microbiology and Molecular Techniques	Biotechnology	-	-	1.5	1.5	3	50	-	50	-
BTM170	Seminar	Biotechnology	-	-	1.5	1.5	3	50	-	50	-
			Total Credits			28	33	Total Marks		600	

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Scheme of Teaching and Examination for M.Tech (Biotechnology)

II Semester

Sub code	Name of the subject	Teaching Department	Credits				Contact hours	Marks			Exam duration in hrs
			L	T	P	Total		CIE	SEE	Total	
BTM 210	Molecular Cell Biology and Genetic Engineering	Biotechnology	5	-	-	5	5	50	50	100	03
BTM 220	Molecular Diagnostic and Therapeutic Biotechnology	Biotechnology	4		1	5	6	50	50	100	03
BTM 230	Process Modeling and Simulation	Biotechnology	5	-	-	5	5	50	50	100	03
BTM 24X	Elective-1	Biotechnology	5	-	-	5	5	50	50	100	03
BTM 25X	Elective-2	Biotechnology	5	-	-	5	6	50	50	100	03
BTM260L	Principles of Bioengineering Lab	Biotechnology	-	-	1.5	1.5	3	50	-	50	-
BTM270	Seminar	Biotechnology	-	-	1.5	1.5	3	50	-	50	-
			Total Credits			28	33	Total Marks		600	

ELECTIVES

Sl. No	Subject Code	Subject	Sl. No	Subject Code	Subject
1	BTM241	Biomaterials and Surface Biotechnology	1	BTM251	Human Molecular Genetics and Cancer
2	BTM242	Process Validation and Engineering	2	BTM252	Regulatory Basis of Development and Manufacture of Biopharmaceuticals
3	BTM243	Quality Control and Management	3	BTM253	Health Care Biotechnology
4	BTM244	Instrumental Methods of Analysis			
5	BTM245	Chemical Reaction Engineering, Transport Phenomena and Mathematical Method			

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Scheme of Teaching and Examination for M.Tech (Biotechnology)

III Semester

Sl. No	Subject code	Course title	Teaching department	Credits				Contact hours	Marks			Exam duration in hrs
				L	T	P	Total		CIE	SEE	Total	
1	BTM310	Practical Training in Industry / Exploration Research	Biotechnology	0	0	4	4	–	100	–	100	–
2.	BTM41P	Project Work (Phase-I)	Biotechnology	0	0	14	14	–	100	–	100	–
				Total credits			18	–	Total marks		200	–

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Scheme of Teaching and Examination for M.Tech (Biotechnology)

IV Semester

Sl. No	Subject code	Course title	Teaching department	Credits				Contact hours	Marks			Exam duration in hrs
				L	T	P	Total		CIE	SEE	Total	
1	BTM41P	Project Work (Phase-II)	Biotechnology	–	–	26	26	–	200	100	300	3
				Total credits			26	–	Total marks		300	–

Department of Biotechnology, SJCE, Mysuru

Subject Name & Code	**FRONTIERS IN BIOTECHNOLOGY BTM110**
No. of Teaching Hours – 65	**Credits : 5:0:0 L-T-P**
CIE Marks : 50	**SEE Marks: 100**

Unit I: Introduction

Facts about Biotechnology, Biotechnology time line & significance, Industry statistics. How does Biotechnology work? International & National Biotechnology organizations. Relevant case studies.

10hrs

Unit II: Medical

Recombinant DNA drugs, Monoclonal Antibody-based Drugs, molecular drug designing and Drug development, Drug Development & Approval Process, Approved Biotechnology drugs. Gene therapy, Micro RNAs and RNAi as Human Therapeutics, Cloning in mammals and hES and Adult stem cells, Natural Bioactive drugs, Neutraceuticals,Biotechnology and Global Health. Drug case studies.

14hrs

Unit III: Animal Health

Animal Genetic resources and Conservation and cataloguing, Anthropology, Management of Wild Life Populations, Animal Health care and Biotechnology. Case Study.

12hrs

Unit IV: Marine Biotechnology

Aqua culture, Seafood safety and Human Health, Biofilms and Corrosion, Biomaterials and Bioprocessing.

13hrs

Unit V: Agriculture Biotechnology

Genetically Modified Crops, Plant Incorporated Protectants, Crops on the market, Who's who in Agriculture Biotechnology, Bt Insect Resistance Management & Safety, Molecular breeding, Disease targets, Environmental regulation & Safety of GM crops and food issues related to acceptance.

16hrs

Text Books

1. Morgan Rempel – *A Student's Guide to Biotechnology*, (Greenwood Publishing Group, ISBN: 0313322562)
2. *A Revolution in Biotechnology*, (Cambridge University Press, ISBN: 052137490)

References:

1. D. Grierson & S.N. Covey- *Plant Molecular Biology*, (Blackie, London)
2. William Bains - *Biotechnology from A to Z, 2nd edition*, (Oxford University Press, ISBN: 0199633347)

Department of Biotechnology, SJCE, Mysuru

Subject Name & Code	**ENGINEERING PRINCIPLES OF BIOTECHNOLOGY BTM120**
No. of Teaching Hours – 65	**Credits : 5:0:0 L-T-P**
CIE Marks : 50	**SEE Marks: 100**

COURSE OBJECTIVE:

1. To introduce fundamental principles of mechanical operations used in Bioprocess industries.

2. To Provide fundamental concepts of fluid statics and fluid dynamics.

3. TO develop concepts and mathematical tools required to understand and analyze

- Processes involved in Biological systems.
- Unit operations in product recovery
- Unit processes in product recovery
- Models related to Fermentation
- Energy balances in different processes

4. To understand principles of Heat transfer

5. To understand principles of Mass transfer

COURSE OUTCOMES

After completing the course students will be able to

1. Identify and adopt suitable physical operations for size reduction that has to be used in bioprocess industry.
2. Use the concepts developed for fluid flow analysis to issues in bioprocessing
3. Apply basic engineering principles to systems containing biological systems and solve problems related to separation techniques and unit processes used in bioprocess industry.
4. Blend the principles and mechanism of heat transfer in issues related to biochemical operations.

5. Blend the principles and mechanism of mass transfer operations in issues related to biochemical operations

Unit 1: Mechanical operations:

Unit process, Unit operations, Size reducing techniques, Separation techniques, Sedimentation, Fluidization, Filtration, Mixing, Agitation. **10hours**

Unit 2: Fluid Mechanics:

Dimension analysis, Newton's law of Viscosity, Manometers, Types of flow, Bernoulli's equation, Hagen poiselle equation, Flow measuring devices

15 hours

Unit 3: Stoichiometry:

Units and dimensions, Material balance for Unit process, Material balance for Unit Operations, Energy balances.

10 hours

Unit 4: Heat transfer:

Heat transfer by Conduction, Convection and Radiation, Heat transfer by Condensation, Heat transfer equipments, Evaporation.

15 hours

Unit 5: Mass transfer:

Types of Diffusion, Fick's law of diffusion, Absorption, Adsorption, Crystallization, Drying, Distillation, Extraction.

15hours

TEXT BOOKS:

1. McCabe Smith, "Unit operations of Chemical engineering" McGraw Hill Pub
2. Coulsan,JM and Richardson J F Chemical Engineering, McGraw Hill Pub

Reference Books:

1. R.E .Trebal,"Mass transfer Operations",Mcgraw Hill Co..
2. Vora and Batt, "Stoichiometry", Tata Mcgraw Hill co

Department of Biotechnology, SJCE, Mysuru

Subject Name & Code	**STRUCTURE AND FUNCTION OF BIOMOLECULES** **BTM130**
No. of Teaching Hours – 65	**Credits : 5:0:0 L-T-P**
CIE Marks : 50	**SEE Marks: 100**

Course objective

The subject is designed to equip students with a broad understanding of the chemical and molecular structures of biological molecules as well as functions of them. The subject provides a foundation for careers in Biotechnology, or research in all branches of the biological sciences.

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.

14 hrs

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.

12**hrs**

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.

12hrs

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.

12 hrs

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

15 hrs

Text books:

1. Lehninger Principles of Biochemistryby 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.

Department of Biotechnology, SJCE, Mysuru

Subject Name & Code	**IMMUNOLOGY AND INFECTION BIOLOGY BTM140**
No. of Teaching Hours – 65	**Credits : 5:0:0 L-T-P**
CIE Marks : 50	**SEE Marks: 100**

Course Outcome :

Students will conceptualize different components of immune system their function hematopoesis and MHC.

Students would be able to apply and choose different techniques in diagnosis of immunodiseases and infection. And knowledge will employ to develop scientific method to generate new technique.

Explore the strategies to improve existing vaccines and new approach to make them more effective in the treatment.

To determine how immune modulate strategies can be used to express unwanted immune response in hyper sensitivity, auto immune diseases and transplantation

Acquire the knowledge of different type of cancer and different strategies used for the treatment of cancer effectively.

Unit I

Fundamental concepts and anatomy of the immune system: Components of innate and acquired immunity; Phagocytosis; Complement and Inflammatory responses; Haematopoesis; Organs and cells of the immune system: ymphoidtissue.,(MALT & CALT); Antigens - immunogens, haptens; Major Histocompatibility : Complex - MHC genes, MHC and immune responsiveness and disease susceptibility, HLA typing : Immunoglobulins-basic structure, classes and subclasses of immunoglobulins, antigenic determinants; Multigene organization of immunoglobulin genes; B cell maturation, activation and differentiation; Generation of antibody

diversity; T-cell maturation, activation and differentiation and T-cell receptors; Functional T Cell Subsets; Cell-mediated immune responses, ADCC.

Unit II

Antigen-antibody interactions: Precipitation, agglutination and complement mediated immune reactions; Advanced immunological techniques - RIA, ELISA, Western blotting, ELISPOT assay, immunofluorescence, flow cytometry and immunoelectron microscopy , CMI techniques-lymphoproliferation assay, Mixed lymphocyte reaction, Cell Cytotoxicity assays, Apoptosis, Microarrays, Transgenic mice, Gene knock outs.

Unit III

Vaccinology: Active and passive immunization; Live, killed, attenuated, sub unit vaccines; Vaccine technology- Role and properties of adjuvants, recombinant DNA and protein based vaccines, plant-based vaccines, reverse vaccinology; Peptide vaccines, conjugate vaccines; Antibody genes and antibody engineering- chimeric and hybrid monoclonal antibodies;

Unit IV

Clinical Immunology: Immunity to Infection : Bacteria, viral, fungal and parasitic infections (with examples from each group); Hypersensitivity – Type I-IV; Autoimmunity; Types of autoimmune diseases; Mechanism and role of CD4+ T cells; MHC and TCR in autoimmunity; Treatment of autoimmune diseases; Transplantation – Immunological basis of graft rejection; Clinical transplantation and immunosuppressive therapy; Tumor immunology – Tumor antigens; Immune response to tumors and tumor evasion of the immune system, Cancer immunotherapy; Immunodeficiency-Primary immunodeficiencies, Acquired or secondary immunodeficiencies.

Unit V

Cancer biology and treatment : Cancer cells and its types; metastatis-stages: Apoptosis- stages, signal transductions: Identification – mAB and protein markers; Cancer theraphy-Chemotheraphy, radiotheraphy, drug development and clinical trials.

Texts/References

1. Kuby, RA Goldsby, Thomas J. Kindt, Barbara, A. Osborne Immunology, 6th Edition, Freeman, 2002.

2. Brostoff J, Seaddin JK, Male D, Roitt IM., Clinical Immunology, 6th Edition, Gower Medical Publishing, 2002.

3. Janeway et al., Immunobiology, 4th Edition, Current Biology publications., 1999.

4. Paul, Fundamental of Immunology, 4th edition, Lippencott Raven, 1999.

Department of Biotechnology, SJCE, Mysuru

Subject Name & Code	**BIOPROCESS OPTIMIZATION AND CONTROL** **BTM150**
No. of Teaching Hours – 65	**Credits : 5:0:0 L-T-P**
CIE Marks : 50	**SEE Marks: 100**

COURSE OBJECTIVE:

The objective of the course is to

1. Understand Basic concepts of physical and mathematical modeling

2. Develop design equations for growth rate in different cultures

3. Optimize and scale up and scale down different parameters in fermentors

4. Monitor and control different parameters in fermentor

5. Determine mass transfer parameters in fermentor

Course outcome (CO)

After completion of the course

CO-1: Students will have the ability to understand Basic concepts of physical and mathematical modeling

CO-2: Students will have the ability to develop design equations for growth rate in different cultures

CO-3: Students will have the ability to optimaize and scale up and scale down different parameters in fermentors

CO-4: Students will have the ability to monitor and control different parameters in fermentor

CO-5: Students will have the ability to determine mass transfer parameters in fermentors

Unit 1: Modeling principles: Fundamentals of modeling, Types of modeling, Development of dynamic differential balances, formulation of balance equations.

10Hours

Unit 2: Bioreactor concepts and biological kinetics: Information for bioreactor modeling, bioreactor operation, enzyme kinetics, microbial kinetics, structured kinetic models(growth associated and non growth associated).. Bioreactor modeling batch reactors, tank-type biological reactors and tubular plug-flow bioreactors.

15 Hours

Unit 3: Scale-up and scale down process and optimization: Airlift reactors, Aeration and agitation, MassTransfer coefficient, scale-up and scale down methods bioprocessing. Optimization of medium. Optimization techniques (analytical, gradient, computerized) used in Bioprocesses. Online, offline and inline Optimization

15Hours

Unit 4: Automatic Bioprocess Control: Elements of feedback control, control principles, On-off controller, Proportional (P) controller, Proportional-Integral (PI) controller, Proportional-Derivative (PD) Controller, Proportional-Integral-Derivative (PID) Controller. Controller tuning, Measuring principles, online and offline sensors, Expert systems in bioprocess control. Artificial intelligence in bioprocess control.

15 Hours

Unit 5: Mass transfer in Biological Reactors: Mass transfer by diffusion, Theories of diffusion mass transfer, mass transfer by convection, Oxygen mass transfer methodologies in fermenters, general oxygen balances for gas-liquid transfer. Factors affecting oxygen transfer rate, intra –particle diffusion and reaction rate, selection criteria.

10 Hours

TEXT BOOKS

1. Process modeling – Morton M.Denn, Longman Scientific and Technical, 1987.
2. Process dynamics, modeling and control – Ray Ogunnaike, Babatunde A Ogunnaike, W.Harmon Roy. Oxford University Press, 1994

3. Process dynamics and control by Dale E.Seborg, Duncan A. Mellichamp, Thomas F.Edgar, Francis J.Doyle III John Wiley & Sons 1989

REFERENCE BOOKS

1. Biological Reaction Engineering, I.J Dunn, E. Heinzle, J. Ingham & J.E PrenosilWieley-VCH, 2003
2. Bioprocess Technology: Modeling and transport phenomena- BIOTOL Series, 2002

Department of Biotechnology, SJCE, Mysuru

Subject Name & Code	**Microbiology and Molecular Techniques** **BTM160**
No. of Teaching Hours – 39	**Credits : 0:0:1.5 L-T-P**
CIE Marks : 50	**SEE Marks:---**

PREREQUISITES: Students should have the knowledge of Biology, Chemistry, Biochemistry, basic Biotechnology and Microbiology.

COURSE OBJECTIVE:

1. The coursehelps students to understand microbiological techniques used in research and applications in pharmaceuticals and food industry.
2. The knowledge gained helps students doing research in molecular biology and genetic engineering.

COURSE OUTCOME

After completion of the course

1. Students have the ability to understand basic concept of isolation, culturing, identification and preservation of microorganism.
2. Students are able to understand concept and applications of molecular biology and genetic engineering techniques.

LIST OF EXPERIMENTS

1. Sterilization, disinfection, safety in microbiological laboratory.
2. Preparation of media for growth of various microorganisms.
3. Identification and culturing of various microorganisms.
4. Staining and enumeration of microorganisms.
5. Growth curve, measure of bacterial population by trubidometry and studying the effect of temperature, pH, carbon and nitrogen.
6. Isolation and screening of industrially important microorganisms.

7. Isolation of genomic DNA from *Bacillus subtilis* genome
8. PCR amplification of microbial gene and analysis of agarose gel electrophoresis.
9. Restriction digestion of vector (gel analysis) and insertion.
10. Transformation experiments of recombinant plants of microorganisms.
11. Blotting techniques.

REFERENCE BOOKS

1. Laboratory Methods in Microbiology (2010),W. F. Harrigan and Margaret E. McCance, ISBN: 978-1-4832-3205-8, Elsevier Publisher.

2. Molecular Biology Techniques **(2012, Third Edition)** *Carson, Susan,* ISBN: 978-0-12-385544-2, Elsevier Publisher.

Department of Biotechnology, SJCE, Mysuru

Subject Name & Code	**Molecular cell Biology and Genetic Engineering BTM210**
No. of Teaching Hours – 65	**Credits : 5:0:0 L-T-P**
CIE Marks : 50	**SEE Marks: 100**

Prerequisites: Students should have the fundamental knowledge of biology, Genetics and molecular biology

Course objectives: The objectives of this course are

1. To give an overview of prokaryotic and eukaryotic cells, to understand the structure and function relationship of each organ in plants and animals with an emphasis on their habitat diversity and adaptation.
2. To study differences in genome size, its complexity, organization and expression of gene and its regulation both in prokaryotes and eukaryotes.
3. To understand the processes of cell to cell communication through receptors, different forms of signaling in animals and plants,processes of cell cycle and its regulation, cell division in somatic and germline cells and steps involved in cell death.
4. To state the basic principles of genetic engineering, acquaint with tools and techniques of genetic manipulation.
5. To impart knowledge pertaining to genetic modification and its applications in various fields.

Course outcomes: After successful completion of this course, students would be:

1. Able to differentiate between the prokaryotic and eukaryotic cell, their diversity in habitat, adaptations and to relate the structure and function of all organs in plants and animals.
2. Able to explain genome size complexity, C- value paradox, repetitive elements, gene expression and its regulation in prokaryotes and eukaryotes.
3. Able to outline the concept of cell to cell communication receptors types, their classes and role in communication of animal and plant cells, analyze stages in cell cycle and its regulation, mitosis and meiosis and steps involved in apoptosis.

4. Able to describe the principle of genetic engineering, tools and techniques involved in gene manipulation of microbes, plants and animals.
5. Able to explain and evaluate applications of genetic engineering in agriculture, medicine, forensic science and evolutionary studies.

Unit 1. Unity and Diversity of cells

Universal features of cells on earth, diversity of cells on tree of life, different cell types: prokaryotes and eukaryotes. Viruses and their importance, Bacterial cells, shape and habitat diversity,reproductive cycle, cellsand their Diversity in habitat, classification, reproductive cycle and importance in: Algae, fungi Bryophytes, Pteridophytes and gymnosperms. Angiosperms and their diversity in habitat, unique features and importance of their adaptations and interactions with environment. Diversity of Animals, diversity in habitat, animal organ system and basic cell types -epidermal, epithelia, sensory epithelium, endothelium, airways and gut cells, Blood cells, skeletal muscle cells, neuronal, hepatic, pancreatic, Bile duct, kidney cells, cytoskeleton and unique features of higher animals and importance of their adaptations (Structural and behavioural) and interactions (Symbiosis-parasitism, mutualism, and commensalism) with environment.

12hrs

Unit 2. Genomes and regulation of gene expression

Genome size and evolutionary complexity, the c-value paradox, super coiling of DNA, the structure of bacterial and eukaryotic chromosomes, packaging of DNA, molecular structure of centromere and telomere, repetitive sequences in eukaryotic genomes, organelle genomes, an overview of gene control, DNA binding motifs in gene regulation, regulatory proteins, transcriptional factors, molecular switches and post transcriptional control, molecular mechanism of genetic regulation in prokaryotes and eukaryotes.

11hrs

Unit 3. Mechanism of cell communication,Cell cycle and Apoptosis

Quorum sensing, Cell-cell interaction in plants, role of plasmodesmata, principles of cell communication, signaling through GPCR, enzyme coupled surface receptors with different

examples,Overview of cell cycle, cell cycle control system, programmed cell death/apoptosis, steps and biochemical reaction involved in it.

11hrs

UNIT 4: Tools and Techniques of Genetic Engineering:

a) Isolation and purification of nucleic acids: Total cell DNA, Plasmid DNA,Bacteriophage DNA;
b) Manipulation of purified DNA: Range of DNA manipulating enzymes, Restriction endonucleases-function,Type II restriction endonucleases Blunt ends and sticky ends, Analyzing the result of cleavage, Restriction Mapping, Ligation-mode of action, linkers, Adaptors, homopolymer tailing.
c) Gene transfer techniques- Transformation –DNA uptake by bacterial cell, Transfection – phage DNA into bacterial cells
d) Vectors for Gene cloning - Cloning vectors for E. coli, Cloning vectors for Eukaryotes, Cloning vectors for higher plants, Cloning vectors for animals;
e) Selection, screening and identification of cloned genes- Direct selection, Identification of a clone from a Gene library, Methods of clone identification - Screening using nucleic acid hybridization, Immunological screening.

16hrs

UNIT 5: Applications of Genetic Engineering:

a) Agriculture: Transgenic farm animals, Crop improvement;
b) Biotechnology industry: Protein engineering, Metabolic engineering;
c) Medical application: Identification of disease, Gene therapy,
d) Forensic application: Studying kinship by DNA profiling, Identification of crime suspects by Genetic fingerprinting;
e) Evolutionary studies: Origin of modern humans, Study of prehistory human migration.

15hrs

Text Books

1. Alberts B et al. (2008) Molecular biology of the Cell. 6th edition, Taylor and Francis group,NY.

2. Hartl D.L and L.WJones (2009) Genetics- analysis of genes and genomes. 7th edition, Jones and Bartlett publishers.
3. BrownT.A. (2006) Gene Cloning and DNA Analysis: An Introduction, Wiley Publication.

References

1. Cooper G.M. and R.E. Hausman (2007). The Cell – A molecular approach 5th edition, ASM press.
2. Primrose S.B. and R.M. Twyman (2006). Principles of Gene manipulation and Genomics. 7th edition, Blackwell Publishing.
3. Glick B.R. and Pasternak J.J. (2010),Molecular Biotechnology: Principles andApplications of Recombinant DNA, ASM Press.

Department of Biotechnology, SJCE, Mysuru

Subject Name & Code	**Molecular Diagnostics and Therapeutic Biotechnology** **BTM220**
No. of Teaching Hours – 65	**Credits : 4:0:1 L-T-P**
CIE Marks : 50	**SEE Marks: 100**

Students will be able to

CO1: To have insights into the molecular basis of disease processes and its amalgamation in diagnosis and prognosis of human diseases.

CO 2: Have a thorough knowledge on the different diagnostic methods utilized and its careful selection based on performance specification of the tests in Diagnostic laboratories.

CO 3: Apply the diagnostics methods for genetic identification, diagnosis of different fungal, viral diseases and genetic disorders

CO 4: Relate to the importance of international standards and reference materials;

To relate patient results to ethical, legal, social issues in clinical practice

Guidelines; to help improve the quality of laboratory practices.

CO 5: Importance and use of modern biological drugs designed to block key

exogenous and endogenous mediators of several diseases.

Unit 1. Fundamentals Of Molecular Diagnostics

Historical introduction. Infection – mode of transmission in infections,Factors predisposing to microbial pathogenicity, types of infectious diseases,Normal microbial flora of the human body,Nosocomial infections, Host - Parasite relationships,Basic Molecular Biology,Nucleic Acid Chemistry,DNA Biochemistry: Structure, and Function.How Nucleotides are Added in DNA Replication, DNA Replication Fork,DNA Transcription,RNA Biochemistry: Transcription of RNA,RNA to Protein; Protein Biochemistry.

10hrs

Unit 2: Methods In Molecular Diagnostics

Isolation and Purification of Nucleic acids- Principles and Methods.Resolution and Detection of Nucleic Acids, Molecular cloning,labeling of nucleic acids, hybridization,Nucleic acid amplification methods and types of PCR,Reverse Transcriptase-PCR, Real-Time PCR,Inverse PCR, Multiplex PCR,Nested PCR, Alu-PCR, Hot-start,*In situ* PCR, Long-PCR, PCR-ELISA, Arbitrarily primed PCR, Ligase Chain Reaction.Bioinformatics: *Computer-Based Approaches to Genetic Analysis.*Molecular Diagnostic Technologies: PCR-Based Methods for Mutation Detection, Alternative Methods for Amplified Nucleic Acid Testing , Electrophoretic Methods for Mutation Detection and DNA Sequencing,Single-Nucleotide Polymorphisms: *Testing DNA Variation for Disease Association,* Microarray Approaches to Gene Expression Analysis,Methods for Analysis of DNA Methylation, Flow Cytometry,Medical Cytogenetics,Fluorescence *In Situ* Hybridization, Immunohistochemistry, Laser Capture Microdissection.

12hrs

Unit 3: Applications of Molecular Diagnostics

Infectious Diseases

Molecular Testing for infection caused by *Streptococcus, Coliforms, Salmonella, Shigella, Vibrio, Chlamydia trachomatis,Neisseria gonorrhoeae and Mycobacterium,*Diagnosis of fungal infections. Major fungal diseases: Dermetophytoses, Candidiosis and Aspergillosis.Diagnosis of DNA and RNA viruses. Pox viruses, Adenoviruses, Rhabdo Viruses, Hepatitis Viruses, Retroviruses,Human Papillomavirus and Molecular Diagnosis for HIV-1, Hepatitis C, Cytomegalovirus.Diagnosis of Protozoan diseases: Amoebiosis, Malaria, Trypnosomiosis, Leishmaniasis,Study of helminthic diseases- *Fasciola hepatica* and *Ascarislumbricoides*. Filariasis and Schistosomiasis.

Medical Genetics: Organization of human genome, Human Genome Project, Identifying human disease genes,Genetic Disorders, Molecular basis of genetically Inherited Diseases, Chromosomal Abnormalities and Single Gene Disorders,Genetic Basis of Neurological Disorders, Molecular Pathogenesis of Cardiovascular Diseases, Molecular Diagnosis of Coagulation.

Cancer genetics- Molecular Pathogenesis of Human Cancer, oncogenes, tumour suppressor genes, Genes in pedigree,Genetic disorders: Sickle cell anaemia, Duchenne muscular Dystrophy,Retinoblastoma, Cystic Fibrosis and Sex – linked inherited disorders.

12hrs

Unit 4: Quality Assurance in Molecular Diagnostics

Frame work for quality assurance,Verification of molecular assays,Standards and standardization of Molecular Diagnostics,Laboratory Developed Tests in Molecular Diagnostics.Genetic Counseling Considerations in Molecular Diagnosis,Ethical, Social, and Legal Issues Related to Molecular Genetic Testing.

6hrs

Unit 5: Molecular Therapeutics

Vaccines: Definition of a vaccine, A brief history, Mechanism of action of vaccines,Production of vaccines, Modern production methods, Examples of some specific vaccines.**Hormone-related drugs**: Brief history, Thyroid hormones, Adrenal hormones, The sex hormones,Biological drugs and cancer chemotherapy, Calcitonin, Parathyroid hormone, Insulin, Growth hormone, The incretins,**Development of biological antineoplastic drugs**: Mechanisms and targets for biological antineoplastic drugs,Some biological antineoplastic drugs currently in use or development,Effectiveness of the biological treatments for cancer.**Stem cell therapy**: The nature of stem cells, Embryonic stem cell cultures,Preparation of stem cells from the blastocyst.Prospects and the future for regenerative medicine,Gene therapy and other molecular based therapeutic approaches.Revision and interactive question answer session

Department of Biotechnology, SJCE, Mysuru

Subject Name & Code	**PROCESS MODELING AND SIMULATION** **BTM230**
No. of Teaching Hours – 65	**Credits : 5:0:0 L-T-P**
CIE Marks : 50	**SEE Marks: 100**

COURSE OBJECTIVE:

The objective of the course is to understand

- To study and apply different numerical techniques in mathematical models
- The principles of developing static and dynamic models for different unit operations, unit processes and for various biochemical reactions.
- To study the applications of various software.

COURSE OUTCOMES:

Students will be able to

CO1: To solve mathematical models by using different numerical methods

CO2: Develop staticanddynamic mathematical models for momentum and heat transfer operation

CO3: Develop static and dynamic mathematical models for mass transfer and reaction kinetics.

CO4: Develop staticand dynamic mathematical models for biochemical reactions and novel separations.

CO5: Analyze and Run the softwares for bioprocess models

UNIT I-NUMERICAL TEQUNIQUES:

Solution for linear equations: Cramer's rule, matrix inversion method, Gauss elimination method, Gauss Jordan elimination method, Jacobi method, Gauss siedel iterative method. Solution for differential equation: RungeKutta 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**.** **13 Hours**

UNIT2 MATHEMATICAL MODELS FOR MOMENTUM AND HEAT TRANSFER OPERATION:

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.

13 Hours

UNIT3 -MATHEMATICAL MODELS FOR MASS TRANSFER AND REACTION KINETICS

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.

13 Hours

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 bauble column reactor and numerical problems **13 Hours**

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. **13 Hours**

TEXT BBOKS

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, Weinheitn ,2003

2. J.R. Leigh, Modeling and Control of fermentation Processes, Peter Peregrinus, London, Revised edition, 2000

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

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Subject Name & Code	**BIOMATERIALS AND SURFACE TECHNOLOGY BTM241**
No. of Teaching Hours – 65	**Credits : 5:0:0 L-T-P**
CIE Marks : 50	**SEE Marks: 100**

Unit 1: Definition and classification of biomaterials, Mechanical and visco elastic, properties, Biomaterial characterization, biocompatibility, application of biomaterials. Biodegradation.

Unit 2: Surface characterization of biomaterials, surface modification for biomaterials with cells and tissues.

Unit 3: Bioceramics, bioglasses, polymers as biomaterials. Microbial production of biopolymers.

TEXT BOOKS:

1. Biomaterials science: An introduction to materials in medicine- Ratner, Hoffman, Schoen, Elemons, Academics press.
2. Biomaterials: Principals and applications. Ed J.B. Park and J.D Bronzino, CRC press.

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Subject Name & Code	**PROCESS VALIDATION AND ENGINEERING BTM242**
No. of Teaching Hours – 65	**Credits : 5:0:0 L-T-P**
CIE Marks : 50	**SEE Marks: 100**

Unit 1. Introduction:

Definition of validation, Purpose and scope of process validation in industry, Relationship between product development, Manufacturing process, product specifications and validation, Types of validation - Prospective validation, Concurrent validation, Retrospective validation, Design Qualification (DQ), Installation Qualification (IQ), Operational Qualification (OQ), Performance Qualification (PQ)

Unit 2. Processes that should be validated and conduct of validation:

Standard Operating Procedures (SOPs), manufacturing formulae, Data Submission, detailed batch documentation – Laboratory scale batches, Pilot batches, production-scale batches, Data requirement and Scale up, change control systems

Unit 3. Investigational reporting systems

Development of reports, validation protocols and reports, Process validation scheme

Unit 4. Analytical method validation and instrument performance verification

Method validation for analytical techniques, Bioanalytical method validation, Procurement, Qualification, and Calibration of Laboratory Instruments, performance of analytical instruments, Equipment Qualification and Computer System Validation, Validation of Excel Spreadsheet

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Subject Name & Code	**QUALITY CONTROL AND MANAGEMENT** **BTM243**
No. of Teaching Hours – 65	**Credits : 5:0:0 L-T-P**
CIE Marks : 50	**SEE Marks: 100**

Unit I: Total Quality Management (TQM): Principles of TQM: need for continuous improvement, total company commitment, quality strategy, management of change, customer and supplier focus, motivation, training.

TQM techniques: organisational structures and responsibilities, quality improvement terms, quality circles, vendor rating.

Unit II: Quality Assurance (QA): Key factors: procedures, quality manuals, parameters – fitness for purpose, customer satisfaction, cost effectiveness, compliance with standards, standards organisation and documentation charts, communication, feedback, legislation.

Control: internal and external quality audits, traceability, statistical methods, planned maintenance, condition monitoring.

Costing: cost centres, overheads, and maintenance and downtime costs.

Unit III: Quality Control (QC) Techniques: Statistical quality control techniques: frequency distribution, mean range, standard deviation, control charts.

Process capability:relationship between specification limits and control chart limits, modified limits, relative precision index.

Software packages: quality audit procedures, vendor rating, cause and effect analysis, Pareto analysis, Failure Mode and Effect Criticality Analysis (FMECA).

Unit IV: Introduction to Management: Definition, nature and significance of management, Evolution of management thought, contribution of Max Weber, Taylor and Fayol.

Unit V: Human Behaviour: Factors of individual Behaviour, perception, learning and personality development, interpersonal relationship and group behaviour**.**

TEXT BOOKS:

1. Dale B – Managing Quality, (Prentice Hall, 1994 Ed.)
2. Roggs J.L. – Production Systems: Planning, Analysis and Control, (Wiley, 1997 Ed)

REFERENCES:

1. Saxena, Karunesh - Quality Control Practices in Indian Manufacturing Organizations, (Ess Publication, ISBN: 8170001986)
2. Tenner A, Detoro I J – Total Quality Management, (Addison-Wesley, 1991 Ed)

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Subject Name & Code	**INSTRUMENTAL METHODS OF ANALYSIS BTM244**
No. of Teaching Hours – 63	**Credits : 5:0:0 L-T-P**
CIE Marks : 50	**SEE Marks: 100**

PREREQUISITES: Students should have the knowledge of Biology, Chemistry, Biochemistry, Basic electronics, Basic physicsand basic Biotechnology.

COURSE OBJECTIVE:

3. The coursehelps students to understand the theoretical aspects of Instrumentation used for isolation, purification and characterization of biomolecules.
4. The knowledge gained helps doing research for obtaining pure biomolecules of economic importance in pharmaceutical applications.
5. To facilitate students to gain knowledge on fundamental basis of techniques used in quality control system and research and development in Life science based industries.
6. To develop technical knowledge on instrumentation design and modification for biological research.
7. To develop self-sufficient knowledge in biochemical techniques to pursue higher studies and research.

COURSE OUTCOME

After completion of the course

3. Students have the ability to understand basic concept and components of Instrumentations used bioscience research.
4. Students are able to explain the components of electromagnetic radiation and techniques related to electromagnetic radiation applied in biochemical research.
5. Ability to understand principle and applications of chromatographic methods and electrophoresis methods pertaining to life science research
6. Acquainted with concept of radioisotopes applications advanced instrumentations and electroanalytical method used in biotechnological research

7. Knowledge gained can be applied to understanding of electroanalytical methods on biotechnological aspects.

UNIT I BASICS OF MEASUREMENT AND OPTICAL METHODS

Classification of methods, electrical components and circuits, signal to noise ratio, signal noise enhancement, General design, sources of radiation, wavelength selectors, sample containers, radiation transducers, types of optical instruments, Fourier transform measurements.

14 hrs

UNIT II MOLECULAR SPECTROSCOPY

Measurement of transmittance and absorbance, beer's law, spectrophotometer analysis, qualitative and quantitative absorption measurements, types of spectrophotometers, UV – visible, IR, Mass spectroscopy, Atomic abortion and emission spectroscopy, NMR instrumentation.

12 hrs

UNIT III SEPARATION METHODS

Introduction to chromatography models, ideal separation retention parameters, stationary phases, detectors, different methods of chromatographysupercritical chromatography, Principles of electrophoresis and different methods of electrophoresis, Dialysis.

14 hrs

UNIT VI. ADVANCED INSTRUMENTATION

Introduction to Flowcytometry, Radioisotopes and their applications in biological science. Biosensors and Biomems. Thermogravimetric methods, differential thermal analysis, differential scanning calorimetry. **12 hrs**

UNIT V ABOSRBTION AND ELECTROANALYTICAL METHODS

Colorimetry, Turbidometry, Nephelometry, Introduction to Electroanalytical Methods, Potentiometry, Voltametry **11 hrs**

Text Book

1. Instrumental Methods of Analysis; Willard and H. Merrit, Phi, 2012.
2. Instrumental Methods of Analysis, D. Skoog, 2010.

REFERENCE BOOKS

1. Holme, D.J. and Pick, H. (2007)Analytical Biochemistry, Longman Cambridge press.
2. Tinoco et al., (2009), Physical Chemistry:Principles and Applications in Biological Sciences**,** Prentice Hall, 4th Ed.

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Subject Name & Code	**HUMAN MOLECULAR GENETICS AND CANCER BTM251**
No. of Teaching Hours – 65	**Credits : 5:0:0 L-T-P**
CIE Marks : 50	**SEE Marks: 100**

After completion the course the students should be able to

Course Outcome 1: Explain advance methods in cytogenetic. And analysis of different culture of tissues. Valued interaction of genes and the environment resulting in to different defects.

Course Outcome 2: Interpret articles in genetics of Mendelian diseases, bio-chemical complex diseases, different chromosomal abnormalities and its disorders.

Course Outcome 3: Analyse the results diagnosis of heredity diseases, contribute the legal social and ithical consideration

Course Outcome 4: Discuss some exciting technologies emerging from research in molecular genetics and their application in diagnosing different diseases to employ scientific method to generate new knowledge to solve problems

Course Outcome 5: Expand the knowledge of different types of cancer, oncogenes and their treatment with the new techniques and therapies.

Unit 1: Principles of Human Genetics

10 h

Meaning and scope or Human Genetics Historical development of human Genetics. Its relationship with other Biological sciences and medicine.

Patterns of polygenic and multi factorial inheritance: multifactorial threshold traits- Pyloric stenosis, Neural tube defect. Congenital heart defects. Complex disorders of adult life.

Human cytogenetics: Normal human karyotype, Chromosome preparation methods- Chromosome banding methods and nomenclature of' chromosomebands Leucocyte culture. bone marrow. solid tissue. testicular and ovarian biopsies.

Unit 2: Molecular genetics of disease and disorders

11 h

Patterns of monogenic inheritance: Pedigree construction. Autosomal inheritance, sex linked inheritance. Other modes of inheritance- mitochondrial genes. genomic imprinting. uniparentaldisomy.

Autosomal abnormalities-abnormalities of chromosome number and structure Sex chromosomal abnormalities.

Biochemical genetics: Biochemical and molecular basis of human diseases. In born errors of metabolism- amino acid. carbohydrate and nucleic acid metabolism. Haemoglobinopathies-globin gene mutation and genetic disorders. Lysosomal and other genetic disorders.

Unit3: Diagnosis of Genetic Diseases:

10h

Applied Human Genetics: Prevention and cure of hereditary diseases: prenatal -diagnosis and preimplantaiion diagnosis, amniocentesis, chorion villi sampling, ultrasonography, fetoprotein. Cytogeneticsanlysis. Genetic screening of hereditary diseases. Gene therapy. DNA finger printing and paternity diagnosis Eugenics. Human genetics and legal, social and ethical considerations.

Unit4 : Molecular Basis ofDiagnosis& Discovering human disease genes:

11 h

Introduction to Molecular Basis of Diagnosis. Functional and positional cloning of candidate gene. DNA Diagnostic Systems: Reverse line blotting. Hybridization probes. non radioactive hybridization procedures. molecular beacons. DNA fingerprinting, Pedlock probes. genotyping with fluorescence labeled PCR primers

Molecular Diagnosis of Genetic disease: Direct detection of mutations in Human disease genes-Single strand conformation. polymorphism analysis, Denaturing Gradient Gel Electrophoresis, Heteroduplex analysis, Chemical mismatch cleavage. Direct DNA sequencing, Protein truncation test, Examples-Sickle Cell anaemia.

Unit 5: Cancer and its genetic basis:

10 h

Genetics of Cancer: Forms of cancer, genetic basis and properties of cancer cells. Familial

cancer, cancer cytogenetics, chemical and radiation carcinogenesis.

Oncogenes: Retroviral oncogenes, proto-oncogenes, oncogenes in human cancer, functions of oncogene products. roles of oncogenes and tumor suppressor genes in tumor development.

References:

1. Reece R. J. Analysis of Genes and Genornes, John Wiley & Sons Ltd. 2004. 469 pages. ISBN 0470 843802.

2. Jack J. Pasternak, An Introduction to Human Molecular Genetics, John Wiley and Sons,2005-631 pages

3. Thornpson. M. W .. Mc. lnnes. R.R .. Willard. M.F. (1991) 5^{1h}Edn W.B. Saunders ~1I1d Co. London,

4. Mange, EJ. arid Mange, A.P. (1999): Basic Human Genetics, 2^{11d} Eel. Sinaucr Assoc. Inc. Mass.

5. Pasternak. S. (2000): Introduction to molecular human genetics, Fritzgarland.

6. Limoine, W.R. and CoopeLD.NB (1996): Gene Trophy. Bios Scientific Pub. Oxford.

7. Smtad, D.P .. andSimrnons. M..I. (2003): Principles of Genetics)Id ed. John Wiley and SL '5 Inc.

8. Conner and Smith. MAF (2000): Essential Medical Genetics Blackwell Sci. pub.OxforodGekhrterR.D .

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Subject Name & Code	**REGULATORY BASIC OF DEVELOPMENT AND MANUFACTURE OF BIOPHARMACEUTICALS** **BTM252**
No. of Teaching Hours – 65	**Credits : 5:0:0 L-T-P**
CIE Marks : 50	**SEE Marks: 100**

Unit I: Overview of BIopharma industry & Regulatory agencies

Overview of Biopharma industry: Regulatory basis of drug development process and approval process for new chemical entities and biologics.

Regulatory agencies: U.S.Food and drug administration , European agency for the evaluation of medicinal products (EMEA),international conference of harmonization(ICH),other countries regulatory agencies, world health organization, regulations and guidelines.

Unit II: Formulation of pharmaceutical dosage forms

Physicochemical considerations, pharmacokinetics and pharmacodynamic considerations, quality by design principles, quality risk management, and need for current good manufacturing practices (cGMPs).

Unit III: Formulation & manufacture of pharmaceuticals.

Dosage forms: solid, solution and disperse system, sterile products, inhalation, drug delivery system**s.**

Manufacture of biologics: recombinant source materials, expansion of recombinant organism, Purification of active pharmaceutical ingredients, Manufacture of drug product.

Unit IV: Chemistry, Manufacturing and controls (CMC)

Investigational drug application (INDs), New drug application (NDA), Biologic License application, Marketing Applications,

Common technical documents (CTD): pharmaceutical development section, manufacture of drug substance and drug product, manufacturing process for drug substance and drug product, packaging-container closure system, stability –ICH/WHO, process validation.

Managing post approval changes-Formulation, process, packaging.

TEST BOOKS:

1. The challenges of CMC regulatory compliance for biopharmaceuticals. John Geigert,Kluwer academic/Plenum publisher,Newyork,2004
2. Ansel's Pharmaceutical dosage forms and drug delivery system. Lloyd Allen, Nicholas Popovich, Howard Ansel, Lippincort, Williams and Wilkins 8th edition. 2004

REFERENCES:

1. New drug development. Regulatory overview.Mark.P.Mathieu, Parexel International Corporation, 8th edition, 2008.
2. Martin's Physical pharmacy and pharmaceutical sciences. Patrick .Sinko,Lippincott Williams and Wilkins,5th edition
3. ICH, FDA and EMEA quality guidance documents on websites.

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Subject Name & Code	**HEALTH CARE BIOTECHNOLOGY BTM253**
No. of Teaching Hours – 65	**Credits : 5:0:0 L-T-P**
CIE Marks : 50	**SEE Marks: 100**

1. **Basics Of Biomacromolecules**: Introduction, Endogenous Peptides And Proteins, Modification Of Endogenous Peptides And Proteins
2. **Immunology**: Overview, Antibody - Mediated Response, Vaccines, Cell-Mediated Immune Response, Cancer Immunotherapy.
3. **Oligonucleotides:** Overview, Gene Therapy, Antisense Therapy, Ribozymes.
4. **Radiological Agents**: Radiosensitizers And Radioprotective Agents
5. **Introduction to Cardiovascular Drugs**: Myocardial Infraction Agents, Endogenous Vasoactive Peptides, Hematopoietic Agents, Anticoagulants, AnthromboticsAndHemostatics.
6. **Study of Chemotherapeutic Agents**: Synthetic Antibacterial Agents. Lactam Antibiotics, Anthelminitic Agents, Antiamebic Agents, Antiviral Agents.
7. **Study of Endocrine Drugs**: Female Sex Hormones And Analogs, Agents Affecting The Immune Response
8. **Drug Targeting Organ- Specific Strategies:** Basic Concept And Novel Advances, Brain- Specific Drug Targeting Strategies, Pulmonary Drug Delivery, Cell Specific Drug Delivery.

TEXT BOOKS:

1. Pharmaceutical Chemistry By Christine M. Bladon. John Wiley & Sons, Ltd (2002).
2. Burger's Medical Chemistry And Drug Discovery (5 Th Edition) By Manfred E. Wolff.A Wiley & Sons, INC. (2000)
3. Drug Targeting Organ- Specific Strategies ByGrietjeMolema And Dirk K F Meijer.Wiley-VCH. (2000).

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Subject Name & Code	**Drug Design BTM254**
No. of Teaching Hours – 65	**Credits : 4:0:0 L-T-P**
CIE Marks : 50	**SEE Marks: 100**

UNIT I:Drug Discovery and Development:

Definition of Drug Discovery, Stages of drug discovery, Strategic Issues in drug discovery

Drug Development

Chemistry, Preclinical Studies, Transition from Preclinical to Clinical, Planning the Drug Development Process

UNIT II: Drug designing and drug target classifications:

Introduction to drug designing: types of designing- Ligand based,Structure based ,Computer-assisted drug design,DNA ,RNA ,posttranslational, processing enzymes, metabolic enzymes involved in nucleic acid synthesis, small molecule receptors, ion channel proteins,transporters.Drug target classification, genomics(new target discovery),types of screening, natural products, combinatorial chemistry: general overview modeling methodologies, Simulation Methods, Molecular Mechanics, Monte Carlo, SemiImpirical Method, Abinito Method. Analog based drug design, structure based drug design, de novo design methodologies: indirect drug design,pharmachore development and receptor mapping,3D-database searching techniques.

UNIT III: Design development of combinatorial libraries and QSAR

The molecular diversity problem, drug characterization, QSAR, classical QSAR, molecular descriptors 3D QSAR and COMFA, Drug metabolism, toxicity and pharmacokinetics.

UNIT IV: Basic concept of drug delivery:

Concept of bioavailability, process of drug absorption, pharmacokinetic process, drug administration: parental delivery, oral delivery and systemic delivery, nasal and pulmonary

delivery, ophthalmic delivery, drug targeting to CNS,delivery of genetic material, viral and non viral vectors in gene delivery.

Text:

1. Principles of drug action, W.B Pratt and P.Taylor, Church chill Livingston
2. Liljefors T, P.Krogsqaard-Larsen and Madsen U (2002). Textbook of drug design and discovery,3rdedn,

Reference:

1. Principles of medicinal chemistry,W.OFoye
2. Side effects and drug designing ,E.J.Lien
3. Introduction to biophysical methods for protein and nucleic acid research,J.A. Glasel and M.P Deutscher
4. Drug deliver and targeting, A.M.Hillery, A.W.Lloyd and J.Swarbrick, Harwood academic Publisher.

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Subject Name & Code	**PRINCIPLES OF BIOENGINEERING LABORATORY BTM260L**
No. of Teaching Hours – 39	**Credits : 0:0:1.5 L-T-P**
CIE Marks : 50	**SEE Marks: ---**

COURSE OBJECTIVE:

The course aims at

1. Understanding basics of unit operations and separation techniques involved in Bioprocessing.
2. Giving a practical experience in designing, planning, conducting engineering experiments and writing report.

COURSE OUTCOMES:

After completion of the course students will be able to

1. Perform experiments related to unit operations and unit processes in bioprocess technology.
2. Design and analyze the results with suitable experiments

LIST OF EXPERIMENTS

1. Calibration of venturimeter / orifice meter / Rotameter
2. Study of pump characteristics (single stage and multi stage centrifugal pump)
3. Constant pressure/constant rate filtration using leaf filter
4. Simple distillation
5. Steam distillation
6. Extraction
7. Drying characteristics
8. Cell disruption techniques

9. Heat transfer in shell and tube heat exchanger
10. Heat transfer in double pipe heat exchanger
11. Diffusivity measurements
12. Leaching
13. Sedimentation
14. Centrifugation

TEXT BOOKS:

1. Coulson, J M and Richardson, J.F. Chemical engineering**,** McGraw-Hill Publications Vols I &II
2. McCabe, W.L. & Smith J.C, Unit operations in Chemical Engineering, McGraw-Hill
3. Kumar, K.L. Fluid Mechanics, S. Chand and Company Ltd

REFERENCE BOOKS:

1. Treybal, R.E. Mass Transfer Operations , McGraw-Hill Publications, New York, 1st Edition
2. Kern, J**.** Process Heat Transfer, McGraw-Hill Publications