D.K.M. COLLEGE FOR WOMEN (AUTONOMOUS) VELLORE-1

DEPARTMENT OF BIOTECHNOLOGY

SYLLABUS FOR BACHELOR DEGREE COURSE IN BIOTECHNOLOGY

WITH EFFECT FROM 2021-2022

DEPARTMENT OF BIOTECHNOLOGY (UG)
WITH EFFECT FROM 2021-2022
CBCS PATTERN
THE COURSE OF STUDY AND SCHEME OF EXAMINATIONS

S.No.	Part	Study components / Course Title		Ins. Hrs/ Week	Credits	Title of the paper	Maximum marks		
							CIA	Sem.,Exam	Total
SEMESTER I									
1	I	Language	Paper I	6	4	Tamil –I	25	75	100
2	II	English	Paper I	6	4	English – I	25	75	100
3	III	Core theory	Paper I	5	5	Concepts in biotechnology	25	75	100
4	III	Core practical	Prac I	3	0	Concepts in biotechnology and Cell biology	0	0	0
5	III	Allied theory	Paper I	5	4	Biochemistry	25	75	100
6	III	Allied practical	Prac I	3	0	Biochemistry and microbiology	0	0	0
7	IV	Environmental studies		2	2	Environmental studies	25	75	100
		Total		**30**	**19**				**500**
SEMESTER II									
8	I	Language	Paper II	5	4	Tamil – II	25	75	100
9	II	English	Paper II	4	4	English –II	25	75	100
10	III	Core theory	Paper II	5	5	Cell biology	25	75	100
11	III	Core practical	Prac I	3	3	Concepts in biotechnology and Cell biology	40	60	100
12	III	Allied theory	Paper II	5	4	Microbiology	25	75	100
13	III	Allied practical	Prac I	3	2	Biochemistry and microbiology	40	60	100
14	IV			3	2	Value education		50	50
15	IV	Soft skills		2	1	Soft skills		50	50

		Total		**30**	**25**				**700**
SEMESTER III									
16	I	Language	Paper III	6	4	Tamil – II	25	75	100
17	II	English	Paper III	6	4	English –II	25	75	100
18	III	Core theory	Paper III	4	4	Immunology	25	75	100
19	III	Core practical	Prac II	3	0	Immunology and genetic engineering	0	0	0
20	III	Allied theory	Paper III	4	4	Molecular genetics	25	75	100
21	III	Allied practical	Prac II	3	0	Molecular genetics and Enzymology	0	0	0
22	IV	Skill based Subject	Paper I	2	2	Molecular Diagnostics – I	0	50	50
23	IV	Non-major Elective	Paper I	2	2	Organic farming	0	50	50
24		**Total**		**30**	**20**				**500**
SEMESTER IV									
25	I	Language	Paper IV	6	4	Tamil –IV	25	75	100
26	II	English	Paper IV	6	4	English –IV	25	75	100
27	III	Core theory	Paper IV	4	4	Genetic engineering	25	75	100
28	III	Core practical	Prac II	3	3	Immunology and genetic engineering	40	60	100
29	III	Allied theory	Paper IV	4	4	Enzymology	25	75	100
30	III	Allied practical	Prac II	3	2	Molecular genetics and Enzymology	40	60	100

31	IV	Skill based Subject	Paper II	2	2	Molecular Diagnostics – II	0	50	50
32	IV	Non-major Elective	Paper II	2	2	Kitchen and rooftop gardening	0	50	50
		Total		**30**	**25**				**700**
		Optional			1	Internship	Report submission		
*** Summer internship programme at the end of IV semester (Optional) – Extra credits – 1 to 3**									
SEMESTER V									
33	III	Core theory	Paper V	6	5	Plant and agricultural Biotechnology	25	75	100
34	III	Core theory	Paper VI	6	4	Animal cell culture	25	75	100
35	III	Core theory	Paper VII	5	4	Biophysics and Biostatistics	25	75	100
36	III	Elective	Paper I	4	3	Developmental Biology	25	75	100
37	III	Elective	Paper II	4	3	Bioinformatics	25	75	100
38	III	Core practical	Prac III	3	3	Plant and Animal cell culture	40	60	100
39	IV	Skill based Subject	Paper III	2	2	Bio – business and management	0	50	50
40		**Total**		**30**	**24**				**650**
SEMESTER VI									
43	III	Core theory	Paper VIII	6	5	Microbial and industrial Biotechnology	25	75	100
44	III	Core theory	Paper IX	6	4	Pharmaceutics and Herbal medicine	25	75	100
45	III	Core theory	Paper X	5	4	Bioinstrumentation	25	75	100
46	III	Elective	Paper III	4	3	Medical Biotechnology	25	75	100
47	III	Elective	Paper IV	4	3	Environmental Biotechnology	25	75	100

48	III	Core practical	Prac III	3	3	Bioprocess and Pharmaceutical Biotechnology	40	60	100
49	IV	Skill based subject	Paper IV	2	2	IPR and Ethics in Biotechnology	0	50	50
50	V	Extension activity			3				
51		**Total**		**30**	**27**				**750**
*** Mini project in the VI-Semester (optional) – Extra Credits 1-3**									

CONSOLIDATED STATEMENT

PART	SUBJECT	PAPER	CREDITS	TOTAL CREDITS	MARKS	TOTAL MARKS
I	TAMIL	4	4	16	100	400
II	ENGLISH	4	4	16	100	400
III	ALLIED ODD SEM	2	4	8	100	200
III	ALLIED EVEN SEM	2	4	8	100	200
III	ALLIED PRACT	2	2	4	100	200
III	ELECTIVES	4	3	12	100	400
III	CORE	10	4x5=20 6x4=24	44	100	1000
III	CORE PRACT	4	3	12	100	400
IV	ENV SCI	1	2	2	100	100
IV	SOFT SKILL	1	1	1	50	50
IV	VALUE EDU	1	2	2	50	50
IV	NME	2	2	4	50	100
IV	SKILL BASED	4	2	8	50	200
V	EXTENSION ACTIVITY	1	3	3	100	100
	TOTAL			**140**		**3800**

PROGRAM EDUCATIONAL OBJECTIVES

PEO 1 – Provide robust rationale in core biotechnology courses to produce biotechnology graduates who will be employable in core Biotech/Pharma industries where they could evaluate and propose biotechnological solutions with economic and social viability

PEO 2 – Sensitize on environmental, health and bioethical issues, Intellectual property rights, professional ethics and life-long learning through application orientated activities

PROGRAM OUTCOMES

PO1 To provide basic understanding and knowledge on the concepts of biotechnology

PO2 To make the graduates understand the quantum of science in their daily lives

PO3 To apply the knowledge they gain through their course of study

PO4 Graduates will be able to think analytically

PO5 To provide them with competent Evaluation strategies

PO6 Understanding of professional and ethical responsibility.

CONCEPTS IN BIOTECHNOLOGY

Semester	Subject Code	Category	Lecture		Theory		P	C
I	21CBT1A	Core - I	5 hrs per week	75	5 hrs per week	75	0	5

COURSE OBJECTIVE:

- To provide students with an introduction to concepts applied in the field of biotechnology from other interdisciplinary subjects such as genetics, molecular biology, biochemistry, applied microbiology and to equip learners with a strong foundation essential for subjects in the later years of the Biotechnology Science Major.

COURSE OUTCOMES: Upon successful completion of the course, students will be able to

CO NUMBER	CO STATEMENT	KNOWLEDGE LEVEL (K1 – K4)
CO 1	Recall the basics of biotechnology and categorize different fields	K1 & K2
CO 2	Demonstrate the use of microbes in biotechnological products	K2
CO 3	Illustrate the cloning procedures and methods in rDNA technology	K3
CO 4	Correlate and differentiate plant and animal cell lines and its usage in agriculture and medicine	K4
CO 5	Interpret the sequence analysis through bioinformatics tools.	K2

Knowledge level: K1- Remember; K2- Understand; K3- Apply; K4- analyze

MAPPING WITH PROGRAMME OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	S	S	M	S	S
CO2	S	S	S	M	M	M
CO3	M	S	S	S	M	M
CO4	S	S	M	S	M	S
CO5	M	M	S	M	S	S

S-strong; M- medium; L-low

UNIT 1 Introduction to Biotechnology 15 Hours

Definition of biotechnology, History and contributions of scientists, scope in multidisciplinary fields of biotechnology, whole organisms to nano level, stem cells, genetic engineering.

UNIT II Microbial Culture and Applications 15 Hours

Introduction, Microbial Culture Techniques, Measurement and Kinetics of Microbial Growth, Isolation of Microbial Products, Applications of Microbial Culture Technology, Bioethics in Microbial Technology.

UNIT III Cloning and Genetic Engineering 15 Hours

Introduction, Tools of rDNA Technology, Making Recombinant DNA, Introduction of Recombinant DNA into host cells, Identification of Recombinants, Polymerase Chain Reaction (PCR), DNA Probes, Hybridization Techniques, DNA Sequencing, Site-directed mutagenesis.

UNIT IV Biotechnology in Medicine and Agriculture 15 Hours

Introduction, Cell and Tissue Culture Techniques, Applications of Cell and Tissue Culture, Gene Transfer Methods in Plants, Transgenic Plants with Beneficial Traits, Animal Cell Culture Techniques, Characterization of Cell Lines, Applications of Animal Cell Culture.

UNIT V Genomics and Proteomics 15 Hours

Introduction to the world of genomes, bioinformatics, DNA sequence and structural databases, Proteins databases, 3-D Shape of Proteins, Protein based products, Designing Proteins, Proteomics, Microarrays.

Distribution of Marks: Theory 80% and Problems 20%

TEACHING METHODOLOGY:

- Class room teaching
- Assignments
- Discussions
- Homework
- PPT presentations
- Seminars
- Models and charts

TEXT BOOKS:

S.No	Authors	Title	Publishers	Year of Publication
1.	D Balasubramaniam	Concepts in Biotechnology	Universities Press	2016

REFERENCE BOOKS:

S.No	Authors	Title	Publishers	Year of Publication
1.	Raies A. Qadri, JavidParray	Concepts of Biotechnology	LAP LAMBERT Academic Publishing	2011

WEB RESOURCES:

1. https://opentextbc.ca/biology/

2. http://ocw.osaka-u.ac.jp/engineering/biotechnology-fundamentals

Syllabus Designer:

- Dr. Vinita Ernest
  Assistant professor

BIOCHEMISTRY

Semester	Subject Code	Category	Lecture		Theory		P	C
I	21CABC1B	Allied - I	5 hrs Per week	75	5 hrs Per week	75	0	4

COURSE OBJECTIVE:

- To understand the structure of biomolecules, metabolism and their functions and the energy to flow in biological system and catalytic functions of enzymes

COURSE OUTCOMES: Up on successful completion of the course, students will be able to

CO NUMBER	CO STATEMENT	KNOWLEDGE LEVEL (K1-K4)
CO1.	To describe the structure and interactions in aqueous solutions and understand about body fluids	K1, K2
CO2.	Identify and interpret the structure, classification, of carbohydrates, amino acids and lipids	K2
CO3.	To understand analyze metabolism of carbohydrates and proteins.	K2, K4
CO4.	To know about bioenergetics and understand the functions of enzymes and classification	K2
CO5.	To understand the structure and classification of vitamins	K2

Knowledge level: K1- Remember; K2- Understand; K3- Apply; K4- analyze

MAPPING WITH PROGRAMME OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	S	M	M	M	M
CO2	M	S	M	M	M	M
CO3	M	M	S	S	M	S
CO4	S	M	M	S	M	S
CO5	S	S	M	M	M	M

S-strong; M- medium; L-low

UNIT 1: Biological Fluids **15 Hours**

Water – Biological importance, physical properties, structure, Interactions in aqueous solution; pH and buffers- Acid – Base balance, Biological importance of Buffers, Acidiosis and alkalosis. Electrolyte and water balance.

Body fluids – Milk, Colostrum, amniotic fluid and CSF

UNIT 2: Biomolecules **15 Hours**

Carbohydrates – Classification of carbohydrates – Structure and properties of mono, di and polysaccharides in plants, cellulose, starch and pectins.

Amino Acids: Structure, Classification of amino acids and properties. Proteins: structure classification and properties Nucleic acids – structure of phosphoric acid, pentose sugar, nucleotides.

Lipids – Classification of lipids. Structure and properties of fatty acids, fatty oil, Glycerolipids, phospholipids, sphingolipids, glycolipids, and steroids.

UNIT 3: Metabolism **15 Hours**

Digestion of carbohydrates – Glycolysis, TCA Cycle, HMP shunt, Oxidative phosphorylation. Digestion of lipids – beta – oxidation of fatty acids.

Digestion of proteins – Transamination, oxidative and non oxidative deamination – Mechanism of photosynthesis

UNIT 4: Bioenergetics & Catalysis **15 Hours**

Bioenergetics – Free energy, laws of thermodynamics – enthaphy and entrophy – redox potential.

Enzyme – Definition and classification, active site, apoenzyme, coenzyme and isoenzyme, mechanism of enzyme action.

UNIT 5: Vitamins and Deficiency **15 Hours**

Water and Lipid soluble Vitamins – Structure, classification, sources and deficiencies in man.

TEACHING METHODOLOGY:

- Class room teaching
- Assignments
- Discussions
- Homework

- PPT presentations
- Seminars
- Models and charts

TEXT BOOKS:

S.no.	Authors	Title	Publishers	Year of publication
1.	J.L. Jain	Fundamentals of Biochemistry	S. Chand & Company, Limited	2016
2.	A.C. Deb	Fundamentals of Biochemistry	New Central Book Agency (P) Ltd	2017
3.	G. Zubay	Biochemistry	Macmillan Publishing Co, New York	2010

REFERENCE BOOKS:

S.No.	Authors	Title	Publishers	Year of publication
1.	A.L. Lehninger., D.L Nelson and M.M. Cox	Principles of Biochemistry	Worth Publishers, New York	2016
2.	L. Stryer	Biochemistry	W.H. Freeman and Company	2012
3.	D. Voet& J.G. Voet	Biochemistry	Hoboken, N.J:J. Wiley & Sons	2016

WEB SOURCES:

1. http://www.biologydiscussion.com/metabolism/carbohydrates-metabolism/metabolism-of-carbohydrates-10-cycles-with-diagram/11242
2. https://nptel.ac.in/courses/112105129/pdf/RAC%20Lecture%204.pdf
3. http://ocw.ump.edu.my/pluginfile.php/9893/mod_resource/content/1/Nucleic%20Acid%20Metabolism.pdf
4. http://elearning.vtu.ac.in/moodle2/pluginfile.php/101/mod_folder/content/0/10BT43/Biomolecular%20%20%20Interactions.pdf?forcedownload=1

Syllabus Designer:

- Dr. C. Suganthi
  Assistant Professor

CELL BIOLOGY

Semester	Subject Code	Category	Lecture		Theory		P	C
II	21CBT2A	Core - II	5 hrs Per week	75	5 hrs Per week	75	0	5

COURSE OBJECTIVE:

- To understand the basics, characteristics and functions of cell types, cell organelles and investigate the cell division, cytoskeleton and study the interaction between cells or with the environment and learn the principles of signaling mechanisms.

COURSE OUTCOMES: Up on successful completion of the course, students will be able to

CO NUMBER	CO STATEMENT	KNOWLEDGE LEVEL (K1-K4)
CO1.	Remember cells as the basic units of all living things and as the building blocks of multi-cellular organisms and Understand different Cell types and functions of cell organelles.	K1, K2
CO2.	Apply their knowledge by comparing how structures of cell and its organelles are related to their functions.	K3
CO3.	Analyze how cells reproduce by cell cycle, mitosis and meiosis.	K4
CO4.	Understand the fundamental structures and functions of cytoskeleton which gives motility to cells.	K2
CO5.	Identify and understand the principles of interaction between cells and environment and to determine cell signalling pathways.	K1, K2

Knowledge level: K1- Remember; K2- Understand; K3- Apply; K4- analyze

MAPPING WITH PROGRAMME OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	S	S	M	S	M
CO2	S	S	S	M	M	S
CO3	S	S	S	M	M	M
CO4	S	S	M	M	S	M
CO5	S	S	S	S	M	S

S-strong; M- medium; L-low

UNIT I Cell as Basic Unit 10 Hours

Discovery of cells, cell theory, properties of cells, two different types of cells- prokaryotes and eukaryotes, types of prokaryotic cells- bacteria and archea, eukaryotic cells- plant cell, animal cell and viruses, human cells types, blood cells- RBCs and WBCs.

UNIT II Membranes and Organelles 15 Hours

Structure and function of cell organelles- plasma membrane, cell wall, mitochondria, cytoplasm, golgi complex, lysosomes, vacuoles, peroxisomes, endoplasmic reticulum, ribosomes, chloroplast, nucleus- chromosomes and types.

UNIT III Cell reproduction 15 Hours

Cell cycle- Mitosis and Meiosis and its different phases, asexual and sexual reproduction, vegetative reproduction, binary fission, budding.

UNIT IV Cytoskeleton and cell motility 15 Hours

Cytoskeleton structures and functions- microtubules, microfilaments and intermediate filaments, centrioles and basal bodies, cilia and flagella, muscle contractility, non muscle motility

UNIT V Interaction between cells and environment and cell signalling 20 Hours

Extracellular matrix, interaction of cell with extracellular matrix- integrins, hemidesmosomes, interaction of cells with other cells- selectins, immunoglobulin super family, cadherins, adherens and desmosomes, Tight junctions, Gap junctions and plasmadesmata, signal transuction by G-Protein coupled receptor, Ras MAP Kinase pathway, signaling by insulin receptor, apoptosis- intrinsic and extrinsic pathway. Signaling pathways in plants.

Distribution of Marks: Theory 80% and Problems 20%

TEACHING METHODOLOGY:

- Class room teaching
- Assignments
- Discussions
- Homework
- PPT presentations
- Seminars
- Models and charts

TEXT BOOKS:

S.no.	Authors	Title	Publishers	Year of publication
1.	Harvey Lodish, Arnold Berk, Chris A. Kaiser, Monty Krieger	Molecular Cell biology	W.H. Freeman and Company, New York, USA	2016
2.	P.S. Verma & V K Agarwal	Cytology	S.Chand Publishing, New Delhi, India.	2010

REFERENCE BOOKS:

S.no.	Authors	Title	Publishers	Year of publication
1.	Gerald Karp	Cell and Molecular Biology: concepts and experiments:	John Wiley and sons, Inc., NJ.	2015
2.	Geoffrey M Cooper, E. Robert Hausman,	Cell: a molecular approach	Sinauer Associates Inc, Publishers Sunderland, Massachusetts U.S.A	2013
3.	Harvey Lodish, Arnold Berk, Chris A. Kaiser, Monty Krieger, Anthony Bretscher,HiddePloegh; Angelika Amon; Kelsey C. Martin	Molecular cell biology	W.H.Freeman publishers & Co.	2016

WEB SOURCES:

1. https://www2.le.ac.uk/projects/vgec/highereducation/topics/cellcycle-mitosis-meiosis
2. https://www2.le.ac.uk/projects/vgec/highereducation/topics/dna-genes-chromosomes
3. https://www.nap.edu/read/19207/chapter/8#34
4. https://www.khanacademy.org/test-prep/mcat/cells/cell-cell-interactions/a/cell-cell-interactions-how-cells-communicate-with-each-other
5. https://www.youtube.com/watch?v=S-Kj2FR_6_g
6. https://www.toppr.com/guides/biology/the-fundamental-unit-of-life/cell-organelle/

Syllabus Designer:

- Dr. D. Charumathi
  Assistant Professor

MICROBIOLOGY

Semester	Subject Code	Category	Lecture		Theory		P	C
II	21CAMB2A	Allied - II	5 hrs per week	75	5 hrs per week	75	0	4

COURSE OBJECTIVES:

- To provide education in Microbiology to aspiring learners. The course is to ensure that the students at the end of the programme are able to acquire higher education further leading to prospective career.

COURSE OUTCOME: After completion of the course students will be able to

CO Number	CO Statement	Knowledge level k1 – k4
CO1	Recall the history and classification of microbes.	K2
CO2	Evaluate the structure of microbes and microscopy.	K5
CO3	Apply the different methods of sterilization; types of media and pure culture techniques	K3
CO4	Differentiate the dynamics of microbial interactions with other populations and analyze the human diseases.	K4
CO5	Apply the aspects of microbiology.	K3

Knowledge level: K1- Remember; K2- Understand; K3- Apply; K4- analyze

MAPPING WITH PROGRAM OUTCOMES:

COS	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	S	M	M	M	M
CO2	S	S	S	M	S	S
CO3	S	S	S	M	M	M
CO4	S	M	S	S	S	S
CO5	M	M	S	S	S	S

S-strong; M- medium; L-low

UNIT I: Overview of history of Microbiology **15 Hours**

Biogenesis and a biogenesis, Contributions of Spallanzani, Pasteur, Tyndal, Joseph Lister, Koch [Germ Theory], Edward Jenner and Flemming [Penicillin]. Scope of Microbiology. Classification of Microbes – Five kingdom concept, three kingdom concept. Bergey's manual of classification (2^{nd} edition).

UNIT II:Ultra structure of microbes and microscopy: **15 Hours**

A detailed account of General structure, growth and reproduction of Bacteria, fungi and Virus. Basic principles in microscopy, Types of microscopes- light, dark, phase contrast, fluorescent and electron microscope- (Transmission and Scanning electron)

UNIT III: Microbiological Media and culture techniques: **15Hours**

Culture and media preparation – solid and liquid. Types of media – semi synthetic, synthetic, enriched, enrichment, selective and differential media., Sterilization and disinfection – principles – methods of sterilization – physical methods – dry heat – moist heat – radiation – filtration (membrane and HEPA) – chemical sterilization – chemical agents – mode of action.

Preservation and maintenance of culture ; Pure culture techniques – tube dilution, pour, spread, streak plate. Anaerobic cultivation of bacteria. Stains and staining techniques –

Mechanism of gram staining, acid fast staining, negative staining, capsulestaining, flagella staining, endospore staining.

UNIT IV:Physiology and biochemistry of microbes and human diseases: **15 Hours**

Photo-autotrophs, Chemo-autotrophs, Parasitism, Saprophytism, Mutualism and Symbiosis, Commensalisms, endozoic microbes. Nitrogen metabolism including Nitrogen fixation (Symbiotic and asymbiotic)

Pathogenic Microorganisms:

(A) Bacterial diseases of man – Tetanus, Tuberculosis, Pneumonia and Cholera. (B) Viral diseases: AIDS (HIV).

UNIT V: Microbial applications:

In medicine – antibiotics; penicillin and streptomycin. In agriculture; Bio-fertilizer (bacteria and cyanobacteria). In food and dairy industries; microbial bio-products (SCP, bio-pigments, yeast products and enzymes). Economic and industrial importance of yeast and moulds. Biosensors.

Distribution of Marks: Theory 80% and Problems 20%

TEACHING METHODOLOGY:

- Class room teaching
- Assignments
- Discussions
- Homework
- PPT presentations
- Seminars
- Models and charts

TEXT BOOKS:

S.no	Authors	Title	Publishers	Year of publication
1	R. Anandanarayanan and C.KJ. Paniker.	Text book of Microbiology	Universities press	2010
2	Pelczar.M.,etal.,	Microbiology	Tata-McGraw Hill	2013

REFERENCE BOOKS:

S.no	Authors	Title	Publishers	Year of publication
1	Prescott	Microbiology	McGraw Hill Education	2012
2	Edward A. Birge	Modern Microbiology	Wm. C. Brown Publishers, Inc. U.S.A.	1992

WEB SOURCES:

1. http://www.microrao.com/micronotes/pg/culture_media.pdf
2. http://library.open.oregonstate.edu/microbiology/chapter/introduction-to-microbiology/
3. http://microbiology.ukzn.ac.za/Libraries/MICR304/CULTURE_PROCEDURES.sflb.ashx
4. https://www.docsity.com/en/host-parasite-interactions-microbiology-lecture-slides/232518/
5. https://www.studocu.com/en/document/university-of-southern-queensland/medical-microbiology-and-immunology-1/lecture-notes/lectures-notes-1-to-23/319412/view
6. http://www.teilar.gr/dbData/ProfAnn/profann-f2bc2d4d.pdf

Syllabus Designer:

- Mrs. S. Akhila
  Assistant Professor

CONCEPTS IN BIOTECHNOLOGY AND CELL BIOLOGY

Semester	Subject Code	Category	Lecture	Theory	Practical		Credits
III	21CBT21	Core Practical - I	0	0	3 hrs per week	90	3

COURSE OBJECTIVES:

- To create an opportunity to students for experimentally testing the principles and concepts studied in respective theory.

EXPERIMENT LISTS:

1. General safety rules and regulations in Laboratory
2. Microscopy and micrometry
3. Handling Pipettes (Micropipettes)
4. Performing Dilutions
5. Buffer Preparation
6. Colorimetry
7. Buccal smear preparation.
8. Mitosis in onion root tip cells.
9. Meiosis in Grasshopper testis- Demo.
10. Cell fractionation by centrifugation.
11. WBC and RBC count using Hemocytometer.

REFERENCE BOOKS

1. https://www.bjcancer.org/Sites_OldFiles/_Library/UserFiles/pdf/Cell_Biology_Laboratory_Manual.pdf
2. http://olimpiade.psma.kemdikbud.go.id/index/SOAL/SOAL%20OLIMPIADE%20SAINS_2012/SOAL%20SOLUSI%20OSN_12/5.%20Biologi/Praktikum%20Biologi%20Sel%20&%20Molekuler/241labmanu_fall07_08(1).pdf
3. http://www.dbtindia.nic.in/wp-content/uploads/E-MANUAL.pdf

Syllabus Designer:

Dr. D.Charumathi, Assistant Professor
Dr. Vinita Ernest, Assistant Professor

BIOCHEMISTRY AND MICROBIOLOGY

Semester	Subject Code	Category	Lecture	Theory	Practical		Credits
III	21CAMB21	Allied Practical - I	0	0	3 hrs per week	90	2

COURSE OBJECTIVES:

- To get basic knowledge about the microbial techniques in an aseptic environment and demonstrate competency in documenting laboratory results. The students should be able to understand, media preparation, sterilization procedures, isolation and pure culture techniques

EXPERIMENT LISTS:

1. Qualitative analysis of carbohydrates (Glucose, Fructose, Lactose, Xylose, and Starch)
2. Qualitative analysis of aminoscids (Tyrosine, Tryptophan, Histidine, Arginine, Methionine)
3. Colorimetric estimation of proteins by Lowry's method
4. Colorimetric estimation of DNA by Diphenyl amine method
5. Estimation of glycine by formal titration method
6. Estimation of ascorbic acid using dichlorophenol indophenols as link solution
7. Media preparation and sterilization
8. Isolation and Enumeration of microorganism – Spread and Pour
9. Observation of Colony morphology and Characteristics
10. Pure culture technique – Streaking techniques (Simple, T-streak & Quadrant)
11. Measurement of growth of bacteria
12. Antibiotic sensitivity test -Kirby Bauer method

REFERENCE BOOKS

1. http://www.dbtindia.nic.in/wp-content/uploads/E-MANUAL.pdf

2.https://www.researchgate.net/publication/306018042_Microbiology_Laboratory_Manual

3. https://faculty.washington.edu/korshin/Class-486/MicrobiolTechniques.pdf

4.https://www.researchgate.net/publication/306034920_Laboratory_Manual_of_Biochemistry

Syllabus Designer :

Dr. C.Suganthi, Assistant Professor

Mrs.S. Akhila, Assistant Professor

IMMUNOLOGY

Semester	Subject Code	Category	Lecture		Theory		P	C
III	21CBT3A	Core - III	4 hrs per week	60	4 hrs per week	60	0	4

COURSE OBJECTIVE:

- ✓ To understand the components and functions of the immune system and how immune system discriminates self from non-self-antigens its regulation as well as basic immunological techniques and their applications.

COURSE OUTCOMES:

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

CO NUMBER	CO STATEMENT	KNOWLEDGE LEVEL (K1-K4)
CO1	Identify the components of immunity and define the properties and structures of antigens and immunoglobulins.	K1
CO2	Describe the Cells and organs of immune system.	K2
CO3	Discuss the antigen processing and presentation	K2
CO4	Evaluate the role of immune system in health and disease.	K4
CO5	Employ antigen antibody interaction for interpretation of immune diseases.	K3

Knowledge level: K1- Remember; K2- Understand; K3- Apply; K4- analyze

MAPPING WITH PROGRAMME OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	S	S	M	S	S
CO2	S	S	S	M	M	M
CO3	M	S	S	S	M	M
CO4	M	M	S	M	S	S
CO5	M	M	S	M	S	S

S-Strong, M-Medium, L-Low

UNIT-1 INTRODUCTION TO IMMUNE SYSTEM: 14 Hours

Historical perspective, Components of Immunity –Innate immunity, barriers involved in innate immunity. Acquired immunity-humoral and cell mediated immunity.

Antigens**:** Properties of antigen**,** Immunogens, Haptens, Role of adjuvants, antigenicity and immunogenicity. Immunoglobulins-Basic structure, classes and subclasses of antibody molecules.

UNIT-II CELLS AND ORGANS OF IMMUNE SYSTEM: 14 Hours

Cells and molecules involved in innate and adaptive immunity-B cells, T cells, NK cells, Dendritic cells, Monocytes, Macrophages, neutrophils, eosinophil, basophils and mast cells. Organs of the immune system: primary lymphoid organs-Thymus, Bone marrow: Secondary lymphoid organs-Lymph nodes, Spleen, Mucosal associated Lymphoid tissue.

UNIT-III ANTIGEN PROCESSING AND PRESENTATION: 10 Hours

MHC molecules-organization, MHC class I, II and III structure and genes. Antigen processing and presentation-Endogenous antigen (Cytosolic pathway), Exogenous antigen (Endocytic pathway).

UNIT-IV CLINICAL IMMUNOLOGY: 12 Hours

Hypersensitivity – Type I-IV; Autoimmunity-Organ specific (Diabetes mellitus, Hemolytic anemia), Systemic (Rheumatoid arthritis, Systemic Lupus erythematous). Transplantation immunology– Immunological basis of graft rejection; General immunosuppressive therapy, Clinical transplantation (kidney and bone marrow).

Introduction of Cancer biology, tumor antigens, types of tumor antigens, tumor specific antigens and tumor associated antigen.

UNIT-V IMMUNOLOGICAL TECHNIQUES: 10 Hours

Antigen-antibody interactions: Salient features of antigen- antibody interaction, Precipitation reactions-precipitation reaction in fluids and gel,Radialimmunodiffusion, Double immunodiffusion and immunoelectrophoresis. Agglutination reactions.ABO blood grouping. Advanced immunological techniques- RIA, ELISA, Western blotting.Purifications of antigens and antibodies by affinity chromatography.

Distribution of Marks: Theory 80% and Problems 20%

TEACHING METHODOLOGY

- Chalk and board
- Group discussion
- Assignments
- PPT presentations

- Seminars
- Models/Charts

TEXT BOOKS:

S.NO	AUTHORS	TITLE	PUBLISHERS	YEAR OF PUBLICATION
1.	Janis Kuby,Thomas J Kindt,Goldsby	Immunology	W.H.Freeman and company	2007
2.	Ivan Roitt	Essentials of Immunology	Blackwell scientific publication	1988
3.	Kuby	Immunology	Paperback publication	2012
4.	RaifGeha	Case studies in Immunology	Paperback publication	2007
5.	Abul K. Abbas	Basic Immunology	Paperback publication	2002

REFERENCE BOOKS:

S.NO	AUTHORS	TITLE	PUBLISHERS	YEAR OF PUBLICATION
1.	PrimroseS.B., Twyman R.H., and Old R.W	Principles of Gene Manipulation	Blackwell Science	2001
2.	Paul W.E	Fundamentals of immunology	Raven press	1988
3.	Glick B.R. and Pasternak J.J	Principles and applications of recombinant DNA	ASM Press	2003
4.	Thomas J. Kindt	Immunology	Paper pack Publication	2002
5.	Laure M. Sompayrac	How the Immune System Works	Blackwell Publisher	2002

WEB SOURCES:

1. https://study.com/academy/lesson/what-is-immunity-definition-types.html
2. https://www.youtube.com/watch?v=wOy17QrY0bo
3. https://www.youtube.com/watch?v=t9TvTmddanE
4. https://www.youtube.com/watch?v=1uCpPb5jBTQ
5. https://microbiologyinfo.com/antibody-structure-classes-and-functions/

Syllabus designer:

- Mrs. M.Malathi. M.Sc., M.Phil.
  Assistant Professor

MOLECULAR GENETICS

Semester	Subject Code	Category	Lecture		Theory		P	C
III	21CABT3A	ALLIED – III	4 hrs per week	60	4 hrs per week	60	0	4

COURSE OBJECTIVE:

- To understand the genetic workflow and to provide information on gene expression and mutation.

COURSE OUTCOMES:

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

CO NUMBER	CO STATEMENT	KNOWLEDGE LEVEL (K1-K4)
CO1	Identify and understand the molecular machinery of living cells and DNA repair mechanism.	K1, K2
CO2	Describe RNA structure and the concept of transcription.	K2
CO3	Discriminate the regulation of gene expression	K2
CO4	Evaluate the nature and action of mutations.	K4
CO5	Illustrate experimental designs related to molecular genetics	K3

Knowledge level: K1- Remember; K2- Understand; K3- Apply; K4- analyze

MAPPING WITH PROGRAMME OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	S	S	M	S	S
CO2	S	S	S	M	M	M
CO3	M	S	S	S	M	M
CO4	M	M	S	M	S	S
CO5	M	M	S	M	S	S

S-Strong, M-Medium, L-Low

UNIT I: DNA STRUCTURE AND REPLICATION: 12 Hours

DNA Structure, Physical and chemical properties of DNA, Forms of DNA; DNA Replication – in prokaryotes and eukaryotes. Enzymology of DNA replication, semi conservative model of replication, rolling circle replication. DNA repair mechanism.

UNIT II: TRANSCRIPTION: 12 Hours

Transcription – Enzymatic Synthesis of RNA,Structure and function of different classes of RNA-coding(mRNA,tRNA and rRNA) and non-coding (small-miRNA,long-HOTAIR),RNA transport.Transcription in eukaryotes. Posttranscriptional modification (RNA capping, Poly A addition, Splicing).

UNITIII: GENE EXPRESSION AND REGULATION: 12 Hours

The genetic code. Protein synthesis (Initiation, Elongation, Termination) in prokaryotes and eukaryotes,Post translational modification. Gene expression and regulation : Principles of regulation- Lac Operon.

UNITIV: MUTATIONS 12 Hours

Spontaneous-transition,transversion,missense,nonsense,frameshiftmutations,Mutagens-Physical,Chemical and Biological mutagens. Cancer genetics-characteristic of cancer cell causes of cancer, oncogenes and tumor suppressor genes.

UNIT V: MOLECULAR GENETIC TOOLS: 12 Hours

DNArestrictionanalysis, Gel electrophoresis, southern, northern and western blotting. Nucleic acid hybridization,Polymerase chain reaction.

Distribution of Marks: Theory 80% and Problems 20%

TEACHING METHODOLOGY

- Chalk and board
- Group discussion
- Assignments
- PPT presentations
- Seminars
- Models/Charts

TEXT BOOKS:

S.NO	AUTHORS	TITLE	PUBLISHERS	YEAR OF PUBLICATION
1.	David Freifelder	Molecular Biology	Jones and Bartlett	1998

2.	Harvey H. Lodish, Darnell J	Molecular Cell biology	W. H Freeman and Co.	2004
3.	Prakash.M	Molecular Genetics	Discovery Publishing House	2007
4.	Robert J Booker	Molecular Genetics	Scion Pub Limited	2007
5.	Strachan.T	Human Molecular Genetics	Garland Science	2007

REFERENCE BOOKS:

S.NO	AUTHORS	TITLE	PUBLISHERS	YEAR OF PUBLICATION
1.	Watson,Baker,Bell,Levine	Molecular biology of gene	Pearson education	2010
2.	Gerald Karp	Cell and molecular biology	John Wiley and sons	2013
3.	Gardner	Principles of Genetics	John Wiley and sons	1991
4.	Tom Strachan	Human Molecular Genetics	Garland Science	1997
5.	Alfred Puhler	Advanced Molecular Genetics	Springer Science	1984

Web Sources:

1. https://www.youtube.com/watch?v=dKubyIRiN84
2. https://www.ncbi.nlm.nih.gov/books/NBK9851/
3. https://www.youtube.com/watch?v=2BwWavExcFI
4. https://www.youtube.com/watch?v=Avuj0q4mKa8
5. https://www.google.com/ www.biovision.com

Pedagogy:

- Chalk and board
- Group discussion
- Assignments
- PPT presentations
- Seminars
- Models/Charts

Syllabus Designer:

- Mrs. M.Malathi M.Sc., M.Phil
  Assistant Professor

MOLECULAR DIAGNOSTICS I

Semester	Subject Code	Category	Lecture		Theory		P	C
III	21SBT3A	Skill Based Subject- I	2hrs per week	30	2hrs per week	30	0	2

COURSE OBJECTIVE:

- ✓ This course provides an introduction to the theory and use of molecular techniques in the diagnostics lab, with an emphasis on nucleic acids isolation, handling, and storage.

COURSE OUTCOMES:

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

CO NUMBER	CO STATEMENT	KNOWLEDGE LEVEL (K1-K4)
CO1	Introduces about the molecular diagnostics	K1
CO2	Able to assess the different methods of sample collection	K5
CO3	Apply the biochemical estimation for vitals.	K3
CO4	Able to get the knowledge about different diagnostic instruments.	K2
CO5	Interpreting the methods of diagnosis in molecular level.	K2

Knowledge level: K1- Remember; K2- Understand; K3- Apply; K4- analyze

MAPPING WITH PROGRAMME OUTCOMES:

COS	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	S	M	M	M	M
CO2	M	S	S	S	M	M
CO3	S	M	S	S	S	M
CO4	S	M	S	S	M	M
CO5	M	S	S	S	M	M

S-strong; M- medium; L-low

UNIT I:INTRODUCTION TO MOLECULAR DIAGNOSTICS **6 Hours**

Introduction and History of diagnostics, Diseases- infectious, physiological and metabolic errors, genetic basis of diseases, inherited diseases. Infection – mode of transmission in infections, factors predisposing to microbial pathogenicity. ·

UNIT II: SAMPLE COLLECTION **6 Hours**

Types of specimens, Collection of blood, Anticoagulants and preservatives for blood, Preparation of serum, Urine collection – timed urine specimen, urine preservatives, Separation and Storage of Specimens, Care of handling the specimen.

. **UNIT III: BIOCHEMICAL ESTIMATION:** **6 Hours**

Basic Principle of Colorimetric, UV-Spectrophotometry. Estimation & clinical significance of the Followings: Blood sugar (F/PP/R), Glucose Tolerance Test, Total Plasma protein, Albumin, Globulin, Cholesterol, Triglyceride, Lipoproteins- LDL, VLDL, HDL, Blood Urea.

UNIT IV: DIAGNOSTIC EQUIPMENTS: **6 Hours**

Sphygmomanometer, Stethoscope, Semi automated BP Instrument, Automated BP Instrument, ECG machine, Spirometer and Blood cell Counter,

UNIT V: MOLECULAR DIAGNOSIS: **6 Hours**

Nucleic acid amplification methods and types: Real-time PCR, Inverse PCR. Qualitative and quantitative techniques of Proteins and Amino acids: Protein stability, amino acid sequence analysis, FISH, DNA microarray.

Distribution of Marks: Theory 80% and Problems 20%

TEACHING METHODOLOGY

- Chalk and board
- Group discussion
- Assignments
- PPT presentations
- Seminars
- Models/Charts

TEXTBOOKS:

S.NO	AUTHORS	TITLE	PUBLISHERS	YEAR OF PUBLICATION
1.	William Coleman Gregory Tsongalis\	Diagnostic Molecular Pathology	Academic Press	2016
2.	Kamal. V	Textbook Of Pathology	Cbs; First Edition	2017

3.	Shirish M Kawthalkar	Essentials of Clinical Pathology	Jaypee Brothers Medical Publishers (P) Ltd	2016
4.	George P Patrinos	Molecular Diagnostics	Wilhelm Ansorge Academic Press	2005
5.	MousumiDebnath , Godavarthi B.K.S Prasad	Molecular Diagnostics:Promises and Possiblities	Springer Science and Business Media	2010

REFERENCES:

S.NO	AUTHORS	TITLE	PUBLISHERS	YEAR OF PUBLICATION
1.	K.L. Mukherjee	Medical Laboratory Technology Vol-2	Tata McGraw-Hill., India	2010
2.	PranabeswarChakraborty	Practical Pathology	New Central Book Agency	2010
3.	William B. Coleman PhD, Gregory J. Tsongalis	Essential Concepts in Molecular Pathology	Academic press	2009
4.	Davis F.A	Molecular Diagnostics	Lela Buckingham	2019
5.	William B. Coleman, Gregory J. Tsongalis	Molecular Diagnostics	Springer Science & Business Media	2006

WEB SOURCES:

1. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1214554/
2. https://www.bioline.com/us/research/molecular-diagnostics
3. http://dmbj.org.rs
4. https://www.austincc.edu/mlt/mdfund/mdfund_links.html
5. https://www.britannica.com/science/DNA-fingerprinting
6. https://en.wikipedia.org/wiki/DNA_footprinting

Syllabus Designer:

- Mrs. S. Akhila, M.Sc., M.Phil.

  Assistant Professor

ORGANIC FARMING

Semester	Subject Code	Category	Lecture		Theory		P	C
III	21NBT3A	Non Major Elective - I	2hrs per week	30	2 hrs per week	30	0	2

COURSE OBJECTIVE:

- Understand about history and scope of organic farming and describe farm management systems and soil, crop and pests and livestock management

COURSE OUTCOMES:

Up on successful completion of course, students will be able to

CO NUMBER	CO STATEMENT	KNOWLEDGE LEVEL (K1-K4)
CO1.	Understand the nature, history and scope of organic farming and demonstrate types of organic farming	K2,K3
CO2.	Explain pasture varieties and crops	K4
CO3.	Remember Weed management and pest management	K1
CO4.	Summarize livestock management systems	K2
CO5.	Analyze various management issues	K4

Knowledge level: K1- Remember; K2- Understand; K3- Apply; K4- analyze

MAPPING WITH PROGRAMME OUTCOMES:

COS	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	M	S	M	M	M
CO2	M	M	M	S	M	M
CO3	S	S	M	M	M	M
CO4	M	M	M	S	M	M
CO5	M	M	M	M	S	S

S-strong; M- medium; L-low

UNIT: I-CONCEPTS IN ORGANIC FARMING **6 Hours**

Introduction to Organic farming, organics, nature, history, types of organic farming and scope of organic farming, mulching, permaculture, polyculture, biodynamics,Green manures, organic fertilizers, biofertilizers etc.

UNIT: II-PASTURES AND COVER CROPS FOR ORGANIC FARMS **6 Hours**

Pasture Varieties, nitrogen fixation correct seed mix, Crops –Wheat, Plant Fibre, Hay and Silage, Mung Beans and Sesame seed. Cover Crops for organic farms-Benefits and limitations of cover crops

UNIT: III -WEED MANAGEMENT AND PEST MANAGEMENT- **6 Hours**

Weed biology, cultural weed control, Controlling weeds by Tillage and cultivation, controlling weeds by mowing, Flame weeding, Soil 25mmune25ia25ti of weed control, Biorational control of weeds, biological pest controlmethods

UNIT: IV- LIVESTOCK MANAGEMENT **6 Hours**

Organic livestock farming- Introduction, Animal nutrition, Animal housing and Breeding, Principles of organic livestock farming, Consumer benefits, Producer benefits, Environmental benefits. Organic livestock and animal welfare, Animal management- General principles, Animal sources- Beef, Dairy, Sheep.

UNIT: V- ORGANIC MANAGEMENT ISSUES **6 Hours**

Organic Management Issues –certification, environmental concerns, marketing, Organic Soil Management, Soil tillage in organic farming systemsand Crop Nutrition, composting

Distribution of Marks: Theory 80% and Problems 20%

Teaching Methodology

- Class room teaching
- Assignments
- Discussions
- Home work
- PPT presentations
- Seminars
- Models/Charts
- Problems

Text Books:

S.NO.	AUTHORS	TITLE	PUBLISHERS	YEAR OF PUBLICATION
1.	Peter V. Fossel	Organic Farming: Everything You Need to Know	Voyageur Press	2007

2.	Ann Larkin Hansen	The Organic Farming Manual: A Comprehensive Guide to Starting and Running a Certified Organic Farm	Storey Publishing	2010
3.	William Lockeretz	Organic Farming: An International History	Cromwell Press	2007
4	Peter V. Fossel	Organic Farming	Voyageur Press	2007
5	William Lockeretz	Organic Farming	CABI	2007

REFERENCE BOOKS:

S.NO.	AUTHORS	TITLE	PUBLISHERS	YEAR OF PUBLICATION
1.	NPCS Board of Consultants & Engineers	The Complete Book on Organic Farming and Production of Organic Compost	Asia Pasific business press	2010
2.	Munish Kumar Verma	Organic Farming	Sankalp publications	2019
3.	Rana .S	Organic Farming	CSKHPKV	2011
4.	Meena.R.P	Concept of Organic Farming	Popular Kheti	2013
5.	Navdanya	Principles of Organic Farming	System vision, A-199Okhila Phase-1	2004

Web Sources:

1. https://www.hortcourses.com/courses/organic-farming-624.aspx
2. http://agritech.tnau.ac.in/org_farm/orgfarm_introduction.html
3. http://www.omafra.gov.on.ca/english/crops/facts/09-077.html
4. https://www.thebalancesmb.com/best-books-for-organic-farmers-2538068
5. https://www.agrimoon.com/organic-farming-pdf-book

Syllabus Designer:

- Dr.D. Charumathi

  Assistant Professor

GENETIC ENGINEERING

Semester	Subject Code	Category	Lecture		Theory		P	C
IV	21CBT4A	CORE - IV	4hrs per week	60	4 hrs per week	60	0	4

COURSE OBJECTIVE:

- ✓ To gain knowledge about gene cloning strategies and elucidate the cloning techniques in improvement of living organism.

COURSE OUTCOMES:

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

CO NUMBER	CO STATEMENT	KNOWLEDGE LEVEL (K1-K4)
CO1	Identify the role of enzymes in genetic engineering	K2
CO2	Understand the characteristics of vectors and gene transfer methods.	K2
CO3	Analyze different molecular techniques	K4
CO4	Assess the effectiveness of techniques in appropriate field.	K4
CO5	Apply gene manipulation methods in enhancement of living organism	K3

Knowledge level: K1- Remember; K2- Understand; K3- Apply; K4- analyze

MAPPING WITH PROGRAMME OUTCOMES:

COS	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	M	S	M	M	M
CO2	M	M	M	S	M	M
CO3	S	S	M	M	M	M
CO4	M	M	M	S	M	M
CO5	M	M	M	M	S	S

S-strong; M- medium; L-low

UNIT-I: ENZYMES IN GENETIC ENGINEERING **12 Hours**

Overview of gene cloning. Enzymes for in vitro manipulation – Endonuclease, polymerases, topoisomerases, modifying enzymes, Rnase, Ligases-Adapters, Linkers, Photopolymer Tailing.DNA packaging in nucleosome, chromatin and chromosome.

UNIT-II: CLONING VECTORS **12 Hours**

Cloning vehicles: Plasmids – Host range, Copy number control, pBR322, Cosmids, bacteriophages, Phasmids, Yeast vectors-YAC, BAC, Ti Plasmid, Plant viral (CaMV, TMV) and Animal viral (SV 40, Retrovirus) vectors.

UNIT-III: GENE TRANSFER METHODS: **12 Hours**

Gene transfer techniques: Biological methods -Transformation, Conjugation. Chemical methods-Calcium phosphate method, use of polyethene glycol and DEAE Dextran, liposome mediated transfer. Physical or mechanical methods-Electroporation, Microinjection, Biolistic transformation. *Agrobacterium*- mediated gene transfer in plants.

UNIT-IV: GENETIC ENGINEERING TOOLS **12 Hours**

DNA sequencing – Maxam & Gilbert method, Sanger Coulson method. PCR-Principle, technique and its application. RFLP, RAPD and AFLP techniques. Nuclear markers. Mitochondrial markers.

UNIT-IV: APPLICATIONS OF GENETIC ENGINEERING **12 Hours**

Gene therapy and its application. Applications of recombinant DNA technology for humans-insulin production. Gene Silencing, RNA interference, antisense therapy. DNA foot printing, DNA finger printing. DNA microarray and its application.

Distribution of Marks: Theory 80% and Problems 20%

TEACHING METHODOLOGY

- Class room teaching
- Assignments
- Discussions
- Home work
- PPT presentations
- Seminars
- Models/Charts

TEXT BOOKS:

S.NO	AUTHORS	TITLE	PUBLISHERS	YEAR OF PUBLICATION
1.	Brown T.A	Introduction to gene cloning	Stanley Thomas Pub Itd	2016

2.	Primrose S.B. and Twyman R.M.	Principles of gene manipulation and Genomics	Blackwell Scientific Publications	2008
3.	Dr.Desmond S.T	An Introduction to Genetic Engineering	Paperback Publications	2018
4.	Maertin Thompson	Genetic Engineering	Hardback	2017
5.	Christopher How	Gene cloning manipulation	Paperback Publications	2016

REFERENCE:

S.NO	AUTHORS	TITLE	PUBLISHERS	YEAR OF PUBLICATION
1.	Benjamin Lewin	Genes IX	Oxford University & Cell Press	2008
2.	Glick and Pasternak	Molecular biotechnology	Panima publishing corporation,New Delhi	2010
3.	Ernst.L.Winnacker	From gene to clones	Panima publishing corporation,New Delhi	2003
4.	Rose M. Morgan	The Genetics Revolution	Hardback	2005
5.	Ernst.L.Winnacker	From gene to clones	Panima publishing corporation, NewDelhi	2003

Web Sources:

1. https://www.youtube.com/watch?v=6UiKZKFHbMQ
2. https://www.youtube.com/watch?v=BK12dQq4sJw
3. https://www.youtube.com/watch?v=D8oWNrUX8L4&t=16s
4. https://ghr.nlm.nih.gov/primer/therapy/procedures
5. http://www.premierbiosoft.com/tech_notes/microarray.html

Syllabus Designer:

- Mrs.S.Akhila.M.Sc.P.Phil.,

  Assistant Professor

ENZYMOLOGY

Semester	Subject Code	Category	Lecture		Theory		P	C
IV	21CABT4A	Allied theory - IV	4hrs per week	60	4hrs per week	60	0	4

COURSE OBJECTIVE: In this course, students will

- Understand the fundamentals of enzymology and demonstrate enzyme catalysis and analyze enzyme kinetics, inhibition, and demonstrate 30 mmune 30 ia 30 tion and applications of enzymes.

COURSE OUTCOMES:

Up on successful completion of course, students will be able to

CO NUMBER	CO STATEMENT	KNOWLEDGE LEVEL (K1-K4)
CO1.	Understand classification of enzymes and also terms used in enzymology	K2
CO2.	Demonstrate how enzyme works and explain the various mechanisms of enzyme catalysis	K3
CO3.	Compare various factors affecting enzyme activity and categorize different types of enzyme inhibition.	K4
CO4.	Remember enzyme engineering principles and immobilisation	K1
CO5.	Summarize various applications of enzymes	K2

Knowledge level: K1- Remember; K2- Understand; K3- Apply; K4- analyse

Mapping with Programme Outcomes

COS	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	S	M	M	M	M
CO2	M	S	M	M	M	M
CO3	M	M	S	M	M	M
CO4	M	M	M	S	M	M
CO5	M	M	S	S	S	S

S-strong; M- medium; L-low

UNIT I INTRODUCTION TO ENZYMES **12 Hours**

Enzymes- nomenclature and classification of enzymes, chemical nature of enzymes, intracellular enzymes and extracellular enzymes, specific activity, Enzyme assay, Enzyme Units- Katal and IU, abzymes, ribozymes, DNAzymes, isozymes, synzymes.

UNIT II ENZYME CATALYSIS **12 Hours**

Enzyme catalysis-Reaction rate, activation energy, free energy, binding energy, Enzyme catalysis models- Mechanism of enzyme catalysis-Acid base catalysis, covalent catalysis, metal ion catalysis, proximity and orientation effects, examples of catalytic reactions -serine proteases- chymotrypsin, lysozyme, carboxypeptidase, ribonucleases.

UNIT III ENZYME KINETICS AND INHIBITION **12 Hours**

Factors affecting the enzyme activity, Kinetics of a single-substrate enzyme catalysed reaction, Michealis-Menten Equation, Km, Vmax, Lineweaver Burk Plot, Turnover number, Reversible Inhibition- Competitive, Non Competitive, Uncompetitive, Mixed, Substrate, Allosteric and Product Inhibition, Irreversible Inhibition- Suicide inhibition

UNIT IV ENZYME ENGINEERING AND IMMOBILISATION **12 Hours**

Introduction to enzyme engineering, steps involved in enzyme engineering, Immoblisation of enzymes- advantages and disadvantages, supports or matrix used in immobilization technology, methods of immobilization- adsorption, entrapment, cross linking, covalent bonding, microencapsulation

UNIT V APPLICATIONS OF ENZYMES **12 Hours**

Uses of enzymes in clinical diagnosis- alkaline phosphatase, Creatine kinase, Alanine aminotransferase, Aspartate aminotransferase, Lactate dehydrogenases, Cholinesterase, Lipase, Amylase, Glutamyl transferase, trypsin, Glutathione peroxidases, enzymes as therapeutic agents, thrombolytic agents and anti-inflammatory agents, uses of enzymes in industries.

Distribution of Marks: Theory 80% and Problems 20%

TEACHING METHODOLOGY

- Class room teaching
- Assignments
- Discussions
- Home work
- PPT presentations
- Seminars
- Models/Charts

TEXT BOOKS:

S.NO.	AUTHORS	TITLE	PUBLISHERS	YEAR OF PUBLICATION
1.	Trevor Palmer	Enzymes: Biochemistry, Biotechnology, Clinical Chemistry.	Chichester: Horwood	2007
2.	Lehninger Principles of Biochemistry	Freeman, W. H. & Company	David L Nelson and Micheal Cox	2012

REFERENCE BOOKS:

S.NO.	AUTHORS	TITLE	PUBLISHERS	YEAR OF PUBLICATION
1.	Biochemistry	Donald Voet and Judith Voet	John Wiley and Sons	2004
2.	Biochemistry	LubertStryer; Jeremy Berg; John Tymoczko; Gregory Gatto	W.H. Freeman	2002
3.	Fundamentals of Enzymology: Cell and Molecular Biology of Catalytic Proteins	Nicholas Price and Lewis Stevens	Oxford Science publications	1989

WEB SOURCES:

1.https://www.biotopics.co.uk/A15/Enzymes.html

2. https://www.youtube.com/watch?v=vTQybDgweiE

3.https://www.youtube.com/watch?v=a1cAW6x8n9M

4.https://www.youtube.com/watch?v=-DwQMzq0kgU

5.http://www.biology-pages.info/E/EnzymeKinetics.html

Syllabus Designer:

- Dr.D. Charumathi
  Assistant Professor

MOLECULAR DIAGNOSTICS II

Semester	Subject Code	Category	Lecture		Theory		P	C
IV	21SBT4A	Skill Based Subject - II	2hrs per week	30	2hrs per week	30	0	2

- **COURSE OBJECTIVES:**

Knowledge of up to date methods in Molecular Biology and Molecular Genetics, including their theoretical bases

COURSE OUTCOMES:

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

CO NUMBER	CO STATEMENT	KNOWLEDGE LEVEL (K1-K4)
CO1	Able to understand the metabolism and disorders of nutrients	K2
CO2	Apply suitable methods to detect and identify pathogens and drug resistance testing	K3
CO3	Analyze the molecular oncology and mitochondrial disorders	K4
CO4	Introduces biomarkers in disease diagnostics	K1
CO5	Knowledge of chromosomal aberrations and its consequences	K1

Knowledge level: K1- Remember; K2- Understand; K3- Apply; K4- analyse

MAPPING WITH PROGRAMME OUTCOMES:

COS	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	S	M	M	M	M
CO2	S	S	S	M	M	S
CO3	M	S	S	S	S	S
CO4	S	M	M	M	M	M
CO5	S	S	M	M	M	M

S-strong; M- medium; L-low

UNIT I: BIOCHEMISTRY AND MOLECULAR BIOLOGY IN DIAGNOSTICS 6 Hours

Metabolism and disorders: Carbohydrates –regulation and disorders (sickle cell anemia)Protein and amino acids –deficiencies and disorders (tyrosinemia). Lipids – metabolism and disorders (Gaucher disease). Vitamins -Deficiencies and diagnosis. Minerals: Calcium, Sodium, Iron, deficiency manifestations and diagnosis.

UNIT II: IMMUNODIAGNOSTICS 6 Hours

Microbial pathogenesis, diagnostic pathology, immune pathology, and immunohistopathology. Drug susceptibility testing, drug resistance testing.

UNIT III: IMOLECULAR ONCOLOGY MITOCHONDRIAL DISORDERS: 6 Hours

Cancer – Benign and Malignant neoplasms, multifactorial disposition, Cancer pathogenesis, Proto-oncogenes, Oncogenes Mitochondrial inheritance, Mitochondrial myopathy, identity testing.

UNIT IV: BIOMARKERS IN DISEASE DIAGNOSTICS 6 Hours

FDA definition of disease markers, Role of markers in Disease diagnosis. Approaches and methods in the identification of disease markers, tumour& cancer markers, markers in inflammation and diagnosis of cytoskeletal disorders.

UNIT V: CHROMOSOMES AND CYTOGENETIC ANALYSIS 6 Hours

Structural and Numerical aberrations and its consequences. X-chromosome dosage compensation and inactivation mechanism. Uniparentaldisomy, Genomic Imprinting and disorders. FISH, CGH, Flowcytometry technique.

Distribution of Marks: Theory 80% and Problems 20%

TEACHING METHODOLOGY

- Class room teaching
- Assignments
- Discussions
- Home work
- PPT presentations
- Seminars
- Models/Charts

TEXTBOOKS:

S.NO	AUTHORS	TITLE	PUBLISHERS	YEAR OF PUBLICATION
1	DrJayantiTokas	Immunology and Molecular Diagnostics	Laxmi Publications	2015

2	K. K Jain	Hand book of biomarkers	Humana press	2017
3	Nader Rifai, A. Rita Horvath, Carl T. Wittwer, Jason Park	Principles and Applications of Molecular Diagnostics	TNQ technologies	2018
4	Geroge P. Patrinos	Molecular Diagnostics	Wilhelm Ansorge Academic Press	2009
5	Edward Highsmith	Molecular Diagnostics	Springer Science & Business Media	2015

REFERENCES:

S.NO	AUTHORS	TITLE	PUBLISHERS	YEAR OF PUBLICATION
1	Nader Rifai; Andrea R Horvath; C Wittwer.	Tietz Textbook of Clinical Chemistry and Molecular Diagnostics	Academic Press	2016
2	Peter Hu, MadhuriHegde, Patrick Alan Lennon	Modern Clinical Molecular Techniques	Springer Science & Business Media,	2012
3	William B. Coleman	Molecular Diagnostics	Human Press	2007
4	George P. PatrinosWilhelm AnsorgePhillip B. Danielson	Molecular Diagnostics	Academic Press	2016
5	E. Dequeker	Molecular Diagnostics	Academic Press	2014

WEB SOURCES:

1. https://dx.advamed.org/sites/dx.advamed.org/files/resource/advameddx_dxinsights_pdf.pdf
2. https://www.researchgate.net/publication/6541473_Molecular_Diagnostics_of_Medically_Important_Infections/link/0fcfd50d1d052d5dc2000000
3. https://researchguides.austincc.edu/medlab
4. https://www.sciencedirect.com/book/9780128029718
5. https://www.elsevier.com/books/molecular-diagnostics/patrinos/978-0-12...

Syllabus Designer:

- Mrs.S.Akhila, M.Sc.,M.Phil.
  Assistant Professor

KITCHEN AND ROOF TOP GARDENING

Semester	Subject Code	Category	Lecture		Theory		P	C
IV	21NBT4A	Non Major Elective - II	2hrs per week	30	2hrs per week	30	0	2

COURSE OBJECTIVE:

- To grow vegetables in your own premises, using containers and how to make a vegetable garden on rooftop and discusses different techniques through which you can achieve the goal.

COURSE OUTCOMES: Upon successful completion of the course,students will able to

CO NUMBER	CO STATEMENT	KNOWLEDGE LEVEL (K1-K4)
CO1	To remember and understand the fundamental agricultural practice	K1 and K2
CO2	Understand the essentials of materials needed for the gardening	K2
CO3	Apply the methods of roof top garden based on the area or space	K3
CO4	Understand the need of natural composting materials other than fertilizer	K2
CO5	Understand the marketing strategies for the selling of vegetables	K2

Knowledge Level: K1- Remember, K2- Understand, K3- Apply, K4-analyze

MAPPING WITH PROGRAMME OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	S	S	M	S	S
CO2	S	S	S	M	M	M
CO3	M	S	S	S	M	M
CO4	M	M	S	M	S	S
CO5	M	M	S	M	S	S

S-Strong, M-Medium, L-Low

UNIT I: INTRODUCTION TO GARDENING **6 Hours**

Organic gardening, Preparation of soil, selection and sowing of seeds,propagration, manure and fertilizer, watering (irrigation, drip irrigation), weeds, Harvesting, garden designs, typical, terrace,

UNIT II: ESSENTIALS OF GARDENING **6 Hours**

Tools used for gardening, controlling pest and disease, types of greenhouse, preserving of garden produce, water recycling, waste management

UNIT III: INSTALLATION **6 Hours**

Types of roof top gardening, procedure for installation of roof top gardening, plant Species selection, Materials for Kitchen gardening.

UNIT IV HARVESTING AND MAINTENANCES OF ROOF TOP **6 Hours**

Types of harvesting, types and size of garden, benefits of harvesting and beneficial connection in the kitchen garden, maintenance of roof top.

UNIT V: MARKETING STRATEGIES **6 Hours**

Marketing the products of roof top gardening– Quality control and market research. Marketing techniques – creating the demand by awareness and demonstration, advertisements, packaging and transport, Direct marketing.

Distribution of Marks: Theory 80% and Problems 20%

TEACHING METHODOLOGY

- Class room teaching
- Assignments
- Discussions
- Home work
- PPT presentations
- Seminars
- Models/Charts

TEXT BOOKS:

S.no.	Authors	Title	Publishers	Year of publication
1.	Steven A. Frowine	Gardening Basics For Dummies	The National Gardening Association	2007
2.	Mary VC	Vermitechnology	MJP Publishers, Chennai, India.	2008
3.	Michele Osborne	Roof Terrace Gardening	Lorenz Book	2013
4.	Annie Novak	The Rooftop growing guide	Paperback	2016
5.	Denise Lefrak Calicchio	Rooftop Gardens	Paperback	2011

REFERENCE BOOKS:

S.no.	Authors	Title	Publishers	Year of publication
1.	Edward C. Smith	The Vegetable Gardener's Bible	Storey Publishing, LLC	2009
2	Annie Novak	The rooftop Growing guide	Ten speed Press	2016
3.	Denise Lefrak Calicchio	The rooftop Gardens	Paperback	2011
4.	Francisco Di Blasi	Rooftop Gardens	Kindle Edition	2019
5.	Theodore H. Osmundson	Rooftop Gardens, History, Design, and Construction	W. W. Norton & Company	1999

WEB SOURCES:

1. http://agritech.tnau.ac.in/horticulture/horti_Landscaping_roofgarden.html
2. https://www.hgtv.com/outdoors/gardens/garden-styles-and-types/grow-a-rooftop-garden
3. https://scroll.in/magazine/890669/as-indian-cities-grow-congested-the-only-space-left-for-gardens-is-up-on-rooftops
4. https://www.abebooks.com/book-search/isbn/0393730123
5. https://www.thespruce.com/urban-rooftop-gardens
6. https://www.gardendesign.com/rooftop

Syllabus Designer:

- Dr. Amrita Anantharaman
  Assistant Professor

IMMUNOLOGY AND GENETIC ENGINEERING

Semester	Subject Code	Category	Lecture	Theory	Practical		Credits
IV	21CBT41	Core Practical - II	0	0	6 hrs per week	90	3

COURSE OBJECTIVES

- To familiarize students with the various immunological techniques includes antigen antibody reaction and to impart practical knowledge on different strategies of gene cloning.

LIST OF EXPERIMENTS

1. Blood grouping and Rh typing
2. Widal test (Qualitative slide agglutination method)
3. Single radial immunodiffusion
4. Ouchterlony double diffusion method
5. Immunoelectrophoresis method.
6. Isolation of genomic DNA from *E.coli.*
7. Plasmid DNA isolation
8. Restriction digestion
9. Ligation
10. PCR

REFERENCE BOOKS

1. https://www.youtube.com/watch?v=-jKzLLHjRfs
2. https://www.youtube.com/watch?v=Bn-w6P_9TUA
3. Hay FC and Westwood OMR(2003)Practical Immunology,4thEd.,Blackwell Publishing.
4. https://www.youtube.com/watch?v=uKeMiAZ8Zu4
5. https://www.youtube.com/watch?v=6mQGNDnOyH8

Syllabus Designer:

- Mrs.M. Malathi Assistant Professor
- Mrs. Akhila Assistant Professor

MOLECULAR GENETICS AND ENZYMOLOGY

Semester	Subject Code	Category	Lecture	Theory	Practical		Credits
IV	21CABT41	Allied Practical - II	0	0	3hrs per week	45	2

COURSE OBJECTIVES

- To create an opportunity to students for experimentally testing the principles and concepts studied in respective theory.

LIST OF EXPERIMENTS

1. Isolation of Genomic DNA from bacteria
2. Isolation of Genomic DNA from plants
3. Extraction of Genomic DNA from animal tissue
4. Extraction of plasmid DNA from bacteria
5. Separation of DNA fragments by Agarose Gel Electrophoresis
6. Determination of alpha amylase activity
7. Effect of temperature on activity of Salivary amylase
8. Effect of pH on activity of Salivary amylase
9. Determination of Km and Vmax of Salivary amylase
10. Determination of lipase activity

REFERENCE BOOKS

1. https://youtu.be/Rnmzu29UnAg
2. https://youtu.be/m1z7RxrjHOc
3. https://youtu.be/xlrwef2Y3f0
4. https://www.kau.edu.sa/Files/0016333/Subjects/Enzymology%20BIOC231.pdf
5. https://sjce.ac.in/wp-content/uploads/2018/04/Enzyme-Technology-and-Biokinetics-Lab-Manual-BT-47L.pdf
6. Hans Bisswanger. Practical enzymology. 2nd ed. John Wiley & Sons, 2011

Syllabus Designer:

- Mrs.M. Malathi Assistant Professors
- Dr. D.Charumathi Assistant Professors

PLANT AND AGRICULTURAL BIOTECHNOLOGY

Semester	Subject Code	Category	Lecture		Theory		P	C
V	21CBT5A	Core - V	6 hrs per week	90	6 hrs per week	90	0	5

COURSE OBJECTIVE: In this course, students will be able to

- ✓ Understand the basic concepts in plant and agriculture biotechnology including characteristics of tissue culture, culture media and its constituents, plant transformation techniques, plant pathology, field crop production techniques, transgenic plants and applications of plant tissue culture.

COURSE OUTCOMES: Up on successful completion of course, students will be able to

CO NUMBER	CO STATEMENT	KNOWLEDGE LEVEL (K1-K4)
CO1	To know the basic of tissue culture, media and culture types	K1
CO2	Understand different plant transformation techniques	K2
CO3	Analyze various plant pathogens and plant disease management	K4
CO4	Analyze the meaning and scope of Agronomy, Field crops-classification with examples.	K4 & K5
CO5	Apply knowledge for the development of transgenic plants	K3

Knowledge Level: K1- Remember, K2- Understand, K3- Apply, K4-analyze

MAPPING WITH PROGRAMME OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	S	S	M	S	S
CO2	S	S	S	M	M	M
CO3	M	S	S	S	M	M
CO4	M	M	S	M	S	S
CO5	M	M	S	M	S	S

S-Strong, M-Medium, L-Low

UNIT-I
PLANT TISSUE CULTURE **18 Hours**

Introduction to plant tissue culture, Explant, sterilization techniques, culture media and their constituents.

Culture types, cell and organ differentiation, organogenesis, somatic embryogenesis, somoclonal variation, protoplast culture, regeneration, growth hormones and their regulation.

UNIT -II
PLANT TRANSFORMATION **20 Hours**

Ti plasmid, T-DNA integration, binary vector, methods of gene transfer Agrobacterium mediated gene transfer, chloroplast transformation, in-planta transformation, Biolistic, Electroporation, Microinjection, Liposome encapsulation. Advantages and disadvantages of gene transfer.

UNIT-III
FUNDAMENTALS OF PLANT PATHOLOGY **18 Hours**

Classification of plant diseases, symptoms, signs, and related terminology. Parasitic causes of plant diseases (fungi, bacteria, viruses), Nonparasitic causes of plant disorders-temperature effects, herbicide injury, mineral deficiencies.

UNIT -IV
FIELD CROP PRODUCTION AND MANAGEMENT **18 Hours**

Meaning and scope of Agronomy, Field crops-classification with examples. Tillage-Definition, types of tillage, importance and implements used for tillage, manures and fertilizer application and their types, Irrigation-water managements, methods of irrigation, microirrigation. Soil and climatic requirements, Land preparation, seeds and sowing, cultural practices, manuring, irrigation, plant protection measures, harvesting and yield.

UNIT –V
TRANSGENIC PLANTS AND APPLICATIONS OF PTC **16 Hours**

Improvement of agronomic traits: development of Pesticide resistance, herbicide resistance, Production traits: delayed ripening of fruits, increase in vitamin. Production of secondary metabolite-carbohydrate and lipid production. Molecular farming for therapeutic proteins – plantibodies, plantigens, ediblevaccines), Case studies.

Distribution of Marks: Theory 80% and Problems 20%

TEACHING METHODOLOGY:

- Class room teaching
- Assignments
- Discussions
- Homework
- PPT presentations
- Seminars
- Models and charts

TEXT BOOKS:

S.NO.	AUTHORS	TITLE	PUBLISHERS	YEAR OF PUBLICATION
1.	Slater A, Scott NW, Fowler MR	Plant Biotechnology: The genetic manipulation of plants (2nded)	Oxford University press.	2008
2.	Smith RH	Plant Tissue culture: Techniques and Experiments(3rded)	Academic Press, USA	2013
3	G.N Agrios,	Plant pathology(4thed)	Academ. Press, NewYork	2004
4	Arie Altman and Paul Hasegawa	Planat biotechnology and agriculture	Academic Press	2012
5	Chawla. H.S	Introduction to Plant Biotechnology	Science Publisher	2002

REFERENCE BOOKS:

S.NO.	AUTHORS	TITLE	PUBLISHERS	YEAR OF PUBLICATION
1.	Bhojwani SS and Razdan MK	Plant Tissue culture: Theory and Practice,	Elsevier, India.	1996
2.	S.C. Panda	Agronomy	.Agribios Publication, NewDelhi	2006
3	Kamat	Introductory Plant Pathology	Prakashpubl, Jaipur	1967
4	Giri C and ArchanaGiri	Plant Biotechnology	I.K.InternationalPvt Ltd	2007
5	Chopra. V.L and Vedpal .	Applied Plant Biotechnology	Bhat Science Publishers	1999

WEB RESOURCES:

1. https://books.google.co.in/books/about/Agricultural_Biotechnology.html
2. https://ardhindie.com/pdf/plant-biotechnology-and-agriculture
3. https://firequillbooks.com/product/plant-biotechnology
4. https://picklelakehotel.com/pdf-free-download/34325-plant
5. https://www.isaaa.org/.../download/Agricultural_Biotechnology

Syllabus Designer:

- Mrs. J. Hanusha, M.Sc., M.Phil
  Assistant Professor

ANIMAL CELL CULTURE

Semester	Subject Code	Category	Lecture		Theory		P	C
V	21CBT5B	Core theory -VI	6 hrs per week	90	6 hrs per week	90	0	4

COURSE OBJECTIVE:

- To understand the cell culture technique, Cell viability and cytotoxicity assays, significance of its cultivation and its application in the production of valuable products.

COURSE OUTCOMES: Up on successful completion of course, students will be able to

CO NUMBER	CO STATEMENT	KNOWLEDGE LEVEL (K1-K4)
CO1.	Understand the animal cell culture and its types.	K2
CO2.	Understand different types of culture media and stem cells	K2
CO3.	Analyze how cells stored by cryopreservation techniques	K4
CO4.	Apply knowledge for the embryo transfer methods	K3
CO5.	Summarize various applications of animal cell culture and its human genetic engineering risks.	K2

Knowledge level: K1- Remember; K2- Understand; K3- Apply; K4- analyze

Mapping with Programme Outcomes

COS	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	S	M	M	M	M
CO2	M	S	M	M	M	M
CO3	M	M	S	M	M	M
CO4	M	M	M	S	M	M
CO5	M	M	S	S	S	S

S-strong; M- medium; L-low

UNIT-I BASICS OF ANIMAL CELL CULTURE **18 Hours**

Animal cell culture history and principles. Advantages and disadvantages of animal cell culture. Applications of animal cell culture. Cell culture: Primary cell culture techniques – mechanical disaggregation, enzymatic disaggregation, Balanced salt solution, natural media and synthetic media, chemically defined and serum free media – Advantages and disadvantages.

UNIT-II STEM CELLS **20 Hours**

Stem Cells sources, Unique properties of stem cells, Classification, Embryonic stem cells, adult stem cells, umbilical cord stem cells – similarities and differences between adult and embryonic stem cells – Advantages and disadvantages, Applications of stem cells

UNIT-III CYTOTOXICITY AND CELL VIABILITY ASSAYS AND CELL STORAGE TECHNIQUES **18 Hours**

Cytotoxicity and Cell viability assays –MTT Assay, Dye uptake assay, Dye exclusion assay, Enzyme released assays.

Cryopreservation- Introduction, Signification of Cryopreservation, Mechanism of Cryopreservation-Freezing method, Thawing process, Storage of animal cells. Applications of Cryopreservation of animal stock cells.

UNIT-IV EMBRYO TRANSFER AND TRANSGENIC ANIMALS **18 Hours**

Embryo transfer:Artificial insemination, Super ovulation, in-vitro fertilization, Pregnancy diagnosis, Sexing of embryos, Embryo splitting. Cryopreservation of embryo.

Transgenic animals: Transgenic fish, transgenic mice, transgenic sheep, transgenic insects.

UNIT-V APPLICATIONS OF ANIMAL CELL CULTURE **16 Hours**

Production of recombinant hemoglobin, blood substitutes, artificial blood, vaccines, testing of drugs, testing toxicity of environmental pollutants in cell culture. Genetic counseling drug screening and development.

Distribution of Marks: Theory 80% and Problems 20%

TEACHING METHODOLOGY

- Class room teaching
- Assignments
- Discussions
- Home work
- PPT presentations
- Seminars
- Models/Charts

TEXT BOOKS:

S.NO.	AUTHORS	TITLE	PUBLISHERS	YEAR OF PUBLICATION
1.	Martin Clynes	Animal cell culture techniques	Springer Berlin Heidelberg	1998
2.	John M. Davis	Animal cell culture	John Wiley and Sons	2011
3.	John Masters	Animal cell culture	OUP Oxford	2000
4.	Jennie P. Mather and David Barnes	Animal Cell Culture Methods	Academic Press	1998
5.	Ian Freshney .R	Culture of animal cells	John Wiley & Sons	2015

REFERENCE BOOKS:

S.NO.	AUTHORS	TITLE	PUBLISHERS	YEAR OF PUBLICATION
1.	John M. Walker, Jeffrey W. Pollard and John M.Walker	Animal cell culture	Humana Press	1990
2.	Singh.B, Gautam S.K and Chauhan.M.S	Textbook of animal biotechnology	Paperback	2015
3	Sheelendra Bhatt	Animal cell culture concept and application	Alpha science international Ltd	2011
4.	Singh.B, Gautam S.K and Chauhan M.S	Animal Biotechnology	TERI, New Delhi	2015
5.	Srivastava, R. K. Singh	Animal Biotechnology	Oxford and IBH Publisher	2018

WEB SOURCES

1. https://www.lasc.uzh.ch/en/services/TS-(embryo-transfer-etc.).html
2. https://www.worldcat.org/title/principles-of-animal-cell-culture.
3. https://www.kobo.com/us/en/ebook/culture-of-animal-cells
4. https://www.ebooks.com/enus/book/698880/culture-of-animal-cells/r-ian
5. https://en.wikipedia.org/wiki/Cell_culture
6. https://www.biotechnologynotes.com/animals/animal-cell-culture-history

Syllabus Designer:

- Dr.J. Ilamathi

  Assistant Professor

BIOPHYSICSAND BIOSTATISTICS

Semester	Subject code	Category	Lecture		Theory		P	C
V	21CBT5C	Core theory -VII	5hrs per week	75	5 hrs per week	75	0	4

COURSE OBJECTIVE: To develop an understanding of the biophysics, analytical instrumentation and biostatistics to interpret the results with statistical analysis

COURSE OUTCOMES: Upon successful completion of the course, students will able to

CO NUMBER	CO STATEMENT	KNOWLEDGE LEVEL (K1-K4)
CO1	To remember and understand the essential level or the principle of thermodynamic and also the structure of biomolecules	K1 & K2
CO2	Understand the various instrument usage in the field of biotechnology	K2
CO3	Compare the different types of spectroscopy for various purpose	K3
CO4	Measure the data obtained through various experiment	K1
CO5	Understand the various types of statistical analysis based on the sample obtained	K2

Knowledge Level: K1- Remember, K2- Understand, K3- Apply, K4-analyze

MAPPING WITH PROGRAMME OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	S	S	M	S	S
CO2	S	S	S	M	M	M
CO3	M	S	S	S	M	M
CO4	S	S	M	S	S	S
CO5	M	M	S	M	S	S

S-Strong, M-Medium, L-Low

UNIT –I

PHYSICO-CEMICAL FOUNDATION **15 Hours**

Physicochemical properties of water, Acids- base theory, mole concept, molarity, normality, molality, concept of pH, measurement of pH, Henderson –Hasselbach equation, buffers, titration curve, pK values.

UNIT- II

PHYSICAL FOUNDATIONS **15 Hours**

Thermodynamics: Introduction, Fundamental thermodynamic relation, Isothermal process, Isobaric Process Laws of thermodynamics: (zeroth law. First, second and third law). Understanding structures of Nucleic acids and proteins (primary, secondary, tertiary and quaternary structures)

UNIT -III

MICROSCOPY **15 Hours**

Microscope: Introduction, Principle and application of Microscopes, Types of Microscopes: Phase contrast Microscope-Principle, Procedure and applications. Fluorescence Microscope-Principle, Procedure and applications. Electron microscope- Principle, Procedure and applications, Types of Electron Microscopes (Scanning Electron Microscope & Transmission Electron Microscope).

UNIT IV

BIO-STATISTICAL METHODS **15 Hours**

Bio-statistical methods-Introduction of Biostatics. Methods of data collection (primary data collection and secondary data collection), Frequency distribution curve, Diagrammatic and graphical representation of data.

Measures of central tendency (Arithmetic mean, median and mode), measures of dispersion (Standard deviation and variance).

UNIT V

TESTING OF SAMPLES **15 Hours**

Testing of samples: Introduction, Hypothesis testing (null and alternate), student's t-test, Z- test, Chi-square test: significance in small and large populations. Problems on Probability, conditional probability, Theoretical distributions (Binomial, Poisson, Normal).Protein expression 3D structure prediction (homology modelling).

Distribution of Marks: Theory 80% and Problems 20%

TEACHING METHODOLOGY:

- Class room teaching
- Assignments
- Discussions
- Homework

- PPT presentations
- Seminars
- Models and charts

TEXT BOOKS:

S.no.	Authors	Title	Publishers	Year of publication
1.	Jain JL, Jain N, Jain S	Fundamentals of Biochemistry(7^{th} ed)	S Chand Group, New Delhi, India.	2004
2.	Gupta SC, KapoorVK	Fundamentals of Applied Statistics	S Chand and Sons, New Delhi, India.	2003
3.	Rodney Cotterill	Biophysics: An introduction	Wiley	2014
4.	James F.Zolman	Biostatistics: Experimental design and statistical inference	Oxford University Press	1993
5.	Pattabhi V and Gautham	Biophysics	Springer Science & Business Media	2002

REFERENCE BOOKS:

S.no.	Authors	Title	Publishers	Year of publication
1.	Kothari CR	Research Methodology-Methods and Techniques	New Age International Publishers, New Delhi, India.	2004
2.	William Bialek	Biophysics: Searching of principles	Princeton University Press	2012
3	Anders Kallen	Understanding Biostatistics	John Wiley &Sons	2011
4	Rodney Cotterill	Biophysics an introduction	John Wiley &Sons	2003
5	Walter T. Ambrosius	Topics in Biostatistics	Springer Science and Business Media	2007

WEB SOURCES:

1. https://www.easybiologyclass.com/biostatistics-introduction-significance-applications-and-limitations-of-statistics
2. https://books.google.co.in/books/about/Topics_in_Biostatistics.html
3. https://books.google.com/books/about/Biostatistics.html?id=VDR7s05uFaQC
4. https://edurev.in/studytube/Thapar-University-PBT201-Biophysics
5. https://sites.google.com/site/prakashprabhubiophysics/biostatistics

Syllabus Designer:

- Dr. Amrita Anantharaman
  Assistant Professor

DEVELOPMENTAL BIOLOGY

Semester	Subject code	Category	Lecture		Theory		P	C
V	21CBT5D	Elective - I	4hrs per week	60	4 hrs per week	60	-	3

COURSE OBJECTIVE:

- ✓ To understand the basic concepts of cell interactions involved in the development of whole organism in relation with plants and animals.

COURSE OUTCOMES: Upon successful completion of the course, students will able to

CO NUMBER	CO STATEMENT	KNOWLEDGE LEVEL (K1-K4)
CO1	To understand and remember the basics of cell function terms in relation with the developmental studies of plant and animals	K1 and K2
CO2	Understand the genetic level of cell-cell interactions, hormonal function for the development of whole organism	K2
CO3	Classify the function of different types of cells at all stages of development of whole organism	K3
CO4	Summarize the organ development in vertebrate animals	K1
CO5	Understand the organization of tissues and flowering in plants	K2

MAPPING WITH PROGRAMME OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	S	S	M	S	S
CO2	S	S	S	M	M	M
CO3	M	S	S	S	M	M
CO4	S	S	M	S	S	S
CO5	M	M	S	M	S	S

S-Strong, M-Medium, L-Low

UNIT I **12 Hours**

BASIC CONCEPTS OF DEVELOPMENT BIOLOGY:

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

UNIT II **12 Hours**

MECHANISM OF CELL INTERACTION AND DIFFERENTIATION

Proximate tissue interaction, Cell interaction at a distance: Hormones as mediators of development, differentiation of neurons, Sex determination. Environmental regulation of normal development, Developmental mechanisms of evolutionary change.

UNIT III

GAMETOGENESIS, FERTILIZATION AND EARLY DEVELOPMENT IN PLANTS AND ANIMALS **12 Hours**

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

UNIT IV **12 Hours**

MORPHOGENESIS AND ORGANOGENESIS IN ANIMALS: Cell aggregation and differentiation in *Dictyostelium*; axes and pattern formation in *Drosophila*, organogenesis – vulva formation in *Caenorhabditiselegans*, limb development and regeneration in vertebrates, post embryonic development- larval formation, metamorphosis

UNIT V **12 Hours**

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 and floral development in *plants*

Distribution of Marks: Theory 80% and Problems 20%

TEACHING METHODOLOGY:

- Class room teaching
- Assignments
- Discussions
- Homework
- PPT presentations
- Seminars
- Models and charts

TEXT BOOKS:

S.no.	Authors	Title	Publishers	Year of publication
1.	Gilbert, Scott's.	Developmental biology	Sinauer Association, Inc., Publishers	2014
2.	Slack, JMW	Essential Developmental Biology	Blackwell Scientific Publications	2001
3.	John B. Armstrong, George .M	Developmental biology of the axolotl	Oxford University Press	1989
4.	Brain K.Hall	Evolutionary Developmental Biology	Springer Sciene and Business Media	1998
5.	Scott F.Gilbert	Developmental Biology	Wantirina South	2020

REFERENCE BOOKS:

S.no.	Authors	Title	Publishers	Year of publication
1.	Wolpert. L	Principles of Development	Oxford University Press	1998
2.	Chattopadhyay.S	An Introduction to Developmental Biology	Books and Allied (P) Ltd	2016
3.	Balinsky, B.I.	An Introduction to Embryology	W. B. Saunders Co., Philadelphia	1981
4.	Michael JF Barresi	Developmental Biology	Sinauer Associates	2020
5.	Scott Gilbert	Developmental Biology	Academic Press	2020

WEB SOURCES:

1. http://people.ucalgary.ca/~browder/virtualembryo/dev_biol.html
2. https://www.sciencedirect.com/bookseries/current-topics-in-developmental-biology
3. https://b-ok.cc/book/1195653/885982
4. https://www.e-bookdownload.net/search/developmental-biology
5. https://freebookcentre.net/Biology/Developmental-Biology-Books.html

Syllabus Designer:

- Dr. Amrita Anantharaman
  Assistant Professor

BIOINFORMATICS

Semester	Subject code	Category	Lecture		Theory		P	C
V	21CBT5E	Elective-II	4hrs per week	60	4 hrs per week	60	-	3

COURSE OBJECTIVE: To provide students the knowledge on fundamentals of bioinformatics and update them with proteomics, microarray techniques and protein expression tools.

COURSE OUTCOMES: Upon successful completion of the course, students will able to

CO NUMBER	CO STATEMENT	KNOWLEDGE LEVEL (K1-K4)
CO1.	Remember the fundamentals of bioinformatics and Understand different types of biological database	K1 & K2
CO2.	Apply the obtained information through the experiments and also study the various database arrangements .	K3
CO3.	Analyze how cells reproduce by cell cycle, mitosis and meiosis.	K4
CO4.	Understand the structural and functional aspects of different proteins	K2
CO5.	Identify and understand the principles of protein expression	K1& K2

Knowledge Level: K1- Remember, K2- Understand, K3- Apply, K4-analyze

MAPPING WITH PROGRAMME OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	M	S	M	S	M
CO2	S	M	S	M	M	S
CO3	S	S	S	M	M	M
CO4	S	S	M	M	S	M
CO5	S	S	S	S	M	S

S-Strong, M-Medium, L-Low

UNIT -I
OVERVIEW OF BIOINFORMATICS **12 Hours**

Bioinformatics: Introduction, History and scope of bioinformatics, Biological database –Types of biological database. Primary databases, Secondary databases, Composite databases. Nucleic acid and protein sequence databases.

UNIT –II
SEQUENCE ALIGNMENT **12 Hours**

General introduction to Sequence Alignment –Types of a sequence alignment, Methods of sequence alignment, Dot matrix method. Pair wise and multiple sequence alignment,Global alignment, blast, Applications of bioinformatics in research.

UNIT –III
PROTEOMICS & GENOMICS **12 Hours**

The proteome – the Proteome and the Genome, the life cycle of a protein, protein as modular structures, functional protein families, deduces the proteome from the Genome, gene expression, and Retrieving protein sequences from databases.

Genomics- structural genomics, comparative genomics & functional genomics

UNIT IV
MICROARRAY **12 Hours**

Microarray: Introduction, History of microarray, Basic Principle of microarray. DNA microarray technology Storing information in sequence database, Types of DNA microarray and microarray databases, Protein- Protein docking, Insitu oligonucleotide array format, Applications of microarray technology.

UNIT V
PROTEIN EXPRESSION **12 Hours**

ProteinExpression and purification: Introduction of protein expression Mining proteomics, protein expression profiling, identifying protein–protein interaction, protein structure databases and protein complexes.

Distribution of Marks: Theory 80% and Problems 20%

TEACHING METHODOLOGY:

- Class room teaching
- Assignments
- Discussions
- Homework
- PPT presentations

- Seminars
- Models and charts

TEXT BOOKS:

S.no.	Authors	Title	Publishers	Year of publication
1.	Marketa JZ and Jeremy OB	Understanding Bioinformatics,	Garland Science, Taylor & Francis Group, USA.	2008
2.	ClaverieJM,Notredame C,	Bioinformatics for Dummies	Wiley Publishing Inc., Indiana, USA.	2006
3.	Anna Tramontano	The Ten most wanted solutions in protein bioinformatics	CRC Press	2005
4.	Attwood T.K and Parry Smith. D.J	Introduction to Bioinformatics	Pearson Education India	1999
5.	David W. Mount	Bioinformatics	Cold Spring Harbor Lab Press	2001

REFERENCE BOOKS:

S.no.	Authors	Title	Publishers	Year of publication
1.	Lesk AM	Introduction to Bioinformatics	OUP, Oxford, UK.	2002
2.	HoomanRashidi, Lukas K. Buehler	BioinformaticBasics: Applications in biological Sciecne and medicine	CRC press and Taylor and Francis group	2005
3.	Andreas D. Baxevanis and Francis Ouellette	Bioinformatics	John Wiley & Sons	2004
4.	Lukas K. Buehler and Hooman H. Rashidi	Bioinformatics	CRC Press	2005
5.	David W. Mount	Bioinformatics: Sequence and Genome Analysis	Paperback	2004

WEB SOURCES:

1. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4870335/
2. http://bioinformaticsinstitute.ru/sites/default/files/lapidus_1_0.pdf
3. https://www.goodreads.com/shelf/show/bioinformatics
4. https://www.iscb.org/iscb-publications-bioinformatics-review
5. https://books.google.co.in/books?id=90tZDwAAQBAJ

Syllabus Designer:

- Dr. Amrita Anantharaman
  Assistant Professor

BIO-BUSINESS AND MANAGEMENT

Semester	Subject code	Category	Lecture		Theory		P	C
V	21SBT5A	Skill based subject - III	2hrs per week	30	2 hrs per week	30	0	2

COURSE OBJECTIVE:

- ✓ The course aims at providing an overview of the life sciences sector, supported and complemented by business, entrepreneurial and applied modules.

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

CO NUMBER	CO STATEMENT	KNOWLEDGE LEVEL(K1-K4)
CO1	Identify the concept of business and its principles.	K1
CO2	Describe the project formulation system.	K2
CO3	Discuss the project cost and market potential	K2
CO4	Evaluate the role and opportunity of entrepreneurs in biotechnology	K4
CO5	Apply the marketing skills in business	K3

Knowledge level: K1- Remember; K2- Understand; K3- Apply; K4- analyze

MAPPING WITH PROGRAMME OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	M	S	M	S	M
CO2	S	M	S	M	M	S
CO3	S	S	S	M	M	M
CO4	S	S	M	M	S	M
CO5	S	S	S	S	M	S

S-Strong, M-Medium, L-Low

UNIT I:

INTRODUCTION TO BUSINESS **6 Hours**

Principles of business management and concept of Bio business, Understanding of organizational behaviour and structure. Fundamentals of Business management, Management: Definition and process. Business management Concepts.PMP certification. SWOT analysis of Indian Bio business, bioentrepreneurship.

UNIT II:

PROJECT FORMULATION **6 Hours**

Project formulation and selection: based on size, five stages of project life cycle, Situation analysis and project design, Problem analysis, technological assessment, technical report, feasibility and commercial viability

UNIT III:

PROJECT COST AND MARKET POTENTIAL **6 Hours**

Prepare project management plan, Total product cost, capital investment and profitability, manufacturing cost estimation, capital investment estimation, types of funding –state and central government schemes.

UNIT IV:

ENTREPRENEURSHIP OPPORTUNITY IN BIOTECHNOLOGY **6 Hours**

Business opportunity and scope on Plant cell and tissue culture technique, Nutraceuticals, value added herbal products, Bioethanol production, Integrated compost production, Biopesticide production, Fermented products, Single cell protein and secondary metabolite production, mushroom cultivation.

UNIT V:

SALES AND MARKETING **6 Hours**

Introduction to marketing, scope of marketing, maketing philosophies, marketing management process, marketing analysis, understanding marketing environment, consumer and organization buyer behavior, market measurement and marketing research,

Distribution of Marks: Theory 80% and Problems 20%

TEACHING METHODOLOGY:

- Class room teaching
- Assignments
- Discussions
- Homework
- PPT presentations
- Seminars
- Models and charts

TEXT BOOKS:

S.NO	AUTHORS	TITLE	PUBLISHERS	YEAR OF PUBLICATION
1.	Gupta P.K.	Biotechnology and Genomics	Rastogi Publications Meerut	2003
2.	Gurinder S Shahi	BioBusiness: A Strategic Perspective	Lulu.com	2005
3.	Sharma R.K and Shashi K Gupta	Business management	Kalyani Publishers	2002
4.	James L. Burrow, Brad Kleinfl and Kenneth E.	Business Principles and management	EverardCengage	2007
5.	Kumar H.D	Agricultural Biotechnology	Daya Publishing House	2005

REFERENCE BOOKS:

S.NO	AUTHORS	TITLE	PUBLISHERS	YEAR OF PUBLICATION
1.	Sussman, M., Collmi, C.H., Shimnen, A.A. and Stewart-tull D.E.	The release of Genetically engineered micro-organisms	Academic Press, London.	1994
2.	Karmach, C.L	Biotechnology Regulations Handbook	Centre for energy and environmental management, FanifacStn.Vingnia	1991
3.	Discon, b.	Morals, ethics, and biotechnology	Raven press	1992
4.	Goel B.B	Project Management	Deep and deep publications	2002
5.	Jack R. Meredith and Samuel J. Mantel	Project management	Wiley India Pvt Limited	2010

Web Sources:

1. https://www.youtube.com/watch?v=JPq7gPkvLjI
2. https://www.youtube.com/watch?v=oN6bG4veZrk
3. https://www.youtube.com/watch?v=EyPFi0YO32M
4. https://www.youtube.com/watch?v=fzoYXccm8cY
5. https://www.youtube.com/watch?v=jQVsQenDiEo

Syllabus Designer:

- Mrs. M.Malathi, M.Sc., M.Phil.,
  Assistant Professor

PLANT AND ANIMAL CELL CULTURE

Semester	Subject Code	Category	Lecture	Theory	Practical		Credits
V	21CBT51	Core Practical - III	0	0	3hrs per week	45	3

COURSE OBJECTIVES

To create an opportunity to students for experimentally testing the principles and concepts studied in respective theory.

LIST OF EXPERIMENTS

1. Preparation of MS medium
2. Ex-plant preparation
3. Callus induction
4. Surface sterilization of explants
5. Synthetic seed preparation
6. Isolation DNA from human blood
7. Preparation of Animal cell culture media
8. Sterilization of Animal cell culture media
9. Instrument and facilities for animal cell culture.
10. MTT assay demo

REFERENCE BOOKS

1. Plant Biotechnology - The genetic manipulation of plants (2^{nd}ed) Slater A, Scott NW, Fowler MR (2008) Oxford University press.
2. Plant Tissue culture: Techniques and Experiments (3^{rd}ed) Smith RH (2013) Academic Press, USA.
3. Plant Tissue culture: Theory and Practice, BhojwaniSS and RazdanMK (1996), Elsevier, India.
4. Biotechnology, Sathyanarayanan.U, Paperpack Publications (2005).
5. https://www.thermofisher.com

Syllabus Designer:

- Dr. J. Ilamathi Assistant Professor
- Mrs. J. Hanusha, Assistant Professor

MICROBIAL AND INDUSTRIAL BIOTECHNOLOGY

Semester	Subject code	Category	Lecture		Theory		P	C
VI	21CBT6A	Core - VIII	6hrs per week	90	6hrs per week	90	0	5

COURSE OBJECTIVE:

- ✓ To provide students the introduction to the overall industrial bioprocess so as to help them to manipulate the processes according to industrial needs.

COURSE OUTCOMES: Up on successful completion of course, students will be able to

CO NUMBER	CO STATEMENT	KNOWLEDGE LEVEL (K1-K4)
CO1	Understand the knowledge about microbial physiology	K2
CO2	Understand the knowledge about fermentation biotechnology	K2
CO3	Analyze the different types of microbial culture methods	K4
CO4	Analyze the meaning and scope of primary and secondary metabolites and its products	K4 & K5
CO5	Apply knowledge for the applications of microbial and industrial biotechnology.	K3

Knowledge level: K1- Remember; K2- Understand; K3- Apply; K4- Analyze

MAPPING WITH PROGRAMME OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	S	S	M	S	S
CO2	S	S	S	M	M	M
CO3	M	S	S	S	M	M
CO4	S	S	M	S	S	S
CO5	M	M	S	M	S	S

S-Strong, M-Medium, L-Low

UNIT-I

MICROBIALPHYSIOLOGY **18 Hours**

Microbiological media, composition and types: Selective and Differential media. Developmental of pure cultures – Maintenance and preservation of cultures. Influence of environmental factors on microbial growth. Bacterial growth curve and kinetics.

UNIT-II

INTRODUCTION TO INDUSTRIAL BIOTECHNOLOGY **18 Hours**

Introduction and Scope of Industrial Biotechnology, Historical overview of Industrial fermentation. Bioreactors in fermentation technique outline of upstream and downstream process. Medium requirement for fermentation: Carbon and Nitrogen sources, minerals, vitamins, antibiotics. Simple and complex media.

UNIT-III

STRAIN IMPROVEMENT **18 Hours**

Strain Improvement Microbial Culture: Introduction to strain improvement, Different types of microbial culture methods Continuous culture methods, Batch culture methods and Fed-batch culture methods. Isolation and preservation of industrial microbes, Improvement of Industrial microbes.

UNIT-IV

PRIMARY AND SECONDARY METABOLITES PRODUCTION **18 Hours**

Role of primary and secondary metabolites. Production of primary metabolites – Organic solvents Productions-Ethanol and Acetone, Vitamins productions- B_{12} and A, Organic Acids productions-Citric acid and Lactic acid. Production of Secondary metabolites: Antibiotics – Tetracycline and Erythromycin.

UNIT-V

APPLICATIONS OF MICROBIAL AND INDUSTRIAL BIOTECHNOLOGY **18 Hours**

Production of Beer, Wine, Milk products. Natural Preservatives. Production of Biopesticides, Bio fertilizers, SCP and Mushroom cultivation. Various Aerobic and Anaerobic processes for solid and wastewater treatment. Microbes in mining, oil recovery and production of Bio-fuels.

Distribution of Marks: Theory 80% and Problems 20%

TEACHING METHODOLOGY:

- Class room teaching
- Assignments
- Discussions
- Homework
- PPT presentations
- Seminars
- Models and charts

TEXT BOOKS:

S.NO.	AUTHORS	TITLE	PUBLISHERS	YEAR OF PUBLICATION
1.	Patel A.H	Industrial Microbiology	McMillan Publishers	2005
2.	Ponmurugan P, Nithya Rand Fredimoses	Experimental Procedures in Bioprocess technology and Downstream processing	Anjana Book House, Chennai	2012
3.	Stanbury PF and Whitaker A	Principles of Fermentation Technology	Pergamon Press, Oxford, UK.	1984
4.	MansE.l, and Bryce C.F.A	Fermentation Microbiology and Biotechnology	Taylor and Francis group.	2002
5	Reddy S.M and Ram Reddy	Basic Industrial Biotechnology	New age international Publisher	2012

REFERENCE BOOKS:

S.NO.	AUTHORS	TITLE	PUBLISHERS	YEAR OF PUBLICATION
1.	Pelczar M. Chanecs, Kreig N.R	Microbiology	Tata McGraw Hill, New Delhi	1996
2	NdukaOkafor	Modern Industrial Microbiologyand biotechnology	SP publisher	2007
3	Lee Yuan Kun	Microbial Biotechnology	World scientific	2003
4	Albert G. Moat and John W. Foster	Microbial Physiology	John Wiley & sons	2003
5	WimSoetaert and Erick J.Vandamme	Industrial Biotechnology	John Wiley & sons	2010

WEB SOURCES

1. https://www.omicsonline.org/microbial-physiology/articles
2.https://www.youtube.com/watch?v=bblvBA7K24M
3. https://www.slideshare.net/jeevaraj9/strain-improvement-techniques
4.https://byjus.com/biology/metabolites
5. https://www.slideshare.net/melamoon/applications-of-industrial-biotechnology

Syllabus Designer:

- Dr.J. Ilamathi
  Assistant Professor

PHARMACEUTICS AND HERBAL MEDICINE

Semester	Subject Code	Category	Lecture		Theory		P	C
VI	21CBT6B	Core theory - IX	6 hrs per week	90	6 hrs per week	90	0	4

COURSE OBJECTIVE:

- ✓ To provide the student with knowledge of the preparation, stability and formulation of different protein and peptide drugs such as antisense agents, transgenic therapeutics and gene therapy. To use the latest techniques for the search of new products from natural sources.

COURSE OUTCOMES: Upon successful completion of the course,students will able to

CO NUMBER	CO STATEMENT	KNOWLEDGE LEVEL (K1-K4)
CO1	To recall the basics of drug discovery and the regulation involved in the development of drugs	K2
CO2	Apply and analyze the different forms of dosage formulations	K2 & K3
CO3	Arrange the methods of drug delivery system from prehistoric times	K4
CO4	Evaluate the drug toxicity	K6
CO5	Evaluate the mode of action of drugs	K6

Knowledge Level: K1- Remember, K2- Understand, K3- Apply, K4-analyze

MAPPING WITH PROGRAMME OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	M	M	M	M	M
CO2	S	S	S	M	M	M
CO3	M	S	S	S	M	M
CO4	M	M	S	M	S	M
CO5	S	M	S	M	M	S

S-Strong, M-Medium, L-Low

UNIT 1 INTRODUCTION: **18 Hours**

Pharmacology: Introduction, History of pharmaceutical industry, drugs, Drugs discovery and Development phases, Sources of drugs, Nature of Drugs, Bioassay of drugs, drug intolerance, drug abuse.

UNIT II DOSAGE SCIENCE **18 Hours**

Definition of Dosage forms, Classification of dosage forms (solid unit dosages –Tablets, capsules; liquids – solutions, lotions, suspension etc; semi-solid dosage forms– ointments, creams, gel, suppositories, etc; Parenterals, Aerosols etc), Routes of drug administration, Mechanism of drug action.

UNIT III DRUG DELIVERY SYSTEM: **18 Hours**

Advanced drug delivery systems – controlled release, transdermal, liposomes and drug targeting, Approaches to the characterization of biosimilars. Problems in characterizing biologics: (Types of biologics, Peptides, Non-glycosylated proteins, Glycosylated proteins, Monoclonal antibodies).

UNIT IV OVERVIEW OF AYURVEDA MEDICINES **18 Hours**

Introduction to ayurveda and traditional medicines, brief understanding on ayurvedic formulation types, preparation and their methods based on ayurvedic formulary of India. Analysis of raw materials and evaluation of finished products giving emphasis on physico-chemical properties, chemical analysis, identification, instrumental analysis, biological and toxicological testing, microbiological testing.

UNITV MEDICINAL PLANTS AND DRUG QUALITY **18 Hours**

Study of medicinal plants under therapeutic categories such as digestives, cardiovascular, anticancer, antirheumatic, antimalarial, antidiabetics, Introduction to ayurvedic pharmacopoeia and methods for standardization and quality control of herbal extracts & products.

Distribution of Marks: Theory 80% and Problems 20%

TEACHING METHODOLOGY:

- Class room teaching
- Assignments
- Discussions
- Homework
- PPT presentations
- Seminars
- Models and charts

TEXT BOOKS:

S.no.	Authors	Title	Publishers	Year of publication
1.	F.S.K. Barar, S.Chand and Co.,	Essentials of Pharmacotherapeutics	S. Chand Publishing	1985
2.	Alfonso RG	The Science and Practice of Pharmacy	Baltimore, Md. : Lippincott Williams & Wilkins	2003
3.	KoKate	Textbook of pharmaceutical Biotechnology	Elsevier Health	2011
4.	Agrawal S.S and Paridhavi M	Herbal Drug Technology	University Press	2007
5.	ManuchairEbadi	Pharmacodynamic Basis of herbal medicine	CRC Press	2006

REFERENCE BOOKS:

S.no.	Authors	Title	Publishers	Year of publication
1.	T V Ramabhadran	Pharmaceutical Design And Development Approach	Ellis Horwood Publishers	2005
2.	S.P Vyas, V. Dixit	Pharmaceutical Biotechnology	CBS publishers and distributors	2018
3.	Dawn C P Ambrose	Leafly Medicinal Herbs	CABI	2016
4	Lester Packer and SissiWachtel-Galor	Herbal and traditional medicine	CRC Press	2004
5.	Carlos A. Guzman	Pharmaceutical Biotechnology	Springer Science & Business Media	2010

WEB SOURCES:

1. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3525971/
2. https://www.imedpub.com/pharmaceutical-biotechnology-current-research/
3. https://www.goodreads.com/book/show/12037577-herbal-drug-technology
4. https://books.google.co.in/books?lr=&id=CMJKgfhCKzIC&oi
5. https://books.google.co.in/books/about/Pharmaceutical_Biotechnologyhttps://books.google.co.in/books/about/Pharmaceutical_Biotechnology
6. https://books.google.co.in/books?id=wwLpDAAAQBAJ

Syllabus Designer :

Mrs. J. Hanusha
Assistant Professor

BIOINSTRUMENTATION

Semester	Subject code	Category	Lecture		Theory		P	C
VI	21CBT6C	Core Theory - X	5 hrs per week	75	5 hrs per week	75	0	4

Course Objective:

- ✓ To provide fundamental theoretical knowledge to the students with an adequate number of analytical tools about bioinstruments, biomethods, its principle and operation methods.

COURSE OUTCOMES: By the end of this course, students will able to:

CO NUMBER	CO STATEMENT	KNOWLEDGE LEVEL (K1-K4)
CO1.	To understand the concepts of microscopy and centrifugation	K2
CO2.	To learn, apply and analyze the samples using centrifugation Techniques.	K4
CO3.	Understand the principles and types of chromatography	K2
CO4.	To analyze and interpret the data obtained using Spectrophotometric methods and NMR	K3
CO5.	To evaluate genetic problems by various electrophoretic techniques	K1 &K3

Knowledge Level: K1- Remember, K2- Understand, K3- Apply, K4-analyze

MAPPING WITH PROGRAMME OUTCOMES

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

S-strong; M- medium; L-low

UNIT-I CENTRIFUGATION TECHNIQUES **15 Hours**

Centrifugation techniques: Basic Principles, Rate of sedimentation, Types of centrifuges-Microfuges, small desk top centrifuges, High speed centrifuges, Ultracentrifuges.

Preparative centrifugation- Differential centrifugation, Density gradient centrifugation-Rate zonal Centrifugation, Isopycnic centrifugation. Applications of centrifugation techniques.

UNIT-II CHROMATOGRAPHY **15 Hours**

Chromatography: Basic principle, source, detectors and applications of Paper Chromatography, Thin Layer Chromatography, Gas Chromatography, Column chromatography, Gel filtration chromatography, High-Pressure Liquid Chromatography, Ion Exchange Chromatography, Size-Exclusion Chromatography.

UNIT- III SPECTROPHOTOMETER **15 Hours**

Spectral Methods of Analysis: Beer-Lambert Law, Colorimeters: UV-Visible Spectrophotometers, Single And Double Beam Instruments, Sources And Detectors, FT-IR Spectrophotometers.

UNIT IV NUCLEAR MAGNETIC RESONANCE **15 Hours**

NMR: Basic Principles, NMR Spectrometer and Applications. Electron Spin Resonance Spectroscopy: Basic Principles, Instrumentation and Applications

UNIT – V ELECTROPHORETIC TECHNIQUES **15 Hours**

Electrophoresis- Introduction, SDS-PAGE, Native –PAGE, pulse field gel electrophoresis, immuno-electrophoresis, isoelectric focusing, Agarose gel electrophoresis, Western Blotting, Sothern Blotting.

Distribution of Marks: Theory 80% and Problems 20%

TEACHING METHODOLOGY:

- Class room teaching
- Assignments
- Discussions
- Homework
- PPT presentations
- Seminars
- Models and charts

TEXT BOOKS:

S.NO.	AUTHORS	TITLE	PUBLISHERS	YEAR OF PUBLICATION
1.	Wilson.K., Walker.J. E.J., Wood.K.	Principles & techniques of practical biochemistry	Cambridge University Press	2000
2.	Veerakumari.L	Bioinstrumentation	Mjp Publishers, 1st edition.	2011
3.	John Denis Enderle	Bioinstrumentation	Morgan & Claypool Publisher	2006
4.	Shakti Chatterjee and Aubert Miller	Biomedical instrumentation Systems	Cengage Learning	2012
5.	Jon B. Olansen and Eric Rosow	Virtual Bioinstrumentation	Pearson Education	2001

REFERENCE BOOKS:

S.NO.	AUTHORS	TITLE	PUBLISHERS	YEAR OF PUBLICATION
1.	John.G Webster	Bioinstrumentation	John Wiley &Sons, New York	2004
2.	Robert D. Braun	Introduction to Instrumental Analysis	McGraw Hill, Singapore	1987
3.	Veerakumari L	Bioinstrumentation	MJP Publishers	2009
4.	Shakti Chatterjee and Aubert Miller	Biomedical instrumentation systems	Cengage Learning	2012
5.	Andrew G. Webb	Principles of Biomedical Instrumentation	Cambridge University Press	2018

WEB SOURCES:

1. https://www.hccfl.edu/media/572066/microscopy.pdf
2. http://www.biologydiscussion.com/biochemistry/chromatography-techniques/top-12-types-of-chromatographic-techniques-biochemistry/12730
3. https://www.labcompare.com/Spectroscopy/105-Spectrophotometers/
4. https://www.oregonstatehospital.net/d/otherfiles/Electron%20Spin%20Resonance%20Spectroscopy.pdf
5. https://nptel.ac.in/courses/102103013/17
6. https://www.amazon.com/Principles-Biomedical-Instrumentation-Cambridge

Syllabus Designer:

- Dr.J.Ilamathi
  Assistant Professor

MEDICAL BIOTECHNOLOGY

Semester	Subject Code	Category	Lecture		Theory		P	C
VI	21CBT6D	Elective - III	4 hrs per week	60	4 hrs per week	60	0	3

COURSE OBJECTIVE:

- To understand the concepts of medical biotechnology and its application in treatment of diseases.

COURSE OUTCOMES:

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

CO NUMBER	CO STATEMENT	KNOWLEDGE LEVEL (K1-K4)
CO1	Understand human physiology and metabolic disorders	K1
CO2	Describe the various microbial diseases.	K2
CO3	Discuss the rights and licensing of copyright.	K2
CO4	Illustrate about Gene therapy and its application in treating various diseases.	K3
CO5	Analyze advanced techniques in treating diseases.	K4

Knowledge Level: K1- Remember, K2- Understand, K3- Apply, K4-analyze

MAPPING WITH PROGRAMME OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	S	S	M	M	S
CO2	S	S	S	S	S	S
CO3	M	M	S	M	S	M
CO4	S	S	S	S	S	M
CO5	M	S	S	S	S	S

S-strong; M- medium; L-low

UNIT I

HUMAN PHYSIOLOGY AND METABOLIC DISORDERS **10 Hours**

Introduction to Human Physiology-Respiratory system, Circulatory system, Digestive system, Excretory system, Nervous system and Reproductive system. Metabolic Disorders: Phenylketonuria, Diabetes mellitus, Hypercholesteremia, Rickets, Hyperthyroidism and Hypothyroidism.

UNIT II

PATHOGENESIS **10 Hours**

Mechanisms of infection and Epidemiology, prevention, diagnosis and treatment– Bacterial (Tuberculosis, Cholera), Viral (HIV, Rabies), Fungal (Athlete's foot) and Parasite (Malaria).

UNIT III

DIAGNOSTIC PROCEDURES **15 Hours**

Prenatal diagnosis – Invasive techniques (Amniocentesis, fetoscopy, chorionic villi sampling) and Non-invasive techniques (Ultrasonography, X-ray, TIFA), maternal serum and fetal cells inmaternalblood. Disease Diagnosis- Hepatitis, CML, AIDS using Protein and enzyme markers, DNA/RNA based diagnosis.

UNIT IV

GENE THERAPY **15 Hours**

Gene therapy: Introduction, Basic process of gene therapy, Types of Gene therapy ex-vivo Gene therapy, in vivo Gene therapy, strategies of gene therapy. Gene therapy trials –Cystic fibrosis, Alzheimer's disease, Severe combined immune deficiencies, AIDS, Parkinson's disease.

UNIT V

ADVANCED TECHNIQUES **10 Hours**

Nanomedicine: Introduction to nanomedicine, Applications of nanomedicine. Stem Cells and its clinical implications, History of stem cell research, Types of stem cells based on potential Po (Totipotent, Pluripotent and multipotent) Cell based therapies,. Microarray technology-genomic array, cDNA array and their application to diseases. Face transplants, human genome projects, 3 dimensional printed organs.

Distribution of Marks: Theory 80% and Problems 20%

TEACHING METHODOLOGY:

- Class room teaching
- Assignments
- Discussions
- Homework
- PPT presentations

- Seminars
- Models and charts

TEXTBOOKS:

S.NO	AUTHORS	TITLE	PUBLISHERS	YEAR OF PUBLICATION
1	J Brostoff, D Male, D B Roth, I M Roitt	Immunology.	Elsevier, Philadelphia, USA	2012
2	David G	Medical Microbiology	Elsevier, UK.	2007
3.	Anna M. Wobus and Kenneth Boheler	Stem cells	Springer Science & Business media	2006
4.	Mathew Sebastian and NeethuNihan	Nanomedicine and drug delivery	CRC Press	2012
5.	Schmidt R.F. and Thews G	Human Physiology	Springer Science & Business media	2013

REFERENCE BOOKS:

S.NO	AUTHORS	TITLE	PUBLISHERS	YEAR OF PUBLICATION
1	Murray P, Rosenthal K	Medical Microbiology (8 thed)	Elsevier, UK	2015
2	JuditPongracz, Mark keen.	Medical Biotechnology	Elsevier, UK	2009
3	U Satyanarayana	Biotechnology	Books and allied (p)limited	2013
4	AdeyemiOlubummo	Human anatomy and Physiology	Universe	2010
5	EvgenijBorisovicBabskij	Human Physiology	Mir Publishers	1975

WEB SOURCES:

1. https://www.youtube.com/watch?v=zFxDhRobC0g
2. https://www.youtube.com/watch?v=BxEoX6TkitY
3. https://www.youtube.com/watch?v=vOnNk2EFLcE
4. https://www.youtube.com/watch?v=mYWVi7B-13c
5. https://www.youtube.com/watch?v=2Zfvey5lEW8

Syllabus Designer:

- Mrs. M.Malathi M.Sc., M.Phil
  Assistant Professor

ENVIRONMENTAL BIOTECHNOLOGY

Semester	Subject Code	Category	Lecture		Theory		P	C
VI	21CBT6E	Elective -IV	4 hrs per week	60	4 hrs per week	60	0	3

COURSE OBJECTIVE: In this course, students will

- Understand the fundamental concepts and underlying principles in the Environmental biotechnology and explain various strategies of bioremediation and methods of producing biofuels.

COURSE OUTCOMES: Up on successful completion of course, students will be able to

CO NUMBER	CO STATEMENT	KNOWLEDGE LEVEL (K1-K4)
CO1.	Recall what is environment and identify environmental problems	K1
CO2.	Illustrate and classify various waste water treatment processes	K2
CO3.	Differentiate various solid waste treatment methods	K4
CO4.	Explain different strategies of bioremediation	K3
CO5.	Summarize different methods of producing biofuels and bioplastics	K2

Knowledge level: K1- Remember; K2- Understand; K3- Apply; K4- analyze

Mapping with Programme Outcomes

COS	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	S	M	M	M	M
CO2	S	S	M	M	M	M
CO3	M	M	M	M	M	M
CO4	M	M	S	S	M	S
CO5	M	S	M	M	S	M

S-strong; M- medium; L-low

UNIT I INTRODUCTION TO ENVIRONMENTAL ISSUES **10 Hours**

Introduction to Environment, Environmental components-, Environmental pollution, bioindicators of pollution, and control measures, ozone depletion, acid rain, greenhouse gases and their effects.

UNIT II WASTE WATER TREATMENT **10 Hours**

Municipal waste water treatment – Physical, chemical and Biological processes-aerobic Activated Sludge Process, Trickling filters, Aerated Lagoons, Oxidation Pond and anaerobic- contact reactor and the up flow reactor, Conventional digester, Packed anaerobic filter, upflow anaerobic sludge blanket, Anaerobic membrane reactor, Waste water treatment in tanneries.

UNIT III SOLID WASTE MANAGEMENT **15 Hours**

Types of solid wastes, thermal treatment- incineration, *Gasification and Pyrolysis*, open burning, dumps and landfills- sanitary landfill, controlled dumps, bioreactors, landfill, composting, vermicomposting, sludge treatment- aerobic and anaerobic.

UNIT IV BIOREMEDIATION **10 Hours**

Bioremediation- insitu, exsitu, slurry phase- advantages and disadvantages, phytoremediation, Biostimulation, Bioaugmentation, Biosparging, Bioventing, Biodegradation of hydrocarbons, xenobiotics, Genetically Engineered Microorganisms used in biodegradation of oil spills advantages and disadvantages

UNIT V BIOENERGY AND APPLICATIONS OF FRESH & MRAINE WATER ENVIRONMENT **15 Hours**

Electricity from biomass, Biofuels- biogas, syngas, biodiesel, green diesel, bioethanol, biobutanol and biohydrogen, bioplastics, sources, types, uses.

Applications of fresh & marine water environment: Introduction aquatic resources disease in aquaculture, diagnostics of disease. Bioactive compounds from marine sources (Bacteria and Algae)

Distribution of Marks: Theory 80% and Problems 20%

TEACHING METHODOLOGY

- Class room teaching
- Assignments
- Discussions
- Home work
- PPT presentations
- Seminars
- Models/Charts

TEXT BOOKS:

S.NO.	AUTHORS	TITLE	PUBLISHERS	YEAR OF PUBLICATION
1.	Michael DP, Philip LB, Jeffrey CE	Hazardous Waste Management	Waveland Press Inc.	2010
2.	Chatterjee AK	Introduction to Environmental Biotechnology	PHI, New Delhi, India	2011
3.	Jogdand SN	Environmental Biotechnology: Industrial Pollution Management	Himalaya Publishing, India.	2005
4.	Leslie Jr CP, Glen TD, Nancy GL, Carlos DM	Biological Wastewater Treatment	CRC Press, Taylor & Francis Group, USA.	2011
5	Agarwal .S.K.	Advanced Environmental Biotechnology	APH publishing	2005

REFERENCE BOOKS:

S.NO.	AUTHORS	TITLE	PUBLISHERS	YEAR OF PUBLICATION
1.	P.NicholasCheremisinoff	Biotechnology for Wastewater Treatment	Prentice Hall Of India	2001
2.	P.K. Mohapatra	Text book of environmental biotechnology	I.K. International Pvt. Ltd.	2010
3.	U.Satyanarayana	Biotechnology	Books & allied (p) ltd.-kolkata	2008
4.	Murray Moo Young W.A and Chakrabarty A.M	Environmental Biotechnology	Springer Science & Business Media	1996
5.	Daniel A. Vallero	Environmental Biotechnology	Academic Press	2010

WEB SOURCES

1. https://www.researchgate.net/publication/26789987_Biodegradation_of_aromatic_compounds_Current_status_and_opportunities_for_biomolecular_approaches
2. https://www.european-bioplastics.org/bioplastics/
3. https://www.energy.gov/eere/bioenergy/biofuels-basics
4. http://www.esru.strath.ac.uk/EandE/Web_sites/02-03/biofuels/what_bioethanol.htm
5. http://livinggreen.ifas.ufl.edu/waste/composting.html

Syllabus Designer:

- Dr.D.Charumathi
  Assistant Professor

IPR AND ETHICS IN BIOTECHNOLOGY

Semester	Subject code	Category	Lecture		Theory		P	C
VI	21SBT6A	Skill based subject - IV	2 hrs per week	30	2 hrs per week	30	0	2

COURSE OBJECTIVE:

- To understand the concepts of IPR and learn the basics of bioethics.

COURSE OUTCOMES:

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

CO NUMBER	CO STATEMENT	KNOWLEDGE LEVEL (K1-K4)
CO1	Identify the characteristics and role of IPR.	K1
CO2	Describe theconcepts of patent.	K2
CO3	Discuss therights and licensing of copyright.	K2
CO4	Illustrate about trademark.	K3
CO5	Analyze Ethics and Ethical issues in GMO's	K4

Knowledge level: K1- Remember; K2- Understand; K3- Apply; K4- analyze

Mapping with Programme Outcomes

COS	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	S	S	M	M	S
CO2	S	S	S	S	S	S
CO3	M	M	S	M	S	M
CO4	S	S	S	S	S	M
CO5	M	S	S	S	S	S

S-strong; M- medium; L-low

UNIT I INTRODUCTION TO IPR **6 Hours**

Intellectual Property Rights: Introduction and scope of IPR, Major types of Intellectual property International Character of IPRs, Role of IPRs in Economic Development. Protection of biotechnological inventions, World Intellectual Property Rights organization (WIPO), GATT (General agreement of tariff and trade),

UNIT II PATENTS **6 Hours**

Introduction To Patents, Invention, Life and duration, Basic patent rights, Object of Patent Law, Obtaining Patents, Rights and Obligations of a Patentee. Patenting of genes, biological organisms, plants, animals, microbes and transgenic organisms, Consumer protection act, Patent holders in India.

UNIT III COPYRIGHTS **6 Hours**

Introduction to Copyrights, scope of copyright, Indian copyright act and its perspective, Assignment of copyright, Subject Matters of Copyright, Rights Conferred by Copyright, Assignment and Licensing of Copyrights, International Copyright.

UNIT IV TRADEMARKS **6 Hours**

Functions, Significance and Types of Trademarks, Distinctiveness and Deceptive Similarity, Registration Procedure, Trademark Registry, Grounds for Refusal of Registration of Trademarks.

UNIT V ETHICS **6 Hours**

Bioethics in plant and animal genetic engineering and transgenics- Ethics of genetically modified microbes, ethics in genetically modified food, ethical issues in human biotechnology and Nano biotechnology, ethics in stem cell research, gene therapy and bio warfare.

Distribution of Marks: Theory 80% and Problems 20%

TEACHING METHODOLOGY

- Class room teaching
- Assignments
- Discussions
- Home work
- PPT presentations
- Seminars
- Models/Charts

TEXTBOOKS:

S.NO	AUTHORS	TITLE	PUBLISHERS	YEAR OF PUBLICATION
1	Radhakrishnan R. and Balasubramanian.	Intellectual Property Rights.	S. Excel Books, I ed.,	2008

2	Sree Krishna, V	Bioethics and Biosafety in Biotechnology	NewAge International Publishers	2007
3.	DeepaGoel and ShominiParashar	IPR, Biosafety and Bioethics	Pearson Education India	2013
4.	PrabuddhaGangul i	Intellectual Property Rights	Tata McGraw-Hill publishing company	2001
5.	RajagopalanRadh akrishnana	Intellectual Property Rights	Excel books, India	2008

REFERENCE BOOKS:

S.NO	AUTHORS	TITLE	PUBLISHERS	YEAR OF PUBLICATION
1	Subbaram N. R,	Handbook of Indian Patent Law and Practice,	Viswanathan Printers and Publishers Pvt. Ltd.,	1998
2	Martin. M.W. andSchinzinger. R. III Edition,	Ethics in engineering	Tata McGraw- Hill, New Delhi.	2003
3	Goel Cohen	Technology Transfer	Sage Publications	2004
4	Ashok Kumar	Intellectual property rights	Allied publishers	1994
5	PrabuddhaGang uli	Intellectual property rights	Tata McGraw Hill Publishing company	2001

WEB SOURCES:

1. https://www.youtube.com/watch?v=Z_u2Z7F8-bg
2. https://www.youtube.com/watch?v=HsTi3vD_Usw
3. https://www.youtube.com/watch?v=k1a2larfMIA
4. https://www.youtube.com/watch?v=GKqOWCK71K4
5. https://books.google.com/books/about/Intellectual_Property_Rights

Syllabus Designer:

- Mrs. M. Malathi, M.Sc., M.Phil

  Assistant Professor

BIOPROCESS & PHARMACEUTICAL BIOTECHNOLOGY

Semester	Subject Code	Category	Lecture	Theory	Practical		Credits
VI	21CBT61	Core Practical - III	0	0	3 hrs per week	45	3

COURSE OBJECTIVES

To create an opportunity to students for experimentally testing the principles and concepts studied in respective theory.

LIST OF EXPERIMENTS

1. Preparation of wine from grapes
2. Mushroom cultivation demo
3. Isolation of Rhizobium from root nodule of legume plant
4. Production of penicillin in lab
5. Isolation of Azotobacter from soil
6. Isolation of Antibiotic producing microorganism
7. Determination of Antimicrobial activity of Plant extract
8. Qualitative phytochemical screening of crude drugs
9. Paper and Thin layer Chromatography of plant extract

REFERENCE BOOKS

1. The Science and Practice of Pharmacy (20thed) Alfonso RG (2003) Lippincott Williams and Wilkins, Philadelphia, USA.
2. Pharmaceutical Biotechnology: Fundamentals and Applications (Eds) Crommelin DJA, Robert DS, Bernd M (2013) Informa Healthcare, UK.
3. Techniques and practice of chromatography- Raymond P. W. Scott, Vol. 70
4. Vogel's text book of Quantitative chemical analysis, 6th edition, 2004.

Syllabus Designer:

- Dr. J. Ilamathi Assistant Professor
- Mrs. J. Hanusha Assistant Professor