MASTER OF SCIENCE IN BIOTECHNOLOGY

SYLLABUS 2018-19

(Outcome Based Education)

Dr. N.G.P. ARTS AND SCIENCE COLLEGE

(An Autonomous Institution, Affiliated to Bharathiar University, Coimbatore)
Approved by Government of Tamil Nadu and Accredited by NAAC with 'A' Grade (2nd Cycle)
Dr. N.G.P.- Kalapatti Road, Coimbatore-641048, Tamil Nadu, India
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MASTER OF SCIENCE (BIOTECHNOLOGY)

REGULATIONS

ELIGIBILITY:

A pass in any one of the following Degree Courses of B.Sc. Biotechnology / Biology /Agriculture / Botany / Zoology /Plant Science/ Microbiology / Animal Sciences / Biochemistry / Bioinformatics / Environmental Science / Food and Nutrition of any University in Tamil Nadu or an Examination accepted as equivalent thereto by the Academic Council, subject to such conditions as may be prescribed thereto are permitted to appear and qualify for the **M.Sc., Biotechnology Examination** of this College after a course study of two academic years.

PROGRAMME EDUCATIONAL OUTCOME

1. This programme will enable students to acquire knowledge on the fundamentals of Biochemistry, Cell biology, Microbiology and Molecular biology. It helps them to understand emerging and advanced concept in modern biology and guide them to take up their carrier in this field.
2. This programme will facilitate the students to acquire knowledge in fields such as Genetic Engineering, Protein Engineering and Molecular Therapeutics.
3. The programme will aid the students to learn the recent developments in the field of Genomics, Proteomics, Stem cell biology and Tissue Engineering approach

PROGRAM OUTCOMES

On the successful completion of the program, the following are the expected outcomes.

PO Number	PO Statement
PO1	Impart quality biotechnology education to students and to develop young minds as outstanding scholars/teachers/entrepreneurs and responsible citizens.
PO2	Apply their understanding of the commercialization processes to biotechnology products or services in future.
PO3	Graduates of the course will have strong background in the interface of biotechnology and be able to use the tools in industry and/or institutes wherever necessary.
PO4	Ability to design and carry out experiments (safely) and to interpret experimental data and apply the scientific method by developing valid hypotheses, designing experiments, gathering relevant data using current technology, and interpreting quantitative and qualitative data.
PO5	Develop an awareness of ethical issues in biochemical research and careers options along with understanding of the area of biotechnology chosen.

SCHEME OF EXAMINATIONS

Course Code	Course	Hrs of Instruction	Exam Duration (Hrs)	Max Marks			Credit Points
				CA	CE	Total	
First Semester							
18PBT13A	Molecular Biology & Genetics	4	3	25	75	100	4
18PBT13B	Biochemistry	4	3	25	75	100	4
18PBT13C	Microbiology	4	3	25	75	100	4
18PBT13D	Genomics and Proteomics	4	3	25	75	100	4
18PBT13P	Core Practical- I: Molecular biology & Genetics and Biochemistry	5	6	30	45	75	3
18PBT13Q	Core Practical – II: Microbiology, Genomics and Proteomics	5	6	30	45	75	3
	Elective –I:	4	3	25	75	100	4
		30				**650**	**26**
Second Semester							
18PBT23A	Immunotechnology	4	3	25	75	100	4
18PBT23B	Genetic Engineering	4	3	25	75	100	4
18PBT23C	Microbial Biotechnology	4	3	25	75	100	4
18PBT23D	Molecular Therapeutics	4	3	25	75	100	4
18PBT23P	Core Practical- III: Immunotechnology and Molecular therapeutics	5	6	30	45	75	3
18PBT23Q	Core Practical – IV: Microbial Biotechnology and Genetic Engineering	5	6	30	45	75	3

20.12.2019
BoS Chairman/HoD
Department of Biotechnology
Dr. N. G. P. Arts and Science College
Coimbatore – 641 048

Academic Council
Dr.V. Rajendran
CHAIRMAN
Dr. N.G.P. Arts and Science College

	Elective- II:	4	3	25	75	100	4
		30				**650**	**26**
Third Semester							
18PBT33A	Plant Biotechnology	4	3	25	75	100	4
18PBT33B	Animal Biotechnology	4	3	25	75	100	4
18PBT33C	Environmental Biotechnology	4	3	25	75	100	4
18PBT33D	Research Methodology & IPR	4	3	25	75	100	4
18PBT33P	Core Practical - V: Plant Biotechnology and Animal Biotechnology	5	6	30	45	75	3
18PBT33Q	Core Practical VI : Environmental Biotechnology, Research Methodology & IPR	5	6	30	45	75	3
18PBT33T	Internship *	Grade A to C					
	Elective- III:	4	3	25	75	100	4
		30				**650**	**26**
Fourth Semester							
18PBT43A	Pharmaceutical Biotechnology	4	3	25	75	100	4
18PBT43V	Project and Viva Voce	22	-	40	60	100	6
	Elective –IV:	4	3	40	60	100	2
		30				**300**	**12**
Grand Total						**2250**	**90**

*** Student shall undergo Training for period of not less than 15 days during third Semester and report has to be submitted for Viva-voce examination (External Evaluation).**

ELECTIVE – I

(Student shall select any one of the following Course as Elective-I in first semester)

S.No	Course Code	Name of the Course
1.	18PBT1EA	Biodiversity & Bioprospecting
2.	17PMB1EA	Principles of Quality Assurance
3.	17PBC1EA	Cancer : Biology, Diagnosis and therapy

ELECTIVE – II

(Student shall select any one of the following Course as Elective- II in second semester)

S.No	Course Code	Name of the Course
1.	18PBT2EA	Organic farming
2.	17PMB2EA	Pharmaceutical Quality Control
3.	17PBC2EA	Biochemistry of Toxicology

ELECTIVE – III

(Student shall select any one of the following Course as Elective-III in third semester)

S.No	Course Code	Name of the Course
1.	18PBT3EA	Stem Cell Technology
2.	17PMB3EA	Food Microbiology and quality control
3.	18PBC3EA	Nutrition and clinical nutrition

ELECTIVE – IV

(Student shall select any one of the following course as Elective-IV in fourth semester)

S.No	Course Code	Name of the Course
1.	18PBT4EP	Practical-Applied Biotechnology
2.	18PMB4EP	Practical-Microbiological Laboratory Techniques
3.	18PBC4EP	Practical-Nutritional Science

TOTAL CREDIT DISTRIBUTION

Courses	Credits	Total Marks		Credits	Cumulative Total credits
Core Theory	4	13 X 100 =	1300	52	**76**
Core Lab	3	6 X 75 =	450	18	
Project and Viva Voce	6	1 X 100 =	100	06	
Elective	4	3X 100 =	300	12	**14**
Elective	2	1x100	100	2	
		Total	**2250**	**90**	**90**

FOR PROGRAMME COMPLETION

Students have to complete the following Subjects:

- Core papers in I, II, III and IV Semesters.
- Elective papers in the I, II, III and IV Semesters.
- Core practicals in I, II and III Semesters.
- Institutional/Industrial Training in III Semester
- Project and Viva - Voce in IV Semester

Earning Extra credits is not mandatory for course completion

Extra Credits

Subject	Credit	Total credits
Publication with ISSN Journal	1	**1**
Hindi /Other Foreign language	1	**1**
Paper Presented in Sponsored National/ International Seminar/conference/ workshop	1	**1**
Online Courses / Self study paper prescribed By Department	1	**1**
Representation – Academic/Sports /Social Activities/ Extra Curricular Activities at University/ District/ State/ National/ International	1	**1**
Total		**5**

Rules:

The students can earn extra credit only if they complete the above during the course period (I to III semesters) and based on the following criteria. Proof of completion must be submitted in the beginning of IV semester. (Earning Extra credits is not mandatory for course completion)

1. Publication with ISSN Journal by a student and co-authored by staff member will be given one credit extra.
2. Student can opt Hindi/ French/ Other foreign Language approved by certified Institutions to earn one credit. The certificate (Hindi) must be obtained from **Dakshina Bharat Hindi Prachar Sabha** and he/ she has to enroll and complete during their course period (**first to Third semester)**

3. Award winners in Paper Presentation in Sponsored International Seminar/conference/Participation in short term workshop (minimum 5 days) will be given one credit extra.
4. Student can earn one credit, if they complete any one online certification courses / Self study paper prescribed by the concerned department.

Self study paper offered by Biotechnology Department

S. No.	Semester	Course Code	Course Title
1.	III Sem	18PBTSS1	Food Biotechnology
2.		18PBTSS2	Developmental Biology

5. Award Winners in /Social Activities/ Extra Curricular /Co-Curricular Activities / Representation in Sports at University/ District/ State/ National/ International level can earn one credit extra.

18PBT13A	MOLECULAR BIOLOGY AND GENETICS	SEMESTER - I

Total Credits: 4
4 Hours / Week

Preamble:

1. To study the Basic components and functions of Cells and its organelles.
2. To learn gene expression and its regulation.

Course outcomes

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

CO Number	CO Statement	Knowledge Level
CO1	Imparts knowledge on the mode of DNA replication and repair mechanisms	K3, K4, K5
CO2	Provide in-depth understanding of transcriptional events and its role in gene regulation	K4, K5
CO3	Focus on translational events and its role in gene expression & protein targeting Documentation, Inspection and certification Procedure	K4, K5
CO4	To gain knowledge about Human genetics and various genetic disorders	K4,K5
CO5	To analyze the inheritance pattern and population genetics	K4,K5

Mapping with Programme Outcomes

COs/Pos	PO1	PO2	PO3	PO4	PO5
CO1	S	M	M	M	M
CO2	S	M	S	M	M
CO3	S	M	S	S	M
CO4	S	S	S	S	M
CO5	S	S	S	S	M

S-Strong: M-Medium; L-Low

18PBT13A	MOLECULAR BIOLOGY AND GENETICS	SEMESTER - I

Total Credits: 4
4 Hours / Week

CONTENTS

UNIT – I **(10 Hours)**

DNA replication:

Over view of Central dogma & Experimental proof for Semiconservative method*. Enzymes & accessory proteins involved in DNA replication. Replication process in prokaryotic & Eukaryotic DNA. Regulations of Eukaryotic replication. Differences between Prokaryotic and eukaryotic replication. Other Replication models – Theta and Rolling circle model. **DNA Repair mechanism**- Nucleotide excision, Base excision, Mismatch repair, Photo-reactivation, SOS and recombination repair. **Recombination:** Homologous and site-specific recombination.

Case Study: DNA defects and abnormalities

UNIT – II **(10 Hours)**

Transcription:

Importance of DNA binding Proteins, RNA polymerase. Mechanism of Transcription in prokaryotes & Eukaryotes. **Transcriptional Regulation-** Regulatory elements and mechanisms of transcription regulation, Transcriptional and post-transcriptional gene silencing. **Modifications in RNA-** 5′ cap formation, transcription, 3′-end processing and polyadenylation, splicing, RNA Editing, Nuclear export of mRNA. r-RNA & t- RNA processing.

Case Study: Disease caused by RNA Splicing errors

UNIT – III **(10 Hours)**

Translation:

Overview of Genetic code, codon and anticodon concepts, wobble hypothesis*. The translation machinery, role of t RNA & ribosome. Mechanism of translation in Prokaryotes & Eukaryotes. **Post translational modifications of proteins**- Phosphorylation, Deformylation, Glycosylation, Acetylation, Amidation, Lipid attachment, S - Nitrosylation and Disulfide bond formation. **Translation Regulation-**Translational inhibitors, Control of gene expression at translational level. **Protein targeting-** Synthesis of Secretory and membrane proteins, import into nucleus, mitochondria and chloroplast.

Case Study: Diseases of protein sorting

UNIT – IV **(10 Hours)**

Mendelism and Non Mendelism:

Overview on mendelian and non-mendelian inheritance.*

Human Genetics- Introduction to Human Genetics. Chromosomal changes resulting in abnormal phenotype: Numerical (Aneuploidy) changes resulting in genetic syndromes eg: Turner, Down & Klinefelter Syndromes. Structural changes resulting in genetic diseases: eg: Cri-du-chat syndrome,

Genetic Diseases and Inheritance Pattern: Autosomal inheritance – Dominant (Eg: Adult polycystic kidney, Achondroplasia); Autosomal inheritance – Recessive (Eg: Albinism, Sickle Cell Anemia, Phenyl Ketonuria); X-linked: Recessive (Eg: Duchenne muscular dystrophy – DMD); X-linked: Dominant (eg.Xg blood group); Y-linked inheritance (Holandric – eg. Testes determining factor); Mitochondria disorders like LHON, DAD, MERRF and MELAS. Cancer genetics.

Case Study: Autosomal dominant genetic disorders.

UNIT – V **(10 Hours)**

Analysis of interitance pattern:

Pedigree analysis; Diagnosis of disease: Molecular cytogenetics, DNA markers -VNTR, STR, microsatellite, SNP and their detection techniques - RFLP genotyping, RAPD, AFLP. **Prevention of disease:** Prenatal diagnosis; Genetic counseling. **Population genetics:** Organization and measure of genetic variation: Random mating population, Hardy-Weinberg principle. Sources responsible for changes in gene frequencies: Mutation, selection, migration and isolation; random genetic drift; insights into human migration, natural selection and evolution.

Case Study: Pedigree analysis of inherited genetic disorders

(Note: * Self Study)

TEXT BOOKS:

1. *Lodish, H. & Baltimore. D.* 1994. **Molecular cell Biology**. 2nd edition. American Scientific Books.

2. *Gardner, E.J.* 1991. **Principles of Genetics**. 8th edition. John Wiley and Sons Inc, New York.

REFERENCE BOOKS:

1. *Lewin, B.* 2004. **Genes V.** Oxford University press.
2. *Gerald Karp.* 2002. **Cell and Molecular Biology.** 3rd edition. John Wiley Sons.
3. *Freifelder, D. and Malacinski, G. M.* 1996. **Essential of Molecular Biology**, 2nd edition. Panima Publishing Co., New Delhi.
4. *Strickberger, M. W.* 2013. **Genetics.** 3rd edition. Prentice Hall College Division, New Delhi
5. *Peter* J. *Russell*. 1993. **Fundamentals of Genetics**. 3rd Revised edition. Longman Publisher

18PBT13B	BIOCHEMISTRY	SEMESTER – I

Total Credits: 4
4 Hours/week

Preamble:

1. To understand the Structure, function and interrelationship of various Biomolecules.
2. Integration of the various aspects of metabolism and their regulatory pathways.

Course outcomes

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

CO Number	CO Statement	Knowledge Level
CO1	Understand the physical properties, Classification, metabolism and disorders of Carbohydrates	K3, K4
CO2	Know the concepts of structure and function, metabolism and disorders associated with Lipid and Fatty acid	K3, K4
CO3	Structural understanding, Biosynthesis of Amino acids and to know about disorders related to amino acids.	K3, K4, K5
CO4	Learning about Mechanism, kinetics and inhibition of Enzymes and Coenzymes.	K3, K4
CO5	Concept and regulatory mechanism of different metabolic activities and their disorders of Nucleic acid.	K3, K4, K5

Mapping with Programme Outcomes

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	M	M
CO2	S	M	S	M	M
CO3	S	M	S	S	M
CO4	S	M	S	S	M
CO5	S	S	S	S	S

S-Strong: M-Medium; L-Low

18PBT13B	BIOCHEMISTRY	SEMESTER – I

Total Credits: 4

4Hours / Week

CONTENTS

UNIT–I **(10 Hours)**

Carbohydrates:

*Classification and reactions: occurrence, properties and biological reactions. Structural features of carbohydrates, Glycolysis and TCA cycle; Glycogen breakdown and synthesis; Gluconeogenesis; interconversion of hexoses and pentoses. Carbohydrate metabolic disorders. Glycogen storage diseases. Lectins – characteristics and functions in biological system.

Case Study: Carbohydrate metabolic disorders

UNIT-II **(10 Hours)**

Lipids:

*Classification, Structure, functions and reactions of Lipids, Biosynthesis of fatty acids, Triglycerides, phospholipids and Sterols, Catabolism of **Fatty acids -** Oxidation(α, β and ω), Catabolism of triglycerides and phospholipids, Essential fattyacids and their physiological functions. Disorders associated with lipid metabolism and its therapeutic intervention - ketone bodies and ketosis; fatty liver, atherosclerosis.

Case Study: Therapeutic intervention in lipid metabolism

UNIT-III **(12 Hours)**

Amino Acid:

*Classification and Biosynthesis. Peptides, Classification of Protein, Primary structure of proteins, structural comparison at secondary and tertiary levels (Ramachandran Plot), quaternary and domain structure and architecture. Regulation of Protein metabolism. Protein metabolism in prolonged fasting. Disease related to protein folding – Alzheimer's and mad cow disease.

Case Study: Alzheimer's and mad cow disease

UNIT–IV **(10 Hours)**

Enzymes and coenzymes:

IUBMB classification of enzymes, active site, *Lock and key Model and induced fit hypothesis. Factors affecting enzyme activity, Mechanism of enzyme catalysis: Lysozyme, Enzyme kinetics- Michaelis – Menten (MM) equations, Transformations of MM equation and their significance, Enzyme inhibition: Reversible – Competitive, Noncompetitive, Uncompetitive,

Irreversible inhibition, Kinetics of Enzyme inhibition. Isoenzymes, allosteric enzymes, ribozymes, abzymes and artificial enzymes. Diseases Caused By Deficiency Of Digestive Enzymes-Obesity, Galactosemia,Maple Syrup Urine Disease

Case Study: Diseases Caused By Deficiency of Digestive Enzymes

UNIT-V **(8 Hours)**

Nucleic Acids:

*Classification, structure, functions and reactions of nucleic acids, Conformation of Nucleic acids: Structural characteristics of A, B and Z-DNA. 3D structure of t-RNA, ribozymes and riboswitches. Biosynthesis of Nucleotides –*De nova* and Salvage pathway, Regulations of Purines and Pyrimidine, Metabolism of Purine and Pyrimidine. Disorders of nucleic acids metabolism- Gout, Lesch-Nyhan syndrome, oroticaciduria, and xanthinuria.

Case Study: Disorders associated with Purine and pyrimidine metabolism

(Note: * Self Study)

TEXT BOOKS :

1. *Albert L. Lehninger, Michael M. Cox.* 2008. **Principles of Biochemistry**. 5th Edition. W H Freeman & Co.
2. *Robert K. Murray, Darryl K. Granner, Peter A. Mayes, Victor W. Rodwell.* 2006. **Harper's Illustrated Biochemistry.** 26th Edition. McGraw-Hill Medical Publishing Division.

REFERENCE BOOKS:

1. *Geoffrey L. Zubay.* 1998. **Biochemistry.** 4th Edition. Brown (William C.) Co,U.S.
2. *Donald Voet; Judith G Voet; Charlotte W Pratt.* 1999. **Fundamentals of Biochemistry.** Wiley & sons. Publications.
3. *Jeremy M. Berg, Lubert Stryer, John L. Tymoczko, Gregory J. Gatto.* 2015. **Biochemistry**. 8th edition. Palgrave Macmillan Publications
4. *Herbert J. Fromm, Mark Hargrove*.2012.**Essentials of biochemistry**, Kindle edition, Springer publisher.
5. *S. C. Rastogi*, 2003. **Biochemistry**, Tata McGraw Hill Publication.

18PBT13C	MICROBIOLOGY	SEMESTER – I

Total Credits: 4
4 Hours / Week

Preamble:

1. To understand the microbial diversity and systematics.
2. To investigate microbial interactions and their applications.

Course outcomes

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

CO Number	CO Statement	Knowledge Level
CO1	To gain knowledge about introduction to Microbiology & Microscopy	K3, K4
CO2	To elucidate microbial growth and physiology	K4
CO3	To analyze microbial interactions and infections	K4, K5
CO4	To examine the microorganisms in different environment	K4, K5
CO5	To apply the knowledge of microbes in food processing and production	K4, K5

Mapping with Programme Outcomes

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	M	M
CO2	S	M	S	S	M
CO3	S	M	S	S	M
CO4	S	S	S	S	M
CO5	S	S	S	S	S

S-Strong: M-Medium; L-Low

18PBT13C	MICROBIOLOGY	SEMESTER – I

Total Credits: 4
4 Hours / Week

CONTENTS

UNIT-I **(10 Hours)**

Introduction to Microbiology & Microscopy

*Evolution of Microorganisms and Microbiology, Classical and modern methods and concepts; Domain and Kingdom concepts in classification of microorganisms; Criteria for classification; Classification of Bacteria according to Bergey's manual; Microscopy – Light, Electron, SEM, TEM. Principles of staining methods to differentiate microbes.

UNIT-II **(10 Hours)**

Microbial Growth & Physiology

Ultrastructure of Archaea (Methanococcus); *Eubacteria (*E.coli*); Unicellular Eukaryotes (Yeast) and viruses (Bacterial, Plant, Animal and Tumor viruses); Microbial growth: Batch, fed-batch, continuous kinetics, synchronous growth, yield constants, methods of growth estimation, stringent response, death of a bacterial cell. Microbial physiology: Physiological adoption and life style of Prokaryotes; Unicellular Eukaryotes and the Extremophiles (with classical example from each group).

Case Study: *E. coli* as a model for gram negative bacteria

UNIT–III **(10 Hours)**

Microbial Interactions and Infection

Host–Pathogen interactions; *Microbes infecting humans – Urinary tract infection, Sexually transmissible infection, Oral cavity and respiratory infection, Nosocomial infection. Microbes infecting plants; Pathogenicity islands and their role in bacterial virulence. Diseases caused by Viruses: Chicken pox, Rabies virus, hepatitis, Dengue. Emerging Diseases: Swine flu, Chicken gunya, Ebola.

Case Study: Mosquito borne viral diseases

UNIT–IV **(10 Hours)**

Microbes and Environment

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 system; Quorum sensing; Microbial fuel cells; Prebiotics and Probiotics; Vaccines.
Case Study: Effect of prebiotics and probiotics on intestinal microflora

UNIT-V (10 Hours)

Applications of Microbes in food process operations and production

*Fermented foods and beverages; Food ingredients and additives prepared by fermentation and their purification; fermentation as a method of preparing and preserving foods; Microbes and their use in pickling, producing colours and flavours, alcoholic beverages and other products; Process wastes-whey, molasses, starch substrates and other food wastes for bioconversion to useful products; Bacteriocins from lactic acid bacteria – Production and applications in food preservation.
Case Study: Lactic acid bacteria in food preservation
(Note: * Self Study)

TEXT BOOKS:

1. *Pelczar MJ Jr., Chan ECS and Kreig NR.,* 1993. **Microbiology**, 5th Edition, Tata McGraw Hill, New Delhi.
2. *Patel A H*. 2008. **Industrial Microbiology.** PB Books**.**

REFERENCE BOOKS:

1. *Casida, L.E.* 1997. **Industrial Microbiology**. New Age International Publishers.
2. *Julian E Davies and Arnold L Demain*. 2009. **Manual of Industrial Microbiology and Biotechnology**. ASM Publisher.
3. *Vidhyasekaran , P.* 2008. **Fungal pathogenesis in plants and crops: molecular biology and host defence mechanisms**, Volume 58 of Books in soils, plants, and the environment, 2nd ed., illustrated, CRC Press.
4. *Presscott, L. M. Harley, J. P. and Klein, D. A.* 1999. **Microbiology**, International edn. 4th edn. WCB Mc Graw-Hil
5. *Crueger and A Crueger,* 1990. (English Ed., TDW Brock); **Biotechnology: A textbook of Industrial Microbiology**, Sinaeur Associates.

18PBT13D	GENOMICS AND PROTEOMICS	SEMESTER – I

Total Credits: 4
4 Hours / Week

Preamble:

1. To know the scope of Bioinformatics
2. Focus on Protein and Genome analysis using Bioinformatics tools

Course outcomes

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

CO Number	CO Statement	Knowledge Level
CO1	Understand about Bioinformatics and Databases	K3, K4
CO2	Data interpretation using Alignment Algorithms	K3, K4
CO3	Highlight Genome Analysis and Principles of Docking	K3, K4, K5
CO4	Learning Proteome analysis, tools and databases available	K3, K4,K5
CO5	Concept of pharmacogenomics and other omics along with their applications	K3, K4, K5

Mapping with Programme Outcomes

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	M	M	M
CO2	S	M	S	M	M
CO3	S	S	S	S	M
CO4	S	S	S	S	M
CO5	S	S	S	S	M

S-Strong: M-Medium; L-Low

18PBT13D	GENOMICS AND PROTEOMICS	SEMESTER – I

Total Credits: 4
4 Hours / Week

CONTENTS

UNIT-I **(10 Hours)**

Bioinformatics and Databases

Bioinformatics – Introduction and History. Biological Databases. Primary and secondary databases with examples. Data generation - large scale molecular biology data, BIOSEQ. Nucleic acid sequence databases: Gene bank, Protein sequence databases - Swiss-Prot, PDB, PIR. Rasmol - Molecular modeling. Steps to retrieve sequence and structure of a protein. Applications of Bioinformatics.

Case study: Retrieving the structure of a protein from Rasmol and PDB

UNIT-II **(10 Hours)**

Genomics

Introduction and classification of genomics- Functional genomics, structural genomics. Sequencing of genomes and sequencing methods (next-generation sequencing). Structure, organization and composition of prokaryotic genomes. Microbial genomics and genome epidemiology. Metagenomics and methods of Metagenomics.

Case study: Metagenomic analysis of different life forms in soil.

UNIT- III **(10 Hours)**

Genome Analysis and Docking

Genome analysis of Microbes, plants and animals; Accessing and retrieving genome project information from web; Comparative genomics, Identification and classification using molecular markers-16S rRNA typing/sequencing, Fragment Assembly- ESTs and genomic fragments, Mapping, Annotation, Gene predictions. Codon optimization tools and its advantages. Bioinformatics of Microarray and its applications. Gene Expression Profiling. GENSCAN. Molecular docking principles, molecular dynamic simulation.

Case study: Methods and problems in protein-Ligand docking

UNIT–IV **(10 Hours)**

Tools in Proteomics

Protein analysis (includes measurement of concentration, amino-acid composition, N-terminal sequencing); Proteomics classification. 1D-SDS-

PAGE and 2D-SDS PAGE. Detection and quantitation of proteins in gels. Pros and cons of various staining methods. Basics of mass spectrometry. MALDI - TOF and ESI and their application in proteomics. Tandem MS/MS spectrometry - Peptide sequencing by tandem mass spectrometry - Affinity purification of protein - TAP tag.
Case study: Microbial identification using MALDI-TOF

UNIT–V **(10 Hours)**

Pharmacogenomics and other omics:

High throughput screening in genome for drug discovery-identification of gene targets Pharmacogenetics; Pharmacogenomics - classical and non- classical. Pharmacogenomics of genetic diseases e.g. hypertension and Cancer. Metabolomics - techniques involved. Nutrigenomics and its applications. Other omics - lipidomics, transcriptomics, metagenomics, toxicogenomics, venomics and its applications. Basics of CADD, its importance.
Case study: Pharmacogenomics of genetic diseases

TEXT BOOKS:

1. *Rao, S. D*. 2010. **Bioinformatics.** Biotech Pharma Publications, India.
2. *Pevsner*, J. 2015. **Bioinformatics and Functional Genomics**. 3rd edition. Wiley Blackwell Publications.
3. *Hubbard, S.J. and Jones, A.R.* 2010. **Proteome Bioinformatics**. Springer Protocols.
4. *Lesk, A.M*. 2014. **Introduction to Bioinformatics.** Oxford Publications.

REFERENCE BOOKS:

1. *Campbell, A.M. and L. J. Heyer*. 2007. **Discovering Genomics, Proteomics and Bioinformatics**. 2nd edition. Pearson Education.
2. *Tramontano A*. 2005. **The Ten Most Wanted Solutions in Protein Bioinformatics.** 1st edition. CRC Press.
3. *Womble D D, Krawetz S A*. 2003. **Introduction to Bioinformatics.** Humana Press.
4. *Heyer L J and Campbell A M*. 2002. **Discovering Genomics, Proteomics and Bioinformatics.** Benjamin/Cummings Publisher
5. *Baxevanis, A.D. and Ouellette, B.F.F*. 2004. **Practical Guide to Analysis of Genes and Proteins**. 3rd edition. Wiley Jone and Sons.

18PBT13P	CORE PRACTICAL- I: MOLECULAR BIOLOGY, GENETICS AND BIOCHEMISTRY	SEMESTER – I

Total Credits: 3
5 Hours / Week

CONTENTS

1. Isolation of genomic DNA from human blood sample
2. Mounting of polytene chromosome from Chironomous larvae.
3. Bacterial conjugation.
4. Bacterial Transformation
5. Molecular analysis using RAPD
6. RFLP analysis
7. Estimation of total Protein and albumin from serum
8. Estimation of Sugar from the given source.
9. Estimation of Vitamin C from Citrus fruits.
10. Estimation of DNA & RNA.
11. Determination of blood cholesterol
12. Analysis of Protein by TLC, Paper Chromatography.

REFERENCE BOOKS :

1. *Joseph Sambrook*, *Michael R. Green*. 2012. **Molecular Cloning: A Laboratory Manual.** 4th edition. Cold Spring Harbor.
2. *Thomas R. Mertens and Robert L. Hammersmith*. 1997. **Genetics Laboratory Investigations.** 11th edition. Benjamin Cummings.
3. *Sadasivam, S. and Manickam, A.* 1996. **Biochemical Methods,** New Age International.

18PBT13Q	CORE PRACTICAL- II: MICROBIOLOGY, GENOMICS AND PROTEOMICS	SEMESTER – I

Total Credits: 3
5 Hours / Week

CONTENTS

1. Isolation of enzyme producing Bacteria from soil.
2. Isolation of Fungi from spoiled food.
3. Isolation of Antibiotic producing microorganisms against given pathogen.
4. Observation of Bacterial growth rate.
5. UV mutagenesis.
6. Morphological Analysis of Microbes
7. Biochemical observations of Bacteria
8. 16S rRNA sequence amplification
9. Sequence analysis using BLAST and Clustal W
10. Construction of phylogenetic tree using Bioinformatic tool

REFERENCE BOOKS :

1. *Joseph Sambrook*, *Michael R. Green*. 2012. **Molecular Cloning: A Laboratory Manual.** 4th edition. Cold Spring Harbor.
2. *Thomas R. Mertens and Robert L. Hammersmith*. 1997. **Genetics Laboratory Investigations.** 11th edition. Benjamin Cummings.
3. *Sadasivam, S. and Manickam, A.* 1996. **Biochemical Methods,** New Age International.

18PBT1EA	ELECTIVE- I: BIODIVERSITY & BIOPROSPECTING	SEMESTER – I

Total Credits: 4
4 Hours / Week

Preamble :

1. To learn the importance of biodiversity and various methods of conservation.
2. To identify the Bioprospecting potentials of available natural resources.

Course outcomes

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

CO Number	CO Statement	Knowledge Level
CO1	To understand about the biodiversity species, conservation methods of the species then organization involved for the conservation	K3, K4, K5
CO2	Elucidate the Biodiversity Data Requirements, Web Resources for Biodiversity Informatics and Major Bioinformatic Resources **Web Resources for Biodiversity Informatics Major Bioinformatic Resources**	K4, K5
CO3	Focus on Major areas of Bio-prospecting and Natural products from plants	K3, K4, K5
CO4	Elucidate Screening for bioactive compounds and highlight drug discovery and product development	K4, K5
CO5	To understand the role of various techniques in drug development and regulatory legislation in Bioprospecting	K3, K4, K5

Mapping with Programme Outcomes

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	M	M	M
CO2	S	S	M	M	M
CO3	S	S	S	S	M
CO4	S	S	S	S	S
CO5	S	S	S	S	S

S-Strong: M-Medium; L-Low

18PBT1EA	ELECTIVE- I: BIODIVERSITY & BIOPROSPECTING	SEMESTER – I

Total Credits: 4
4 Hours / Week

CONTENTS

UNIT-I **(10 Hours)**

Biodiversity

*Biodiversity – definition, history, mapping and Human impacts, maintaining biodiversity. **Organizations involved for Conservation in India**- ENVFOR, AWBI, CEEINDIA, ENVIS, NBA, NCF – INDIA, NBPGR and WWF - INDIA. **Sustaining Biodiversity-** The Species and Ecosystem Approach, Sustaining Aquatic Biodiversity.

Case Studies: Cockroaches: Nature's Ultimate Survivors, Where have all the honey bees gone?

UNIT-II **(10 Hours)**

Biodiversity Data Requirements

*Botanical Survey of India, Zoological Survey of India, National Parks, Wildlife Sanctuaries, Parks and Zoos. **Biodiversity Data Requirements-** Taxonomic and Historical Data – Museum and Herbarium, Molecular Data- Geonomics and Barcode Data. Spatial datasets. Data Standards: TDWG, DELTA, Darwin core, Barcode Data Standards. Indian Biodiversity Portal. **Web Resources for Biodiversity Informatics-** GBIF, Catalogue of Life, OBIS, MANIS, COP, UNEP-WCMC, ITIS, FAO, GLCF, NCBI Taxonomy, IBIS.

Case Studies: New trends in biodiversity informatics (particulate any one kind of species).

UNIT-III **(12 Hours)**

Bio-prospecting

*Bio prospecting-definition, history, values of Bioresources and current Practices **Major areas of Bio-prospecting:** Chemical prospecting, Bionic prospecting and Gene prospecting. Bioresources mapping, inventorisation and monitoring of biological diversity. Biodiversity prospecting – the INBio experiences, contracts for Bioprospecting. **Natural products from plants:** Antitumor agents, Cardiotonics, Antiinflammatory drugs, Antimalarial drugs and analgesic drugs.

Case Study: Antimalarial and Antiinflammatory drugs from natural sources.

UNIT-IV **(8 Hours)**

Screening for bioactive Compounds

Antimicrobials, Bioprospecting for industrial enzymes, plant growth promoting agents, Bioprospecting novel antifoulants and anti-biofilm agents from microbes. Bioprospecting of marine organisms. **Drug discovery and product development:** Discovery from traditional medicine. Modern tools in drug discovery.

Case Study: Antimicrobial drugs from marine sources.

UNIT-V **(10 Hours)**

Role of techniques in drug analysis

*HPLC, GC - LC and GC Mass spectrometry, FTIR, NMR. Product development procedures and policies. **Regulating Bioprospecting:** Rules and regulations in patenting of products. Approval and IPR. Drug R&D and the structure of the industry, International policy dimensions of Bioprospecting, Transaction costs and their impact on the market for Bioprospecting, Intellectual property rights on traditional medicinal knowledge, Scope.

Case Study: Analysis of Traditional medicine for therapeutic purpose

(Note;*Self study)

TEXT BOOKS:

1. *Alan T. Bull.*2004. **Microbial Diversity and Bioprospecting.** ASM Press.
2. *Kevin J. Gaston, John I. Spicer*. 2004. **Biodiversity: An Introduction.** Second Edition. Blackwell Publishing Company.

REFERENCE BOOKS:

1. *Londa Schiebinger.* 2007. **Plants and Empire - Colonial Bioprospecting in the Atlantic World.** 1st Edition. Harvard University Press.
2. *Vanessa Sunkel.* 2010. **Marine Bioprospecting and Natural Product Research.** LAP Lambert Academic Publishing.
3. *Russell Paterson, Nelson Lima.* 2017. **Bioprospecting - Success, Potential and Constraints**. Springer International Publishing *Padmashree Gehl Sampath.* 2005. **Regulating Bioprospecting:**
4. **Institutions for drug research, access, and benefit-sharing.** United Nations University Press.
5. *G. Tyler miller, Jr, Scott E. Spoolman*. 2007. **Essentials of Ecology**. Fifth Edition. Yolanda Cossio Publishers

17PMB1EA	ELECTIVE I- PRINCIPLES OF QUALITY ASSURANCE	SEMESTER – I

PREAMBLE:

To understand the quality assurance in microbiology laboratory, role of quality assessment in diagnostic procedures and significance of quality management and standards.

COURSE OUTCOMES

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

CO Number	CO Statement	Knowledge Level
CO1	Knows the definition of quality assurance, able to design microbiology laboratory and control of quality.	K2
CO2	Understands the quality assessment of laboratory environments and able to maintain records and reports.	K2
CO3	Importance of quality assessment in sterilization and disinfection, preservation and quality control of media and stains.	K2
CO4	Elucidates the quality assessment of disposal on decontaminated matters and gains knowledge o=n biological references and standards.	K2
CO5	Clearly able to categorize good laboratory practices with management of laboratory hazards and first aid procedures.	K2

MAPPING WITH PROGRAMME OUTCOMES

COs/ POs	PO1	PO2	PO3	PO4	PO5
CO1	M	M	S	S	S
CO2	M	M	M	S	S
CO3	M	S	S	S	S
CO4	M	M	M	S	S
CO5	S	M	S	S	S

S-Strong, M-Medium, L-Low

17PMB1EA	ELECTIVE I- PRINCIPLES OF QUALITY ASSURANCE	SEMESTER – I

Total Credits: 4

Hours per week: 4

CONTENTS

UNIT - I

Quality assurance – Introduction and overview – Definition. Designing of microbiology laboratory – Control of quality – Applications.

UNIT - II

Quality assessment of Equipments, chemicals, glass wares and laboratory environments – Quality management – Maintenance of records and reports.

UNIT - III

Quality assurance in sterilization and disinfection - Preservation of stock cultures, media and diagnostic kits – Quality control of media and stains.

UNIT - IV

Quality assessment of disposal – decontaminated matters and other biological effluents – Quality management in transportations of cultures. National control of biologicals – Biological references and standards.

UNIT - V

Good laboratory practices – Management of laboratory hazards and knowledge in First aid procedures.

TEXT BOOKS:

1. *Rajesh Bhatia and Rattan lalIchhpujani*. 1995. I ed. "**Quality assurance in Microbiology".**
2. *Anne. A. Hurley.* 2001. **Principles of Quality Control.** John Wiley and sons**.**

17PBC1EA	ELECTIVE-I: CANCER- BIOLOGY, DIAGNOSIS AND THERAPY	SEMESTER-I

PREAMBLE:

- This course offers an overview on cancer, mutations causing cancer, repair mechanism and multiples of diagnostic and treatment methods for cancer.
- Students can gain an in-depth knowledge and understanding on the basic principles of cancer development and available therapeutic approaches.

COURSE OUTCOMES:

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

CO number	CO Statement	Knowledge Level
CO1.	Compare and contrast benign and malignant tumors. Explain morphological characteristics of cancer cells.	K4 & K5
CO2.	Justify molecular basis of the cancer. Distinguish interdisciplinary areas in cancer biology. Elaborate the carcinogenetic process.	K4, K5 & K6
CO3.	Discuss about molecular mechanism of oncogenesis and tumor biology. Compare and explain the role of cell cycle in cancer. Value the importance of nutrition given to cancer patients.	K4, K5 & K6
CO4.	Judge the role of tumor suppressor genes and apoptosis. Elaborate on epigenetics.	K5 & K6
CO5.	Elaborate on the choice of diagnosis and therapy available for cancer patients.	K5 & K6

MAPPING WITH PROGRAMME OUTCOMES:

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	M	S	S
CO2	S	S	M	S	S
CO3	S	S	S	S	S
CO4	S	S	M	S	S
CO5	S	S	S	S	S

L-Low; M-Medium and S-Strong.

17PBC1EA	ELECTIVE-I: CANCER- BIOLOGY, DIAGNOSIS AND THERAPY	SEMESTER-I

Total Credits: 4
Hours per week: 4

CONTENTS

UNIT-I Introduction

Introduction: Cancer cell-morphology and growth characteristics. Types of growth-hyperplasia, dysplasia, anaplasia and neoplasia. Types and prevalence of cancer. Nomenclature of neoplasms, classification based on origin/organ. Differences between benign and malignant tumors.

UNIT-II Carcinogenesis

Cancerepidemiology. Cancer endocrinology. Cancercausing agents- radiation, viruses, chemicals. Multistep carcinogenesis: Initiation, Promotion, Progression. Para-neoplastic syndromes. Mutation- definition, significance, rates and frequency. Mutagenic agents. Molecular basis of mutagenesis, induced and spontaneous mutations, crossing over and segregation. Various types of mutations- addition, deletion, inversion, reciprocal, translocation, insertional translocation and frame-shift mutations. Chemical carcinogenesis- genetic and epigenetic carcinogens, pro-carcinogens and co-carcinogens, promoters and initiators, testing for carcinogenecity, Ames test. Cancer biology and biochemistry-aberrant metabolism during cancer development.

UNIT-III Tumor Markers and Signal Transduction

Oncogenes- RNA and DNA tumor viruses, retroviruses and viral oncogenes. Src and Ras gene, mechanism and characteristic of cell transformation. Molecular mechanism of oncogenesis- proto oncogenesis, oncogene, oncoproteins, tumour suppressor genes involved in cancer. Tumormarkers; cellular proto-oncogenes-oncogene activation. Radiation- effect of ionising radiations on DNA, chromosomal aberrations. Genetic basis of cancer,

metastasis, use of tumor markers in detection and monitoring of cancer. Signal transduction in cancer: cell- cell interactions, cell adhesion-invasion and metastasis - VEGF signaling and angiogenesis; role of transcription factors. Growth factors-EGF, TNF-α and TGF-β and growth factor receptors. Free radicals and antioxidants in cancer. Diet and cancer.

UNIT-IV Cell Cycle, Cell Death and Cancer

Cell Cycle Regulation cancer: control of the cell cycle-cyclins and CDKs, and tumor suppressor genes p53, p21 Rb, BRACA1 and BRACA2. Telomeres, and Immortality; Epigenetics- role of DNA methylation in gene silencing-epigenetic silencing of tumor-suppressor genes. Role of DNA-methylation in gene silencing-epigenetic silencing of tumor-suppressor genes; Death-signaling pathways-mitochondrial and death receptor pathways, apoptosis and cancer (Intrinsic and extrinsic pathways). Mechanism of apoptosis. Impact of apoptosis on oncogenesis. Principles and methods of cancer diagnosis-biochemical, genetic, cytotoxic, cell growth and viability tests.

UNIT-V Cancer Diagnosis and Cancer Therapy, Stem Cells and Cancer

Diagnostics of cancer by histo-pathlogy, MRI scan, PET-scan, cytogenetis test, kariotype, FISH. Strategies of anticancer drug therapy–chemotherapy-gene therapy. Immuno-therapy and Radiotherapy. Immune therapy, surgical therapy and biologic therapy. Principles of cancer biomarkers and their applications. Stem Cells and Cancer.

TEXT BOOKS:

1. *McKinnell R. G, Parchment R. E., Perantoni A. O, BarryPierce,Damjanov.I,*.2006. **The Biological Basis of Cancer**, Second Edition, Cambridge University Press, United Kingdom.
2. **The Biology of Cancer**: R. A. Weinberg. Garland Science. 2006.
3. Franks,L.M. and Teich,N.M. 1991. **An introduction to Cellular and Molecular Biology of cancer,** 2nd Edition, Oxford University Press.
4. Vincent,T. *et al*., 2011. **Principles and Practice of Oncology: Primer of the Molecular Biology of Cancer**, 1st Edition, Lippincott Williams and Wilkins.

REFERENCE BOOKS:

1. Weinberg,R.A. 2013. **The Biology of Cancer**, 2nd Edition, Garland Science.
2. Hesketh,R. 2013. **Introduction to Cancer Biology**, Cambridge University Press.
3. Pelengaris,S. and Khan,M. 2002. **The Molecular Biology of Cancer**, 2nd Edition, Wiley Blackwell.

18PBT23A	IMMUNOTECHNOLOGY	SEMESTER – II

Total Credits: 4
4 Hours / Week

PREAMBLE :

1. To study the mechanism of immune system.
2. To learn various detection methods of antigen-antibody and vaccine technology.

COURSE OUTCOMES

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

CO Number	CO Statement	Knowledge Level
CO1	Understand about basic of immune response	K3
CO2	Know the antigen – antibody related test	K3
CO3	Learn about new generation of antibody production techniques	K3, K4, K5
CO4	Awareness on vaccine immunological types and its role in immune system	K3,K4,K5
CO5	Know about allergic reaction, tumour immunology and its affect on immune system	K3,K4,K5

Mapping with Programme Outcomes

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	M	M	M
CO2	S	M	M	S	S
CO3	S	S	S	S	M
CO4	S	S	S	S	S
CO5	S	S	S	S	S

S-Strong: M-Medium; L-Low

18PBT23A	IMMUNOTECHNOLOGY	SEMESTER – II

Total Credits: 4
4 Hours / Week

CONTENTS

UNIT – I **(10 hours)**

Cells and Organs of Immune system

*History and scope of immunology. Types of Immunity: Passive, Active and Acquired immunity. Humoral, Cell Mediated immunity. Cells and organs of immune response and their functions. Antigens - Types, haptens, epitopes and Factors influencing antigenicity. Antibody – Structure, types, properties and functions. Immunoglobin gene rearrangements.

Case Study: Humoral and cell mediated immune response in children

UNIT – II **(10 hours)**

Antigen Antibody Reactions

Antigen – Antibody interaction, affinity, cross reactivity, specificity, epitope mapping; Agglutination reactions and Precipitation reactions. Immuno assays –Immuno Diffusion and Immunoelectrophoresis, RIA, *ELISA, Western blotting, ELISPOT assay, immunofluorescence, Surface plasmon resonance, Biosensor assays for assessing ligand –receptor interaction.

Case Study: Cross reactivity allergy and its therapy to human

UNIT – III **(10 hours)**

New Generation Antibodies

Antibody engineering; *Hybridoma and monoclonal antibody (MCAb) techniques, Production of murine hybridoma, Production of MCAbs in cultures and animal (Ascites), Purification of MCAbs. Characterization of MCAbs/ and Labelling of antibodies. Phage display libraries; Antibodies as *in vitro* and *in vivo* probes

Case Study: Monoclonal antibodies therapy against cancer

UNIT - IV **(10 hours)**

Vaccine Technology

Rationale vaccine design based on clinical requirements: *Active immunization, live, killed, attenuated, Sub unit vaccines; Recombinant DNA and protein based vaccines, plant-based vaccines and reverse vaccinology; Peptide vaccines, conjugate vaccines; Passive Immunization; Antibody, Transfusion of immuno- competent cells, Stem cell therapy; Cell based vaccines.

Case Study: Stem cell therapy to treat genetic disorder

UNIT - V **(10 hours)**

Hypersensitivity and Transplantation

Hypersensitivity– Mechanism and Types. Tumor immunology: tumor antigens, oncogenes, immune responses, detection of cancers and therapy- chemotherapy and radiation therapy. *Transplantation Immunology.

Case Study: Organ transplantation survey

(Note: * Self Study)

TEXT BOOKS:

1. *Arvind Kumar.* 2013. **Textbook of Immunology.** TERI Publisher.
2. *Seemi Farhat Basir.* 2012. **Textbook of Immunology**. 2nd edition. Phi learning pvt. Ltd- New Delhi.
3. *Nandini Shetty*. 2005. **Immunology: Introductory Textbook**. 2nd edition. Newage Publishers.
4. *Ramesh.* 2016. **Immunology**. 1st edition. McGraw Hill Education India Private Limited.

REFERENCE BOOKS:

1. *F.C. Hay, O.M.R. Westwood.* 2002. **Practical Immunology**, 4th Edition, Blackwell Publisher.
2. *Ed Harlow, David Lane.* 1988. **Antibodies Laboratory Manual**, Cold Spring Harbor, Laboratory Press.
3. *Janis Kuby*. 1997. **Immunology.** WH Freeman& Company, New York.
4. *Ivan Riot.* 1988. **Essentials of Immunology.** 6th edition. Blackwell Scientific Publications, Oxford.
5. *Harlowand David Lane.* 1988. **Antibodies A laboratory Manual.** Cold spring Harbor laboratory Press.

18PBT23B	GENETIC ENGINEERING	SEMESTER – II

Total Credits: 4
4 Hours / Week

PREAMBLE:

1. To learn various types of vector host systems and steps in creating rDNA molecule.
2. To gain knowledge on various recombinant DNA techniques and their applications.

COURSE OUTCOMES

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

CO Number	CO Statement	Knowledge Level
CO1	Understand the steps in recombinant DNA preparation and labeling	K3,K4
CO2	Explain the features of various types cloning vectors for bacteria, yeast , animals and plants	K3, K4
CO3	Understand the methods of gene transfer and hybridization	K3,K4
CO4	Describe various molecular techniques and its applications	K4, K5
CO5	Knowing different types of sequencing and gene therapy	K4, K5

Mapping with Programme Outcomes

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	M	M
CO2	S	S	S	M	M
CO3	S	S	S	M	S
CO4	S	S	S	S	M
CO5	S	S	S	S	S

S-Strong: M-Medium; L-Low

18PBT23B	GENETIC ENGINEERING	SEMESTER – II

Total Credits: 4
4 Hours / Week

CONTENTS

UNIT – I **(10 hours)**

Basics concepts

*Genetic engineering – Overview and scope. Steps involved in recombinant DNA constructions, enzymes involved in genetic engineering, role of linkers, adaptors and Homopolymer tailing. Selectable and Screenable markers. Labeling of DNA - Nick translation, Random priming, Radioactive and non-radioactive probes.

Case Study: DNA Probes and mapping

UNIT - II **(10 hours)**

Cloning Vectors

Plasmids –*pBR322 and pUC vectors, Bacteriophage vectors - M13 vectors, Lambda vectors (Insertion and Replacement vectors), Phagemids, Cosmids, Yeast vectors, Shuttle vectors, Animal Viral vectors - SV-40, baculo & retroviral vectors, Expression vectors – pMal, GST and pET-based vectors, Plant vectors -Ti and Ri. Artificial chromosome vectors (YACs; BACs).

Case Study: SV-40 and human cancer

UNIT - III **(10 hours)**

Cloning Methodologies

Introduction of cloned genes into cell – transformation, particle bombardment, liposome mediated transfer, electroporation, microinjection and calcium phosphate mediated transfer. Construction of cDNA and genomic libraries. Hybridization techniques - *Northern, Southern and Colony hybridization, Fluorescence *in situ* hybridization, South western and Far-western cloning.

Case Study: Limitations of the microinjection systems for adherent cells

UNIT – IV **(10 hours)**

PCR and Its Applications

Primer design; Fidelity of thermostable enzymes, *DNA polymerases, PCR and Types – multiplex, nested, reverse transcriptase, real time PCR, touchdown PCR, hot start PCR, colony PCR, cloning of PCR products, PCR in gene recombination, Site specific mutagenesis, PCR in molecular diagnostics, PCR based mutagenesis, Mutation detection - SSCP, DGGE,

RFLP, Oligo Ligation Assay (OLA), MCC (Mismatch Chemical Cleavage, ASA (Allele-Specific Amplification), PTT (Protein Truncation Test)
Case Study: Analysis of chemical mismatch

UNIT - V **(10 hours)**

Gene silencing and Therapy

DNA sequencing- Chain termination method and NGS. Gene silencing techniques - Introduction to siRNA, siRNA technology, Micro RNA, Construction of siRNA vectors, Principle and application of gene silencing. Gene knockouts and Gene Therapy - Creation of knockout mice, Disease model, Somatic and germ-line therapy (*in vivo* and *ex-vivo*), Suicide gene therapy, Gene replacement, Gene targeting.
Case Study: Gene knockouts and Gene Therapy
(Note: * Self Study)

TEXT BOOKS :

1. *Brown, T. A.* 1998. **Introduction to Gene Cloning**. 3rd edition. Stanley Thornes Publishing Ltd.
2. *Primrose, S. B.* 2003. **Principles of Gene Manipulation**. 6th edition. Blackwell Science Ltd.

REFERENCE BOOKS:

1. *Bernard R. Glick, Jack J. Pasternak.* 2010. **Molecular Biotechnology: Principles and Applications of Recombinant DNA**, ASM press, U.S.A
2. *Singh, B.D.* 2008. **Text book of Biotechnology**, Fourth Edition, Kalyani Publishers, New Delhi.
3. *J. Sambrook and D.W. Russel.* 2001. **Molecular Cloning: A Laboratory Manual**, Vols 1-3, CSHL.
4. *James, D. Watson.* 2001. **Recombinant DNA technology**. 2nd edition. WH Freeman and company
5. *Snustad D. P. And Simmons M. J.* 2015. **Principles of Genetics,** 7th edition. John Wiley & Sons.

18PBT23C	MICROBIAL BIOTECHNOLOGY	SEMESTER – II

Total Credits: 4
4 Hours / Week

PREAMBLE:

1. To recognize the fundamentals of Microbial Biotechnology and to analyze the bioprocess paradigm
2. Development of Microbial products and their regulations.

COURSE OUTCOMES

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

CO Number	CO Statement	Knowledge Level
CO1	Understand the concepts, History and scope of Microbial biotechnology	K3,K4
CO2	Acquire information about types of Fermentation and their mechanism	K3, K4
CO3	Recent development in microbial product production like organic acids, probiotics, vitamins and health care products.	K4, K5
CO4	Learning about microbes in agriculture field and bioprospecting	K4, K5
CO5	Concept and regulatory mechanism of finished products and quality management, GMP regulations.	K4, K5

Mapping with Programme Outcomes

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	M	M	M
CO2	S	M	S	M	M
CO3	S	S	S	M	M
CO4	S	S	S	M	S
CO5	S	S	S	S	S

S-Strong: M-Medium; L-Low

18PBT23C	MICROBIAL BIOTECHNOLOGY	SEMESTER – II

Total Credits: 4
4 Hours / Week

CONTENTS

UNIT – I **(10 hours)**

History and scope of Microbial biotechnology

*Basic principles of microbial biotechnology. Strategies for Microbial product development- Microbial biomass, enzymes, metabolites, recombinant products, transformation process. Upstream and Downstream processing. Isolation, screening and maintenance of industrially important microbes; Strain improvement for increased yield and other desirable characteristics.

Case Study: Impact of Microbial biomass on Industrial production

UNIT - II **(10 hours)**

Fermentation - Types of fermentations

Aerobic and anaerobic fermentation, *Submerged and solid state fermentation. Basic structure and types of fermentor. Submerged fermentation types - Batch, continuous and fed batch - CSTR, Tower fermenter, Jet loop, Air lift, Bubble column, Packed bed. Solid state fermentation types - Tray fermenter, Column fermenter, and Drum fermenter. Factors affecting submerged and solid state fermentation. Fermentation kinetics- Rheological properties of the medium, Theory of mixing. Mass transfer coefficient(K_LA).

UNIT - III **(10 hours)**

Microbial Products

Organic acids (Citric acid, Lactic acid and Acetic acid), aminoacids (Glutamic acid, lysine and Tryptophan), *probiotics, healthcare products (β Lactam Antibiotics, Peptide antibiotics, Vitamin B_{12} and Riboflavin) and edible biomass.

Case Study: Microbes in Vitamin B_{12} Production

UNIT - IV **(10 hours)**

Microbes in Agribiotechnology

Biofertilizer, Bio-inoculants manufacture. *Biopreservation of food and feed by post harvest biocontrol with microorganisms. Microbial control of plant diseases. Safety and regulation of microbial control of weeds. Plant growth promotion with microorganisms. OECD guidelines and

harmonization for microbial control agents. Understanding public risk perception for the use of beneficial microorganisms
Case Study: Biofertilizer and Environment

UNIT – V **(10 hours)**

Finished Product Guidelines

Testing - Writing product specifications - Conditions and options for finished product testing, distributors – product storage - packaging, distribution. Definition of GMP, Principles and Importance of GMP, Quality management, Personnel, Risk management, *Quality control, Documentation, Inspections. GMP regulations - USFDA, Europe, Japan, ICH, PICS/S, WHO.
Case Study: Packaging of microbial products.
(Note: * Self Study)

TEXT BOOKS :

1. *Stanbury, A. H., Whittaker, A and Hall, S. J.* 1995. **Principles of fermentation Technology**. 2nd edition. S.J. Pergamon Press.
2. *El-Mansi, E.M.T, Bryce, C. F., A, Arnold L. Demain,* and *Allman, A.R.* 2011. **Fermentation Microbiology and Biotechnology**. 3rd edition.CRC Press.
3. *Presscott, L. M. Harley, J. P. and Klein, D. A.* 1999. **Microbiology**, International edn. 4th edn. WCB Mc Graw-Hill.

REFERENCE BOOKS:

1. *Pelczar MJ Jr., Chan ECS and Kreig NR.,* 1993. **Microbiology**, 5th Edition, Tata McGraw Hill, New Delhi.
2. *Crueger and A Crueger,* 1990. (English Ed., TDW Brock); **Biotechnology: A textbook of Industrial Microbiology**, Sinaeur Associates.
3. *G Reed, Prescott* and *Dunn's*, 1987. **Industrial Microbiology**, 4th Edition, CBS Publishers.
4. *Patel A H.* 2008. **Industrial Microbiology.** PB Bookz http://www.cabi.org/bookshop/book/9781845938109
5. GMP manual: Good manufacturing practices and implementation, http://www.gmppublishing.com/media/ebooks/flyer/files/gmpmanual_eu_4c_online.pdf.

18PBT23D	MOLECULAR THERAPEUTICS	SEMESTER - II

Total Credits: 4
4 Hours / Week

PREAMBLE:

1. To study about the types of PCR and its applications in diagnosis
2. To learn about the human genome project

COURSE OUTCOMES

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

CO Number	CO Statement	Knowledge Level
CO1	Review on the process of drug targeting and gene therapy	K3
CO2	Understand the current techniques of gene delivery and other therapeutic products	K3, K4
CO3	Imparts knowledge on recombinant gene therapy	K3, K4, K5
CO4	Focus on pathogenic diseases and metabolic disorders	K4, K5
CO5	In depth understanding of immunotherapy and its applications	K3, K4, K5

Mapping with Programme Outcomes

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	M	S
CO2	S	S	S	S	M
CO3	S	S	S	S	S
CO4	S	M	M	M	M
CO5	S	S	S	S	S

S-Strong; M-Medium; L-Low

18PBT23D	MOLECULAR THERAPEUTICS	SEMESTER – II

Total Credits: 4
4 Hours / Week

CONTENTS

UNIT – I **(10 hours)**

Concepts of Gene Therapy and Drug Delivery:

Gene Therapy, Drug targeting and drug delivery system. Intracellular barriers to gene delivery, overview of inherited and acquired diseases for gene therapy, virus mediated gene transfer. Liposome and Nanoparticles mediated gene delivery,

Case Study: Intracellular barriers to non –viral gene delivery

UNIT – II **(10 hours)**

Stem cells and Tissue Engineering

Cellular therapy; Stem cells: definition, properties and potency of stem cells; Sources: embryonic and adult stem cells; Concept of tissue engineering; Role of scaffolds; Role of growth factors; Role of adult and embryonic stem cells; Clinical applications; Ethical issues.

Case Study: Accident Scaffolding

UNIT – III **(10 hours)**

Recombinant Gene therapy

Recombinant therapy, Clinical application of recombinant technology, Erythropoietin, insulin analogs and its role in diabetes, Recombinant human growth hormone, streptokinase and urokinase in thrombosis. Recombinant coagulation factors

Case Study: Recombinant insulin in the treatment of diabetes

UNIT – IV **(10 hours)**

Microbial Pathogenicity

Factors predisposing to microbial pathogenicity, types of infectious diseases. General concept of infectious disease, Progression of Infection and Disease - Entrance (Portal of entry), Colonization (Adherence; Adhesion; Attachment), Prevention of Host Defenses, Antigenic Variation, Penetration into Host Cytoskeleton, Damage to Host Cells, Production of Toxins

Case Study: Antigenic variation in microbial evasion of immune response

UNIT – V **(10 hours)**

Immunotherapy

Phage and their application, Immunotherapy, Monoclonal antibodies and their role in cancer, role of recombinant interferons, Immunostimulant and Immunosupressors in organ transplants, role of cytokine therapy in cancer. Vaccines: types, recombinant vaccines and clinical applications

Case Study: Unconjugated antibody-treatment in kidney rejection

(Note: * Self Study)

TEXT BOOKS:

1. *Bernhard Palsson and Sangeeta N Bhatia,* 2004. **Tissue Engineering.** 2nd Edition, Prentice Hall.
2. *Pamela Greenwell, Michelle McCulley,* 2008. **Molecular Therapeutics: 21st century medicine.** 1st Edition, Springer.

REFERENCE BOOKS:

1. *W.B. Coleman,* 2006. **Molecular Diagnostics for the Clinical Laboratorian.** 2ed. Humana Press.
2. *D. G. B. Leonard,* 2007. **Molecular Pathology in Clinical Practice.** Second Edition. Springer International Publishers.
3. *Lele Buckingham and Maribeth L. Flaws,* 2007. **Molecular Diagnostics: Fundamentals, Methods & Clinical applications.** First Edition, F.A. Davis Company.
4. *David Whitehouse, Ralph Rapley,* 2012. **Molecular and Cellular Therapeutics,** Wiley – Blackwell Publications
5. Peter J. Quesenberry, Gary S. Stein, Bernard G. Forget, Sherman M. Weissman, 1998, **Stem Cell Biology and Gene Therapy,** John Wiley and Sons Publications.

18PBT23P	CORE PRACTICAL- III: IMMUNOTECHNOLOGY AND MOLECULAR THERAPEUTICS	SEMESTER – II

Total Credits: 3
5 Hours / Week

CONTENTS

1. Total RBC and WBC count
2. Lysis of red blood cells (hypotonic lysis with H_2O and ammonium chloride)
3. Erythrocyte Rosette-forming Cell Test, ERFC
4. Immunodiffusion – Single and Double
5. Rocket Immuno electrophoresis
6. Purification and Restriction analysis of IgG
7. Western Blotting
8. ELISA
9. HLA typing
10. Determination of free radical scavenging by DPPH assay
11. Peroxidase activity

REFERENCE BOOKS :

1. *Olivier Cochet, Jean-Luc Teillaud, Catherine Sautes Wiley.* 1998. **Immunological Techniques Made Easy.** 1st edition. John Wiley & Son Ltd.
2. *S. Ignacimuthu*. 2001. **Methods in Biotechnology**. 1st edition. Phoenix publishing house.

18PBT23Q	CORE PRACTICAL- IV MICROBIAL BIOTECHNOLOGY AND GENETIC ENGINEERING	SEMESTER – II

Total Credits: 3
5 Hours / Week

CONTENTS

1. Isolation of genomic DNA from fungi
2. Isolation of Plasmid DNA
3. Lactic acid production from cabbage
4. *Agrobacterium* mediated transformation
5. Production of Vitamins from microbes
6. Ligation
7. Production of wine using yeast.
8. Life Cycle of the Mosquito
9. Vital staining of Earthworm Ovary
10. Mounting of the Sex Comb in *Drosophila melanogaster*
11. Observation of different mutants in *Drosophila melanogaster*

REFERENCE BOOKS :

1. *Vennison, S.Johnz,* 2009. **Laboratory Manual for Genetic Engineering**. PHI publications.
2. *Nupur Mathur*, 2007. **Industrial microbiology a laboratory manual**, 1st Edition , Aaviskar Publishers

18PBT2EA	ELECTIVE- II: ORGANIC FARMING	SEMESTER - II

Total Credits: 4
4 Hours / Week

PREAMBLE:

1. The importance of organic farming and standardization/certification process has been highlighted.

COURSE OUTCOMES

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

CO Number	CO Statement	Knowledge Level
CO1	Know about the basic of organic farming national and international level	K2, K3
CO2	Understand the farming systems and its management	K3, K4
CO3	Imparts knowledge on the plant protection and weed management	K3, K4, K5
CO4	In depth understanding of Organic crop production practices	K4, K5
CO5	Focus on Organic Certification and terrace farming technology. Documentation, Inspection and certification Procedure	K4, K5

Mapping with Programme Outcomes

COs/Pos	PO1	PO2	PO3	PO4	PO5
CO1	S	M	M	S	S
CO2	M	S	S	S	S
CO3	S	S	S	S	S
CO4	S	S	S	S	S
CO5	S	S	S	S	S

S-Strong: M-Medium; L-Low

18PBT2EA	ELECTIVE- II: ORGANIC FARMING	SEMESTER – II

Total Credits: 4
4 Hours / Week

CONTENTS

UNIT - I

Concept of organic farming

Introduction: Farming, *organic farming, concept and development of organic farming. Principles of organic farming, types of organic farming, biodynamic farming. Benefits of organic farming, need for organic farming, conventional farming v/s organic farming Scope of organic farming; Tamil nadu, National and International status. Agencies and institutions related to organic agriculture. Requirements for organic farming, farm components for an organic farm.

Case Study: Conventional farming methods

UNIT - II

Organic plant nutrient management

Organic farming systems, soil tillage, land preparation and mulching. Choice of varieties. Propagation- seed, planting materials and seed treatments, *water management Green manuring, composting- principles, stages, types and factors, composting methods, Vermi composting Bulky organic manures, concentrated organic manures, organic preparations, organic amendments and sludges. Bio-fertilizers- types, methods of application, advantages and disadvantages, standards for organic inputs-fertilizers

Case Study: Benefits of vermicompost to different types of soil.

UNIT - III

Organic plant protection

Plant protection- cultural, mechanical, botanical pesticides, control agents. *Weed management, Standards for organic inputs- plant protection.

Case Study: Pesticides and its causes to plants

UNIT - IV

Organic crop production practices

Organic crop production methods- rice, coconut. Organic crop production methods- vegetables- okra, amaranthus, cucurbits. Livestock component in organic farming. Sustainable Agriculture-Apiculture, Mushroom cultivation.

Case Study: Organic food and its benefits

UNIT - V

Organic Certification

Farm economy: Basic concept of economics- demand & supply, economic viability of a farm. Basic production principles, reducing expenses, ways to increase returns, cost of production system. Benefit/ cost ratio, *marketing, imports and exports. Policies and incentives of organic production. Farm inspection and certification. Terrace farming.

(Note: * Self study)

TEXT BOOKS:

1. *Palaniappan SP & Anandurai K. 1999*. **Organic Farming–Theory and Practice.** Scientific Publishers, Jodhpur.

REFERENCE BOOKS:

1. *A.K. Sharma. 2002.* **A hand book of Organic Farming**. Agro-Bios.
2. *S. A. Solaimalai, 2003.* Farming system : Theory and Practice. Manohar Publishers & Distributors, New Delhi.
3. *Joshi, M. 2014.* **New Vistas of Organic Farming** 2nd Ed. Scientific Publishers, Jodhpur.

17PMB2EA	ELECTIVE II- PHARMACEUTICAL QUALITY CONTROL	SEMESTER – II

PREAMBLE:

The Course aims to build the concepts regarding:

1. Sterility in pharmaceutical products
2. role of a qualified microbiologist in Pharma Industry
3. Validation and its importance in quality assurance of pharmaceutical products.

Course Outcomes

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

CO Number	CO Statement	Knowledge Level
CO1	Identify and analyse unexpected results during routine analyses and help to provide solutions based on scientific and regulatory considerations by implementing preventive action and corrective actions programs.	K3
CO2	Acquire a working knowledge of Indian GMP (Good Manufacturing Practice) requirements to the manufacture of pharmaceuticals, blood products, and natural health products	K3
CO3	Interpret the requirements for testing of raw materials, in-process samples, and finished product in accordance with pharmacopoeia compendia standards.	K3
CO4	Operate, validate, and calibrate a variety of laboratory equipment used in pharmaceutical industrial labs.Assess instruments malfunction and troubleshoot analytical equipment failure in compliance with regulatory requirements.	K3
CO5	Understand the concept of quality systems and compliance in the regulated industry and the role of quality assurance.Understand the use of controlled documentation.	K2

MAPPING WITH PROGRAMME OUTCOMES

CO5/ PO5	PO1	PO2	PO3	PO4	PO5
CO1	M	M	M	S	S
CO2	S	S	M	S	S
CO3	S	S	S	S	S
CO4	S	S	S	S	S
CO5	S	S	S	S	S

S-Strong, M-Medium, L-Low

17PMB2EA	ELECTIVE II- PHARMACEUTICAL QUALITY CONTROL	SEMESTER – II

Total Credits: 4

Hours per week: 4

CONTENTS

UNIT - I

An introduction to pharmaceutical microbiology. WHO good manufacturing practices: main principles for pharmaceutical products- Quality management in the drug industry: philosophy and essential elements- Heating Ventilation and air-conditioning systems for non-sterile pharmaceutical dosage forms- Validation- Water for pharmaceutical use.

UNIT - II

Types of spoilage, Factors affecting microbial spoilage – assessment of microbial spoilage – preservation. Ecology of microorganisms as it affects the pharmaceutical industry – Sterilization control - methods of sterility testing- sterilization monitors and Quality assurance of products**.**

UNIT - III

Sterile pharmaceutical products – injections, Non-injectable sterile fluids, ophthalmic preparations, dressings & implants. The microbiological quality and regulatory requirements for natural and nutraceutical products - The regulatory control and quality assurance of immunological products, Containment system integrity – sterile products, Regulatory guidelines (microbiology) for veterinary antimicrobial products- Microbiological quality and regulatory requirements for bio therapeutics and manufactured products,

UNIT - IV

The role of the Qualified Person in microbiological quality assurance, Safety in microbiology, Rapid enumeration and identification methods, Selection and use of cleaning and disinfection agents in pharmaceutical manufacturing, Measurement of biocide effectiveness, International disinfectant testing protocols, Prevention and elimination of microbial bio films in the manufacturing environment using Clean-in-Place, Cleanroom design, operation and regulatory standards.

UNIT - V

Microbiological quality assurance. Validation of aseptic processing and media fills, the role of the microbiologist in HACCP, Auditing the pharmaceutical microbiology department.

TEXT BOOKS:

1. World Health Organization. 2007. **Quality assurance of pharmaceuticals A compendium of guidelines and related materials** Volume 2, 2nd updated edition Good manufacturing practices and inspection.
2. *W.B.Hugo&A.D.Russel*, 2007. **Pharmaceutical Microbiology**, 4th Edition, Blackwell Scientific Publications.

REFERENCE BOOKS:

1. *Dr Norman Hodges and Professor Geoff Hanlon* (University of Brighton), 2013. **Industrial Pharmaceutical Microbiology – Vol & Vol II: standards & Controls**.
2. *Madigan M.T.* 2006. **Brock Biology of Microorganisms** 11th Edition. Pearson-Prentice Hall, USA.

17PBC2EA	ELECTIVE-II: BIOCHEMISTRY OF TOXICOLOGY	SEMESTER-II

PREAMBLE:

- This course offers an overview of the biochemical basis of toxicology and the effects & metabolism of toxins.
- Students can gain an in-depth knowledge and understanding of general toxicology, methods of toxicity testing, toxins from microbes, carcinogenic & teratogenic toxins, pesticide, metal and chemical toxicology.

COURSE OUTCOMES:

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

CO number	CO Statement	Knowledge Level
CO1.	Value the importance of toxicology. Explain about factors, which influence toxicity.	K5
CO2.	Distinguish and evaluate the biochemical effects of toxic agents on cellular macromolecules and tissues.	K4 & K5
CO3.	Compare and perceive different genetic methods used for testing toxicity.	K4 & K5
CO4.	Examine the effects and metabolism of various microbial toxins, teratogens and carcinogens.	K4
CO5.	Justify the mode of action of toxic pesticides, heavy metals, chemicals and air pollutants.	K5

MAPPING WITH PROGRAMME OUTCOMES:

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	M	S	S
CO2	S	S	M	S	S
CO3	S	S	S	S	S
CO4	S	S	M	S	S
CO5	S	S	M	S	S

L-Low; M-Medium and S-Strong.

18PBT33A	PLANT BIOTECHNOLOGY	SEMESTER - III

Total Credits: 4
Hours / Week: 4

PREAMBLE:

1. To understand the various *in vitro* culture techniques
2. Gains knowledge on Preservation of plant cells
3. Familiarity to Gene transferring mechanisms in plants

COURSE OUTCOMES

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

CO Number	CO Statement	Knowledge Level
CO1	Review the culture media types and the role of different media constituents	K3
CO2	Understand the plant genome organisation	K3, K4
CO3	Imparts knowledge on Agrobacterium biology and transgenic technology	K3, K4, K5
CO4	Focuses on various types of resistance and green house technology	K4, K5
CO5	In depth understanding of Secondary metabolites and its applications	K4, K5

Mapping with Programme Outcomes

COs/Pos	PO1	PO2	PO3	PO4	PO5
CO1	M	M	S	M	M
CO2	S	S	S	S	M
CO3	S	S	S	S	S
CO4	S	S	S	S	M
CO5	S	S	S	S	S

S-Strong: M-Medium; L-Low

18PBT33A	PLANT BIOTECHNOLOGY	SEMESTER – III

Total Credits: 4
Hours / Week: 4

CONTENTS

UNIT - I

Plant Tissue culture

Media, plant growth regulators: Callus and suspension culture, somoclonal variation, somatic embryogenesis: Embryo culture, micropropagation protoplast isolation and somatic hybridization; Haploid plants, Artificial seeds and hardening. Germplasm preservation- cryopreservation.

UNIT - II

Genome organization

Nuclear genome, chloroplast genome, mitochondrial genome, CMS, Protein targeting to chloroplast and mitochondria, Heat shock proteins, seed storage proteins.

UNIT - III

Plasmids, Vectors and Nuclear Transformation

Features of Ti and Ri plasmids, uses of Ti and Ri as vectors, binary vectors, use of 35S and other promoters, viral vectors, use of reporter genes, Transgenic biology - methods of nuclear transformation – physical, chemical and biological gene transfer methods in plants.

UNIT - IV

Plant Resistance

Engineering of plants for herbicide resistance, insect resistance, disease resistance, antifungal proteins, nematode resistance, abiotic stress. Long shelf life of fruits and flowers. Green house and green – home technology.

UNIT - V

Metabolic Pathways

Secondary metabolic pathways in plants. Extraction & purification of phyto-chemicals. Industrial phytochemical products from plants- Alkaloids, Biodegradable Plastics, Therapeutic proteins, plantibodies, plant vaccines, herbal drugs, bioethanol and biodiesel. Hairy root induction.

TEXTBOOKS:

1. *Singh, B.D*. 2006**.** **Plant Biotechnology.** 1st edition. Kalyani Publishers.
2. *Chawla*, *H. S.* 2013. **Introduction to Plant Biotechnology.** 3rd edition. Oxford &IBH publishing company.

REFERENCE BOOKS:

1. *Grierson, D.* and *Covey, S.V.* 1988. **Plant Molecular Biology**. 2nd edition. Blackie Publishers.
2. *Bhojwan, S. S.* 1996. **Plant tissue culture - Theory and Practice.** 1st edition. Elsevier Publishers.

18PBT33B	ANIMAL BIOTECHNOLOGY	SEMESTER - III

Total Credits: 4
Hours / Week: 4

PREAMBLE:

The students will be able to understand the

1. Various *in vitro* culture techniques
2. Preservation of animal cells
3. Gene transferring mechanisms

COURSE OUTCOMES

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

CO Number	CO Statement	Knowledge Level
CO1	Review the culture media types and the role of different media constituents	K3
CO2	Learn the technique of tissue and organ culture and the applications of the culture products	K3
CO3	Imparts knowledge on cell line maintenance and cryopreservation	K3, K4, K5
CO4	Focuses on scale up of animal cell culture	K4, K5
CO5	In depth understanding of Tissue engineering and its applications	K4, K5

Mapping with Programme Outcomes

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	M	M	S	M	M
CO2	S	S	S	S	M
CO3	S	S	S	S	S
CO4	S	S	S	S	M
CO5	S	S	S	S	S

S-Strong: M-Medium; L-Low

18PBT33B	ANIMAL BIOTECHNOLOGY	SEMESTER – III

Total Credits: 4
Hours / Week: 4

CONTENTS

UNIT - I

Animal cell culture media and its constituents

Structure and organization of Animal cells - Culture media; Balanced salt solutions and simple growth medium, Physical, chemical and metabolic functions of different constituents of culture medium; Role of carbon dioxide, serum, growth factors, glutamine in cell culture; Serum and protein free defined media and their applications.

UNIT – II

Cell culture techniques and cryopreservation

Primary cell culture techniques - mechanical disaggregation, enzymatic disaggregation, separation of viable and non-viable cells. Mass culture of cells - manipulation of cell line selection - types of cell lines -maintenance of cell lines - immobilization of cells and its application - synchronization of cell cultures and cell division. cryopreservation - germplasm conservation.

UNIT – III

Tissue and organ culture

Advantages and limitations of Tissue and organ culture - medical/pharmaceutical products of animal cell culture- genetic engineering of animal cells and their applications. Risks in a tissue culture laboratory and safety - biohazards. Facilities for animal cell culture-infrastructure, equipment, culture vessels.

UNIT - IV

Animal cell culture scale up

Scale up in suspension - stirrer culture, continuous flow culture, air-lift fermentor culture; Scale up in monolayer - Roller bottle culture, multisurface culture, multiarray disks, spirals and tubes - monitoring of cell growth. Organ culture - whole embryo culture - specialized culture techniques - measurement of cell death.

UNIT - V

Tissue engineering

Design and engineering of tissues - tissue modeling. Embryonic stem cell engineering - ES cell culture to produce differential cells - Human embryonic stem cell research. Transgenic animals-transgenic animals in xenotransplantation

TEXT BOOKS:

1. *M.M. Ranga, 2000.* **Animal Biotechnology.** Agrobios, India.

2. *Satyanarayana, U., 2006.* **Biotechnology.** Books and Allied (P) Ltd.

3. *D.C.Darling and S.J.Morgan, 1994.* **Animal Cells Culture and Media.** BIOS , Scientific Publishers Limited.

REFERENCE BOOKS:

1. *Jennie P.Mathur and David Barnes, 1998.* **Methods in Cell Biology.** Volume 57, Animal Cell Culture Methods Academic Press.

2. *Ann Harris, 1996.* **Epithelial Cell Culture.** Cambridge University Press

18PBT33C	ENVIRONMENTAL BIOTECHNOLOGY	SEMESTER - III

Total Credits: 4
Hours / Week: 4

PREAMBLE:

This subject will provide the information about the

1. Basic vocabulary of environmental biology
2. Hazards of industrial pollutants on environment
3. Effect of pollution on biodiversity

COURSE OUTCOMES

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

CO Number	CO Statement	Knowledge Level
CO1	Review on the organization of ecosystem and its functions	K3
CO2	Understand the global environment problems and the hazards of pollution	K3, K4
CO3	In depth understanding of waste water treatment and Vermicomposting	K3, K4, K5
CO4	Imparts knowledge on Xenobiotics and bioremediation methods	K4, K5
CO5	Create awareness on environmental monitoring and environmental laws	K4, K5

Mapping with Programme Outcomes

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	M	M	M
CO2	S	S	S	S	S
CO3	S	S	S	S	M
CO4	S	M	S	M	S
CO5	M	S	S	S	S

S-Strong: M-Medium; L-Low

18PBT33C	ENVIRONMENTAL BIOTECHNOLOGY	SEMESTER – III

Total Credits: 4
Hours / Week: 4

CONTENTS

UNIT - I

Ecosystem structure and functions

Abiotic and biotic components, Energy flow, food chain, food web and tropic levels, Ecological pyramids, N,P,C and S cycles in nature. Threats to environment (Pollutions, waste materials and Xenobiotics). Effect of environment on human genome. Effect of human activities on environment (Bioaccumulation and Biomagnification). Renewal and non renewable resources.

UNIT - II

Hazards of Pollution

Types of pollution (Water, Land, Air, Noise and Nuclear), Methods for the measurement of pollution, Global environmental problems: ozone depletion, UV-B, green house effect and acid rain.

UNIT - III

Waste water Treatment

Physical, Chemical, Biological treatment system and Solid waste pollution and its management: Current practice of solid waste management, composting systems, vermicomposting. Biomedical waste management: Current status of biomedical waste management.

UNIT - IV

Xenobiotics and Bioremediation

Xenobiotics in Environment - Biodegradation of Hydrocarbons, Substituted hydrocarbons, Pesticides, Lignin, Synthetic dyes.

Bioremediation & Phytoremediation: Biofeasibility, applications of bioremediation. Bioabsorption and Bioleaching of heavy metals (Mercury and Lead), advantages and disadvantages of bioleaching.

UNIT - V

Environmental Monitoring and Impact Assessment

Biological monitoring program, bioindicators and environmental monitoring, environmental management. Environmental Laws: Problems in making and implementing environmental laws, Indian environmental laws, national environmental policy.

TEXT BOOKS:

1. *Prohit. S.S.* 2003. **Ecology and environment and pollution.** 1st edition. Agrobios publications.
2. *Varma. P.S*. 1998. **Concept of ecology**. 1st edition. Chand & Co Ltd.

REFERENCE BOOKS:

1. *Dash. M.C.* 1998. **Fundamentals of Ecology.** 2nd edition. Tata McGraw Hill.
2. *Alan Scragg*. 2007. **Environmental biotechnology**. 2nd edition. Oxford university press.

18PBT33D	RESEARCH METHODOLOGY & IPR	SEMESTER - III

Total Credits: 4
Hours / Week: 4

PREAMBLE:

The student will understand the

1. Basic concepts of research and its methodologies
2. Identify appropriate research topics
3. Basic theory, philosophy and application of statistics

COURSE OUTCOMES

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

CO Number	CO Statement	Knowledge Level
CO1	Know the process of thesis writing	K2, K3
CO2	Understand the result interpretation and report presentation process	K3, K4
CO3	Imparts knowledge on the publication process in the basic and reputed journals	K3, K4, K5
CO4	In depth understanding of basic sampling methods and error calculation	K4, K5
CO5	Focus on basic Statistical analysis related to thesis work	K4, K5

Mapping with Programme Outcomes

COs/Pos	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	M	S
CO2	S	S	S	S	M
CO3	S	S	S	S	S
CO4	S	M	M	S	S
CO5	S	S	S	S	S

S-Strong: M-Medium; L-Low

18PBT33D	RESEARCH METHODOLOGY & IPR	SEMESTER – III

Total Credits: 4
Hours / Week: 4

CONTENTS

UNIT I

Research Process and Design:

Objective – types- characteristics – significance of research. Research problem – literature survey – development and characteristics of hypothesis – testing hypothesis**.** Research Design **-** essentials of good research design – types. Data collection: Collection - types - sources - precautions in using secondary data - selection of method of data collection. Case study on research problems faced in India.

UNIT II

Sampling, Data Analysis and Interpretation:

Sampling design- steps involved – characteristics - types – probability and nonprobability. Random sampling – merits and demerits - types of variables. Analysis of data: Processing of data – Mean, median, mode, standard deviation, standard error, coefficient of variation. diagrammatic presentation in research. Data Interpretation **-** Chi square test, students t-test, ANOVA with interpretation of data - statistical tables and their significance.

UNIT III

Thesis writing and Journals

Literature collection, format of thesis – steps – writing each part of thesis. Review monographs; Journals – impact factor, H index, information retrieval, National information centre network services. Preparation of presentation for a research conference.

UNIT - IV

Intellectual Property Rights:

Patents – types – filing application process - guidelines. Trade secret, copyright, trademarks, geographic indications (GI). Patenting biological materials: Plant genetic resources, Plant breeders rights and farmer's rights, biodiversity.

UNIT V

Conventions and Protection

Conventions and Treaties: Indian Patent Act 1970, PCT, WIPO, Budapest Treaty, Paris Convention, TRIP, GATT, objectives of patent system. Protection – requirement of patent law – protection in biotechnology - choice of intellectual property protection (IPP). Infringement – litigation – recent amendments - social implications.

Text Books:

1. *Sanjeev Gupta*, SBPD Publishing, Research Methodology.
2. *Jerrold. H. Zar* (2006), Biostatistical analysis, 4th ed., Pearson Education. Pvt. Ltd.

Reference Books:

1. *Kenneth Lange* (2002), Statistics for biology and health; mathematical and statistical methods for analysis.
2. *Singh K.* 2008, Intellectual Property Rights on Biotechnology, BCIL, New Delhi.
3. *Annadurai, P.* 2007, **A Text book of biostatistics**. 1st edition. New Age International Publishers.
4. *B. Burt Gerstman.* 2008. **Basic Biostatistics**. 1st edition. Jones and Barlett Publishers, California, USA.
5. *Robert R. Sokal* and *F. James Rohl*. 2009. **Introduction to Biostatistics**, 2nd edition. Dover publications, USA

18PBT33P	CORE PRACTICAL-V PLANT BIOTECHNOLOGY AND ANIMAL BIOTECHNOLOGY	SEMESTER – III

Total Credits: 3
Hours / Week: 5

1. *In vitro* Seed Germination
2. Micropropagation
3. Meristem culture
4. Callus induction
5. Artificial Seed production
6. Suspension cultures
7. Embryo culture
8. Protoplast Isolation
9. Preparation of primary cell culture
10. Trypsinizing and subculturing cells
11. Determining cell number and viability with a haemocytometer and trypan blue staining

REFERENCE BOOKS:

1. *Sant Saran Bhojwani, Razdan, M. K.* 1996. **Plant tissue culture: theory and practice**. 1st edition. Elsevier science.
2. *Freshney, R. I.* 2010. **Culture of Animal Cells: A Manual of Basic Technique and Specialized Applications**. 6th edition. Wiley Blackwell.

18PBT33Q	CORE PRACTICAL-VI: ENVIRONMENTAL BIOTECHNOLOGY AND RESEARCH METHODOLOGY&IPR	SEMESTER – III

Total Credits: 3
Hours / Week: 5

1. Water Quality analysis-
   a) Colour, b) pH c) Acidity
2. MPN Test
3. Total hardness by EDTA titrimetric method
4. Estimation of Total alkalinity, carbonate and bicarbonate
5. Determination of Chemical oxygen demand
6. Estimation of Chloride
7. Estimation of nitrate
8. Estimation of sulphate
9. Estimation of phosphate
10. To construct frequency distribution using exclusive and inclusive methods and representation of data using Histogram, frequency curve and Ogives
11. To represent data diagrammatically using bars, rectangles, circles and pie diagrams
12. Concept of Test of Hypothesis. Applications of t-test statistics to biological problems/data: Chi-square, statistic applications in Biology
13. Simple Regression and Correlation.

Text book

1. S. Rajan and R. Selvi Christey. 2011. Experimental Procedures in Life Sciences. Anjanaa Book house, Chennai, First Reprint.

18PBT3EA	ELECTIVE - III: STEM CELL TECHNOLOGY	SEMESTER - III

Total Credits: 4
4 Hours / Week

PREAMBLE:

1. To study the types of Stem cells
2. To learn about the applications of Tissue Engineering

COURSE OUTCOMES

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

CO Number	CO Statement	Knowledge Level
CO1	Know the process of stem cell and storage	K3
CO2	Understand the stem cell importance in plants	K3, K4
CO3	Imparts knowledge on the stem cells in animals	K3, K4, K5
CO4	In depth understanding of haemopoietic stem cell	K4, K5
CO5	Focus on stem cell therapies and its application	K4, K5

Mapping with Programme Outcomes

COs/Pos	PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	S	S
CO2	S	S	S	S	S
CO3	S	M	S	S	S
CO4	S	S	M	M	M
CO5	S	S	S	S	S

S-Strong: M-Medium; L-Low

18PBT3EA	ELECTIVE-III: STEM CELL TECHNOLOGY	SEMESTER – III

Total Credits: 4
Hours / Week: 4

CONTENTS

UNIT - I

Stem Cells and Cellular Pedigrees

Scope of stem cells – definition of stem cells – concepts of stem cells – differentiation, maturation, proliferation, pluripolericy, self – maintainance and self – renewal – problems in measuring stem cells – preservation protocols.

UNIT - II

Stem Cell Concept in Plants

Stem cell and founder zones in plants – particulary their roots – stem cells of shoot meristems of higher plants.

UNIT - III

Stem Cell Concept in Animals

Skeletal muscle stem cell – Mammary stem cells – intestinal stem cells – keratinocyte stem cells of cornea – skin and hair follicles –Tumour stem cells, Embryonic stem cell biology - factors influencing proliferation and differentiation of stem cells – hormone role in differentiation.

UNIT - IV

Haemopoietic Stem Cell

Biology – growth factors and the regulation of haemopoietic stem cells.

Hematopoietic stem cell niche, Embryonic stem cell-derived Hematopoietic stem cells. Cord blood hematopoietic stem cells- Cord blood transplantation Characteristics of cord blood stem cells Genomics and proteomics of cord blood stem cells

UNIT - V

Potential Uses of Stem Cells

Cellular therapies – vaccines – gene therapy – immunotherapy – tissue engineering – blood and bone marrow – Fc cells. Stem cells for the treatment of muscular dystrophy- Cellular environment of a dystrophic muscle, Myogenic stem cells from embryonic stem cells and inducible pluripotent stem cells.

TEXT BOOKS:

1. *CS Potten , 1997.* **Stem cells.** Elsevier.

2. *Robert Paul Lanza, 2006.* **Essentials of stem cell biology.** 2nd edition. Academic Press;

REFERENCE BOOKS:

1. *Song Li, Nicolas L'Heureux, Jennifer Elisseeff.* 2011. **Stem Cell and Tissue Engineering.** 1st edition. World Scientific Publishers.
2. *Robert Lanza, John Gearhart, Brigid Hogan.* 2006. **Essentials of Stem Cell Biology**. 2nd edition. Macmillan Publishing Solutions.

17PMB3EA	ELECTIVE III- FOOD MICROBIOLOGY AND FOOD QUALITY CONTROL	SEMESTER- III

PREAMBLE:

1. This course has been designed for students to learn and understand the relation between food and microbes, fermented food, food borne diseases and food quality control.

COURSE OUTCOMES

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

CO Number	CO Statement	Knowledge level
CO1	• To understand the relation between the food and microbes and types of microorganisms in related to food. • To acquaint the knowledge on spoilage of various types of food by microbes • To Understand the principles of food preservation and some preservation methods	K2, K3
CO2	• To describe the characteristics food infections and poisoning and various food borne microorganisms. • To understand the role of microbes and the process involved in the production of various fermented food products.	K3
CO3	• To acquaint the knowledge on indicator organisms and examination of food for the identification of spoilage causing microorganisms.	K3, K4
CO4	• To become equipped with in house quality assurance in food industry and, GMP, SSOP and HACCP Principles	K3, K4
CO5	• To describe about the food laws and regulations. • To understand the GHP and waste disposal in food industry	K3

MAPPING WITH PROGRAMME OUTCOMES

CO5/PO5	PO1	PO2	PO3	PO4	PO5
CO1	S	S	M	M	M
CO2	M	S	M	S	S
CO3	S	M	S	M	M
CO4	S	S	M	S	S
CO5	S	S	S	M	S

S-Strong,M-Medium,L-Low

17PMB3EA	ELECTIVE III- FOOD MICROBIOLOGY AND FOOD QUALITY CONTROL	SEMESTER- III

Total credits: 4
Hours per week: 4

CONTENTS

UNIT - I

Food as a substrate – Incidence and types of microorganisms in food – Contamination and Spoilage of Meat, Poultry, Sea foods, Vegetables, Fruits. Principles of food preservations: Asepsis, Preservation by use of High temperature, Low temperature, Canning, Drying, Radiation and Food additives.

UNIT - II

Food poisoning – Food borne diseases- Bacterial and Non- Bacterial. Fermented foods - Meat and fishery products – Country cured hams, Dry sausages, Katsuobushi. Fermented milk products –, Yoghurt and Cheese.

UNIT - III

Indicator organisms – Direct examination – culture techniques – enumeration methods – plate – Viable & Total Count; Alternative methods – Dye reduction tests , electrical methods , ATP determination: Rapid methods, immunological methods – DNA / RNA methodology – Laboratory accreditation.

UNIT - IV

In house Committee for quality assurance, Persons involved, Internal Microbial Quality control Policy, Quality Check at every step from collection of raw materials till it reaches the customer, GMP, SSOP, HACCP- Principles & Applications.

UNIT - V

Food laws and regulations

A. National – PFA Essential Commodités Act (FPO, MPO etc.)

B. International – Codex Alimentarius, ISO – 9000 series, ISO 22000 & BS 5750.

C. Regulatory Agencies – WTO, FSSAI.

Hygiene and sanitation in food sector General Principles of Food Hygiene, GHP for commodities, equipment, work area and personnel, cleaning and disinfect ion (Methods and agents commonly used in the hospitality industry), Safety aspects of processing water (uses & standards) and Waste Water & Waste disposal.

TEXT BOOKS:

1. *Frazier. W.C and D.C Westhoff*. 2008. **Food Microbiology.** 5th ed. Tata McGraw Hill publishing Co., New Delhi.
2. *Jay, J.M* .2007. **Modern Food Microbiology** 7th edition, Van Nostra and Rainhokdd Co.

REFERENCE BOOKS:

1. *Adams. M. R and M. D Moss*.2008. **Food Microbiology,** 3rd edition. Panama Publishers.
2. Food safety and standards regulations, 2010.
3. The ministry of health and family welfare, The Gazette of India : Extraordinary, Part - III, section
4. D Kumar Bhatt, Priyanka Tomar, 2010**.An Introduction to Food Science Technology and Quality Management** 1st Edition, Kalyani Publishers.
5. Chris Bell, Paul Neavas and Anthony P. Williams, 2006. Food Microbiology and Laboratory Practices, Blackwell Publishing.

18PBC3EA	ELECTIVE – III: NUTRITION AND CLINICAL NUTRITION	SEMESTER –III

PREAMBLE:

1. This course offers an overview of food science and human nutrition knowledge help in achieving and maintaining good health
2. Students can gain an in-depth knowledge and understanding on appropriate nutritional care for prevention/and treatment of the various diseases.

COURSE OUTCOMES:

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

CO number	CO Statement	Knowledge Level
CO1.	Inspect the composition of fiber and nutritional changes in inborn errors. Asses the nutritional status and Understand the nutritional changes due to preservation of food process.	K_4 & K_5
CO2.	Examine the clinical test for Cardiovascular diseases. Explain the importance of nutritional support during treatment of diseases.	K_4 & K_5
CO3.	Test for liver function. Relationship with food habits during treatment of livers diseases such as Hepatitis, Cirrhosis and Hepatic coma.	K_4 & K_5
CO4.	Examine the clinical test for renal functions. Compare the nutritional care- acid and alkaline ash diet and also diet modification with minerals for treatment of renal calculi.	K_4 & K_5
CO5.	Understand the dietary management during treatment of infectious diseases and cancer.	K_4 & K_5

MAPPING WITH PROGRAMME OUTCOMES:

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	M	M	M
CO2	S	S	S	M	M
CO3	S	S	S	M	M
CO4	S	S	M	M	M
CO5	S	S	M	M	M

L-Low; M-Medium and S-Strong

18PBC3EA	ELECTIVE – III: NUTRITION AND CLINICAL NUTRITION	SEMESTER –III

Total Credit: 4
Hours per week: 4

CONTENTS

UNIT I

Concept of Balanced diet, Calories requirement – sedentary, moderate & heavy worker, Fast foods, Additives in the diet, Dietary allergies. Lactose intolerance. Quality of protein – animal versus plant protein, Parenteral nutrition, Types of diets – Paleo diet, keto diet, Prebiotics and Probiotics. Chemical composition of dietary fiber and its importance - Physiological effects and metabolic adaptation during exercise - Nutritional management of inborn errors of metabolism

Diet and nutrition in India

Assessment of nutritional status - Factors affecting digestion and absorption of food - Effects of irradiation, cooking, refining, sprouting and fermentation on nutritional quality of food

UNIT II

Dietary management of Cardio Vascular Diseases

Clinical diagnostic tests and nutrition management for - Dyslipidemias, Atherosclerosis, Angina Pectoris and Myocardial Infarction (MI) and Congestive Cardiac Failure (CCF), Prevention through life style modifications.

Dietary management of Hypertension

Dietary management - Diet related factors influencing hypertension, DASH diet

UNIT III

Dietary management of Liver disease

Types, Etiology, Symptoms and Complications, Physiology, functions of the liver and liver function tests. Metabolic consequences of alcohol consumption, Dietary management for - Hepatitis, Cirrhosis and Hepatic coma.

UNIT IV

Dietary management of Kidney Diseases

Kidney function tests; Types of kidney diseases:- Glomerulonephritis, Nephrotic Syndrome, Acute Renal Failure (ARF), Chronic Renal Failure (CRF), End Stage Renal Disease (ESRD)-Dialysis and Kidney Transplant. Nephrolithiasis/Renal Calculi : Etiology, Types of stones and nutritional care- acid and alkaline ash diet. Use of sodium, potassium and phosphorous exchange lists in diet planning of kidney diseases patient.

UNIT V

Dietary management in Febrile condition: Metabolic changes during infection and dietary treatment for - Typhoid, Influenza, Malaria, Tuberculosis and HIV & AIDS

Dietary management of cancer:

Dietary management to cancer patients.

TEXT BOOKS

1. Swaminathan S,(1985): Advanced Textbook on Food & Nutrition Vol. 1 & N (2nd Ed. Revised _ Enlarged) Bapp Co..
2. Mahan L.K., Sylvia Escott-Stump (2000): Krause‟ s Food Nutrition and Diet Therapy ,10th Edition, W.B. Saunders Company London.

3. B. Srilakshmi, (2007): Dietetics, published by K.K. Gupta For New age International Pvt. Ltd. New Delhi.
4. Swaminathan, M. 1974. Essentials of food and nutrition Vol. II, Applied aspects, Ganesh Pubishers, Madras

REFERENCE BOOKS

1. James Orten and Otto Neuhaus, 2003. Human biochemistry, 10th edition, CV Mosby Company, London.
2. Antia F.P. And Philip Abraham (2001) Clinical Nutrition and Dietetics, Oxford Publishing Company.
3. Passmore P. And M.A. East Wood: Human Nutrition And Dietetics, Churchill Living Stone.
4. WohlShils and Goodheart: Modern Nutrition In Health And Disease, McLAren And Ubrman, Philadelphia.
5. Robinson Ch., M.B. Lawlea, W.L., Chenoweth, and A.E., Carwick: Normal and Therapeutic Nutrition, Macmillan Publishing Company.
6. NIN books Nutritional values of Indian food.

18PBTSS1	SELF STUDY -I: FOOD BIOTECHNOLOGY	SEMESTER III

Total Credits: 1

PREAMBLE

1. To study about various alternate foods.
2. To study the various preservation methods.
3. Quality measures adopted in food industry.

COURSE OUTCOMES:

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

CO number	CO Statement	Knowledge Level
CO1	To comprehend the usage of fermentation technology in food industry	K_4 & K_5
CO2	To understand the role of novel organisms in food industry	K_4 & K_5
CO3	Awareness on food borne infections	K_4 & K_5
CO4	Examine the types of beverages and processes	K_4 & K_5
CO5	Understand the government regulatory policies	K_4 & K_5

MAPPING WITH PROGRAMME OUTCOMES:

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	**S**	**S**	**M**	**M**	**M**
CO2	**S**	**S**	**S**	**S**	**M**
CO3	**S**	**S**	**S**	**S**	**S**
CO4	**S**	**S**	**M**	**M**	**S**
CO5	**S**	**S**	**M**	**M**	**S**

L-Low; M-Medium and S-Strong

18PBTSS1	SELF STUDY -I: FOOD BIOTECHNOLOGY	SEMESTER III

Total Credits: 1

OBJECTIVES :

1. To study about various alternate foods.
2. To study the various preservation methods.

CONTENTS

UNIT - I

Food Biotechnology – Introduction and Scope; Production of Single cell protein and Baker's yeast; Mushroom cultivation. Food and dairy products: Cheese, bread and yogurt. Fermented vegetables – Saurkraut; Fermented Meat – Sausages.

UNIT - II

Novel microorganisms eg. LAB (Probiotics), Cyanobacteria, methylotrophs enzyme biotransformations. Role of Plant tissue culture for improvement of food additives; color and flavor. Genetic modifications of microorganisms; detection and rapid diagnosis. Genetically modified foods and crop

UNIT - III

Food borne infections and intoxications; with examples of infective and toxic types – *Clostridium, Salmonella, Staphylococcus.* Mycotoxins in food with reference to *Aspergillus* species. Food preservation: canning, dehydration, ultrafiltration, sterilization, irradiation. Chemical and naturally occurring antimicrobials; Biosensors in food industry

UNIT - IV

Types of beverages and their importance: Synthetic beverages- carbonated, low-calorie and dry beverages; isotonic and sports drinks; soft drinks.

Production of pectin, vitamins from apple pomace; Production of citrus oil from peels of citrus fruits. Processing of tea waste - as a feed for livestock and poultry; Fermented foods: alcoholic beverages - beer, wine and distilled spirits non alcoholic beverages - yoghurt and vinegar.

UNIT - V

Quality assurance: Microbiological quality standards of food, Intellectual property rights and animal welfare. Government regulatory practices and policies. FDA, EPA, HACCP, ISI. Risk analysis; consumer and industry perceptions.

REFERENCE BOOKS :

1. *Lee Byong, H.V.* 1996. **Fundamentals of Food Biotechnology**. 1st edition. C H Publishers.
2. *Roger, A.* 1989. **Food Biotechnology**, 1st edition. Elsevier Applied Sci. Pub.
3. *Goldberg Israel.* 1994. **Functional Foods**. 1st edition. Chapman & Hall Publishers.
4. *Anthony Pometto, Kalidas Shetty, Gopinadhan Paliyath, Robert E. Levin.* 2005. **Food Biotechnology.** 2nd edition. CRC Publication.

18PBTSS2	SELF STUDY -II: DEVELOPMENTAL BIOLOGY	SEMESTER III

Total Credits: 1

PREAMBLE

1. To study about basics of Developmental Biology.
2. To study the various tools used in Developmental Biology.
3. To understand the Morphogenesis and organogenesis in animals.

COURSE OUTCOMES:

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

CO number	CO Statement	Knowledge Level
CO1	To understand the basic concept of development	K_4 & K_5
CO2	To gain knowledge on gametogenesis, fertilization and early development	K_4 & K_5
CO3	To comprehend the morphogenesis and organogenesis in animals	K_4 & K_5
CO4	To gain insight on morphogenesis and organogenesis in plants	K_4 & K_5
CO5	To highlight on the techniques used in animals and plant cells	K_4 & K_5

MAPPING WITH PROGRAMME OUTCOMES:

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	**S**	**S**	**M**	**S**	**S**
CO2	**S**	**S**	**S**	**S**	**S**
CO3	**S**	**S**	**S**	**S**	**S**
CO4	**S**	**S**	**M**	**S**	**S**
CO5	**S**	**S**	**S**	**S**	**S**

L-Low; M-Medium and S-Strong

18PBTSS2	SELF STUDY -II: DEVELOPMENTAL BIOLOGY	SEMESTER III

Total Credits: 1

OBJECTIVES :

1. To study about basics of Developmental Biology.
2. To study the various tools used in Developmental Biology.

CONTENTS

UNIT – I

Basic concepts of development: Potency, commitment, specification, induction, competence, determination and differentiation; morphogenetic gradients; cell fate and cell lineages; stem cells; genomic equivalence and the cytoplasmic determinants; imprinting; mutants and transgenics in analysis of development.

UNIT - II

Gametogenesis, fertilization and early development: Production of gametes, cell surface molecules in sperm-egg recognition in animals; embryo sac development and double fertilization in plants; zygote formation, cleavage, blastula formation, embryonic fields, gastrulation and formation of germ layers in animals; embryogenesis, establishment of symmetry in plants; seed formation and germination.

UNIT - III

Morphogenesis and organogenesis in animals: Cell aggregation and differentiation in Dictyostelium; axes and pattern formation in Drosophila, amphibia and chick; organogenesis – vulva formation in *Caenorhabditis elegans*; eye lens induction, limb development and regeneration in

vertebrates; differentiation of neurons, post embryonic development - larval formation, metamorphosis; environmental regulation of normal development; sex determination. Programmed cell death and aging.

UNIT – IV

Morphogenesis and organogenesis in plants: Organization of shoot and root apical meristem; shoot and root development; leaf development and phyllotaxy; transition to flowering, floral meristems, floral development and senescence in *Arabidopsis* and *Antirrhinum*.

UNIT – V

Techniques for the study of development: Microscopy - Study of gene expression by biochemical methods – Study of gene expression by *in situ* methods – Microinjection – Cell-labeling methods – Cell sorting.

REFERENCE BOOKS:

1. *Jonathan Michael Wyndham slack*, 2006. **Essential developmental biology.** Wiley-Blackwell.
2. *Geral P. Schatten*.2006. **Current topics in developmental biology.** Academic press.
3. *Wallace Arthur.* 2000. **The origin of animal body plans: a study in evolutionary developmental biology**, Cambridge university press.
4. *Werner A. Muller.* 1997. **Developmental biology.** Springer.

18PBT43A	PHARMACEUTICAL BIOTECHNOLOGY	SEMESTER IV

Total Credits: 4
4 Hours/Week

Preamble:

1. To gain knowledge on existing methods of drug development.
2. To comprehend the sources and constituents of Pharma products.

Course outcomes

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

CO Number	CO Statement	Knowledge Level
CO1	Imparts knowledge on importance of enzymes and applications in drugs	K3, K4, K5
CO2	Provide in-depth understanding of active constituents	K4, K5
CO3	Focus on natural sources for synthesis of drugs	K4, K5
CO4	To gain knowledge vaccine types and production	K4,K5
CO5	To analyze the toxicity levels and measurement	K4,K5

Mapping with Programme Outcomes

COs/Pos	PO1	PO2	PO3	PO4	PO5
CO1	S	M	M	M	M
CO2	S	M	S	M	M
CO3	S	M	S	S	M
CO4	S	S	S	S	M
CO5	S	S	S	S	M

S-Strong: M-Medium; L-Low

18PBT43A	PHARMACEUTICAL BIOTECHNOLOGY	SEMESTER - IV

Total Credits: 4
4 Hours/Week

CONTENTS

OBJECTIVES:

1. To evaluate different pharmaceutical parameters of current biotechnology products.
2. To determine parameters related to stability and formulation of biotechnology products

UNIT –I **8 h**

Enzymes in Pharmaceutical Biotechnology

Properties – dynamics of enzymatic activity, sources, extraction and purification: Applications pharmaceutical, therapeutic and clinical. Production of amyloglucosidase, glucose isomersase, amylase and trypsin. Immobilization –applications – perspective of enzyme engineering.

UNIT-II **10 h**

Active Drug Constituents

Introduction to active constituents - isolation, classification, properties. Systematic pharmacognostic study of a) Carbohydrates and derived products: agar, guar gumm acacia, Honey, Isabgol, pectin, Starch and sterculia b) Lipids: Bees wax, Castor oil, Cocoa butter, Cod~liver oil, Kokum butter, Lard, Rice, Bran oil, Shark liver oil and Wool fat.

UNIT –III **12 h**

Plant and Animal Sources

Herbal Medicines – Characteristics, Efficacy, importance, allergic reactions. Principles - Ayurveda, Unani, Siddha, Homepathy. Drugs derived from Animal – Gelatin, Glycerin, Heparin, Lanolin, Premarin, Animal vaccines. Pharmaceutics from Marine source – Cytarabine, Zicomotide, Omega – 3-acid ethyl ester, Trabectodin, Brentuximab vadotin.

UNIT –IV

Vaccines and Related Products Production **8 h**

DNA Vaccine construction and immunology, DNA vaccine expression, plasmid delivery of DNA vaccines. Bacterial vaccines and preparation. Peptide vaccine. Antitoxins. Serum–immune blood derivatives and immunity related products. Gene Pharming,

UNIT –V **10 h**

Immunogenicity

Estimation of toxicity LD 50 and ED 50. Immunogenicity of biopharmaceuticals: Immunogenicity; Factors contributing to immunogenicity (product-related factors, host- related factors), Measurement of immunogenicity. Consequence of immunogenicity to biopharmaceuticals. Neutraceuticals. Biopharmaceuical. Economics of drug development.

TEXT BOOKS:

1. *Kokate, Jalalpure and Hurakadle*, 2011. **Textbook of Pharmaceutical Biotechnology,** 1st edition. Elsevier Press.
2. *Crommelin, D., Sindelar, R and Meibohn, B.* 2008. **Pharmaceutical Biotechnology – Fundamentals and Applications**, 3rd edition. Informa Press, USA.

REFERENCES:

1. *Oliver Kayser and Rainer H. Müller.* 2005. **Pharmaceutical Biotechnology**: **Drug Discovery and Clinical Applications.** 1st edition. Wiley Publishers.
2. *Jay P. Rho. and Stan G. Louie*. 2003. **Hand book of Pharmaceutical Biotechnology.** 1st edition. CRC Press.
3. *Goodman and Gilman.* 2006. **The Pharmacological Basis of Therapeutic**s. 11th edition. Mc Graw Hill Medical Publishing Division.
4. *Heinrich Klefenz.* 2002. **Industrial Pharmaceutical Biotechnology**. 1st edition. WILEY-VCH Publication.
5. *D. Golan, D. Tashjian, A., Armstrong, E., Galanter, J. Armstrong, W.J., Arnaout, R. and Rose, H.* 2005. **Principles of Pharmacology.** Lippincott Williams and Wilkins, USA.

18PBT4EP	ELECTIVE IV PRACTICAL- APPLIED BIOTECHNOLOGY	SEMESTER IV

Total Credits: 2
4 Hours/Week

CONTENTS

1. Morphology and anatomy of any 5 food crops.
2. Plant fibers - Morphology microscopic study anatomy of whole fibers, using staining methods.
3. Medicinal plants: At least 5 medicinal plants and their morphology, anatomy, phyto-chemistry.
4. Case study – On environmental Management (air and soil)
5. Preparation of Compost/ Vermicompost for agricultural development.
6. Production of spawn for mushroom cultivation.
7. Water quality assessment (acidity and alkalinity tests)
8. Estimation of minerals in soil
9. Agarose Gel Electrophoresis.
10. SDS PAGE
11. Restriction Digestion
12. Ligation

REFERENCES:

1. *Arora, R.K. and Nayar, E.R.* 1984. **Wild relatives of crop plants in India.** NBPGR Science, Monograph No.7.
2. *Thakur, R.S., Puri, H.S. and Husain, A.* 1969. **Major medicinal plants of India, Central Institute of medicinal and aromatic plants.** Lucknow.
3. *Walters, Michele, Scholes, Robert J. (Eds.)*. **The GEO Handbook on Biodiversity Observation Networks.** 2017. 1st Edition. Springer International Publishing.
4. *Paterson, Russell, Lima, Nelson (Eds.).* **Bioprospecting.** 2017. 1st Edition. Springer International Publishing.
5. *Joseph Sambrook***,** *Michael R. Green***.**2012**. Molecular Cloning: A Laboratory Manual.** 4th edition. Cold Spring Harbor.

18PMB4EP	ELECTIVE IV- PRACTICAL MICROBIOLOGICAL LABORATORY TECHNIQUES	SEMESTER - IV

Total Credits: 2
Hours per week: 4

CONTENTS

1. Staining Techniques (Grams and LPCB)–Food samples- vegetables and packed foods.
2. Sterility tests for Instruments – Autoclave & Hot Air Oven
3. Air quality checking by settle plate method.
4. Sterility testing of Microbiological media
5. Sterility testing of Pharmaceutical products –Antibiotics, Vaccines & fluids
6. Enumeration of microbes from industrial effluents.
7. Evaluation of Drug potency by MIC.
8. Isolation & characterization of Bacteria from Wood.
9. Isolation & characterization of Bacteria from Paints.
10. Water quality analysis – MPN.
11. Estimation of BOD
12. Estimation of COD.
13. Isolation of microorganisms from spoiled foods – Meat, milk, Cereals and Bread.
14. Milk quality – Dye reduction test.
15. Determination of Thermal death point and thermal death time.

LABORATORY MANUALS:

1. *Cappuccino & Sherman,* **Microbiology - A laboratory manual**, 6th Ed, Pearson Education.
2. *Dr.B.J.Wadher & Dr.G.L.Bhoosreddy,* **Manual of diagnostic microbiology**, Ist Ed., Himalaya publishing house, Nagpur.
3. *George.A.Wistreich & Max.D.Lechtman,* Laboratory **Exercises in Microbiology**, 3rd Ed, Glencoe press, London.

18PBC4EP	ELECTIVE IV- PRACTICAL-NUTRITIONAL SCIENCE	SEMESTER-IV

Total Credits: 2
4 Hours/Week

PREAMBLE:

1. This course provides an overview of experimental aspects involving Nutritional science

CONTENTS

1. Ashing of food and preparation of ash solution.
2. Estimation of calcium in food.
3. Estimation of phosphorus in food.
4. Estimation of iron in food.
5. Estimation of ascorbic acid in cabbage by dye method.
6. Estimation of thiamine in food
7. Estimation of Protein in food
8. Estimation of Fat
9. Estimation of Carbohydrate
10. Estimation of Vitamin A and carotene
11. Estimation of Antioxidants

REFERENCE BOOK

1. Swaminathan, M, 1974. **Essentials of food and nutrition**, Vol. II, Applied aspects, Ganesh Pubishers, Madras.

20.12.2019
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