PSGR
Krishnammal College for Women

DEPARTMENT OF BOTANY

CHOICE BASED CREDIT SYSTEM (CBCS) &
LEARNING OUTCOMES- BASED CURRICULUM FRAMEWORK (LOCF)

(Semester– I-II)

MASTER OF SCIENCE - BOTANY
(2025 – 2027 Batch)

PSGR
Krishnammal College for Women

MASTER OF SCIENCE - BOTANY
CHOICE BASED CREDIT SYSTEM (CBCS) &
LEARNING OUTCOMES- BASED CURRICULUM FRAMEWORK (LOCF)

SYLLABUS&SCHEMEOF EXAMINATION
2025-2027 Batch Semester I-II

PROGRAMME LEARNING OUTCOMES (PLOs)

PLO 1: To produce graduates with more advanced knowledge and research skills in various disciplines of botany which are relevant to scientific development and conservation of plant diversity for socio-economic development of the country.

PLO 2: To remember, comprehend, apply, analyze, and synthesize the core concepts in botany, like biodiversity, structure and function, evolution, information flow, exchange and storage pathways and transformations of energy and matter, medicinal plants and their uses, food science and nutrition, forestry, energy and environment management.

PLO 3: To pursue advanced education, research and development, and other creative and innovative efforts in Life science.

PLO 4: To define the characteristics of the process of science; practice the skills of the scientific method, engage in research projects and apply quantitative skills to biological problems to understand the ambiguity in science.

PLO 5: To understand the relationship between science and society and will apply their skill to evaluate to solve the social problems like conservation and management of environment.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

At the end of the programme, the student will

PSO1: To gain advanced knowledge in various disciplines to analyze, and understand the core concepts in Botany.

PSO2: To be well equipped to pursue research and development in Life science**.**

PSO3: To secure jobs in the field of education, research and industries that requires scientific thinking and critical problem solving skills.

PSO4: To apply the entrepreneur skills gained in Botany for socio-economic development of the Country.

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MASTER OF SCIENCE - BOTANY
CHOICE BASED CREDIT SYSTEM (CBCS) & LEARNING OUTCOMES- BASED CURRICULUM FRAMEWORK (LOCF)

SYLLABUS&SCHEMEOF EXAMINATION
2025-2027 Batch,Semester I-II

SEM	Course Code	Title of the Course	CourseType	Instructionhours/week	Contact hours	Tutorialhours	Duration of Examination	Examination Marks			Credits
								CA	ESE	TOTAL	
I	MPL2401	Plant Diversity	CC	5	73	2	3	25	75	100	5
	MPL2402	Plant Anatomy, Embryology and Tissue Culture.	CC	5	73	2	3	25	75	100	5
	MPL2503	Applied Microbiology	CC	5	73	2	3	25	75	100	5
	MPL2304	Cell Biology and Genetics	CC	5	73	2	3	25	75	100	5
	MPL25P1	Practical- I	CC	3+3+2+2	150	-	4	25	75	100	5
I-III	17MONL1	Online Course	ACC	-	-	-	-	-	-	-	-
II	MPL2405	Plant Physiology and Biochemistry	CC	5	73	2	3	25	75	100	4
	MPL2406	Molecular Biology	CC	5	73	2	3	25	75	100	4
	MPL2507	Bioinformatics and Nanobiotechnology	CC	5	73	2	3	25	75	100	5
	MPL23CE	Genomics and Drug Discovery	CC	3	45	-	-	100	-	100	3
	MCP19A1	IDC -Clinical Microbiology and	GC	4	60	-	3	-	100	100	4
	MPL25P2	Practical II	CC	3+3+2	120	-	4	25	75	100	6
I-III	17MONL1	Online Course	ACC	-	-	-	-	-	-	-	-

CC – Core Courses GC – General Course ACC – Additional Credit Course CA – Continuous Assessment ESE - End Semester Examination

Assessment pattern for 2025- 26 Batch

Examination System

One test for continuous assessment will be conducted on pre-determined dates i.e., commencing on the 50th day from the date of reopening. The Model exam will be conducted after completing 85th working days. Marks for ESE and CA with reference to the maximum for the courses will be as follows

Continuous Internal Assessment Pattern

Theory

CIA Test	-	5	Conducted for 45 marks after 50 days
Model Exam	-	7	Conducted for 75 marks **after 85 days** (Q.P. Pattern (2,5,8) Each Unit 15 Marks)
Sem/Ass/Quiz	-	5	
Class Participation	-	5	
Attendance	-	3	
Total	-	**25 Marks**	

Practical

Lab Performance : 7 marks
Regularity : 5 marks
Model Exam : 10 marks
Attendance : 3 marks
Total : 25 Marks

ESE Practical Pattern

The End Semester Examination will be conducted for a maximum of 75 marks respectively with a maximum 15 marks for the record and other submissions, if any

Theory Papers

CA Pattern (First 3 Units)

Section A – 3 x 2 = 6
Section B – 3 x 5 = 15 (either or – same CLO Level)
Section C – 3 x 8 = 24 (either or – same CLO Level)
Total = 45

CA Question from each unit comprising of

One question with a weightage of 2 Marks : 2 x 3 = 6
One question with a weightage of 5 Marks(Internal Choice at the same CLO level): 5 x 3=15
One question with a weightage of 8 Marks (Internal Choice at the same CLO level): 8 x 3=24
Total : 45 Marks

ESE Question Paper Pattern: 5 units x 15 = 75 Marks

Section A – 5 x 2 = 10
Section B – 5 x 5 = 25 (either or – same CLO Level)
Section C – 5 x 8 = 40 (either or – same CLO Level)
Total = 75

Question from each unit comprising of

One question with a weightage of 2 Marks : 2 x 5=10
One question with a weightage of 5 Marks (Internal Choice at the same CLO level): 5 x 5=25
One question with a weightage of 8 Marks (Internal Choice at the same CLO level): 8 x 5=40

End semester examination:

Evaluation of the project : 25 Marks
Viva Voce : 50 Marks
Total : 75 Marks

IDC and Special Course:

Section A 5 questions (Internal choice) :25 marks
Section B 5 questions (Internal choice) :75 marks

Total :100 marks

Attendance

91-100%	3Marks
81-90%	2 Marks
75-80%	1 Mark

COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	CREDIT
MPL2401	Plant Diversity	Theory	73	2	--	5

Preamble

- To understand the diversity of plants and their distribution
- To study the evolution of plants.

Course Learning Outcomes

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

CLOs	CLO Statement	KnowledgeLeve
CLO1	Classification of different plant forms	K2, K3.K4, K5
CLO2	To understand in detail about Algae, Fungi, Bryophytes, Pteridophytes and Gymnosperms	K2, K3.K4, K5
CLO3	Understand the life pattern of plants	K2, K3.K4, K5
CLO4	Able to identify the plant diseases	K2, K3.K4, K5
CLO5	Distinguish different fossilized life forms with that of the present plants	K2, K3.K4, K5

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	S	S	S	S
CLO2	S	S	S	M	S
CLO3	M	S	M	S	M
CLO4	M	M	S	M	S
CLO5	S	S	M	S	S

S- Strong; M-Medium

Syllabus

Unit: I **Phycology** **15 hrs**

Classification of algae by Fritsch 1945. Structural organization, Reproduction and Phylogeny of Chlorophyceae, Xanthophyceae, Phaeophyceae, Rhodophyceae, Myxophyceae and Bacillariophyceae. Algae in Biotechnology- Industrial, Nutraceutical and bioactive/Pharmaceutical.

Unit: II Mycology and Plant pathology **14 hrs**

Classification of Fungi by Alexopoulos and Mims, (1979). Salient features, Reproduction and Life cycle of Myxomycetes, Oomycetes, Ascomycetes Basidiomycetes and Deuteromyctes. Application of fungi–Industry, Agriculture and Forestry. Classification of plant diseases based on symptoms. Host - pathogen interaction, Defense mechanism.

Unit: III Bryology **14hrs**

Classification - Reimers (1954). Structural organization of the gametophyte, sporophyte, methods of spore dispersal in Hepaticopsida, Anthocerotopsida and Bryopsida Bryophytes as pollution indicators.

Unit: IV Pteridology **14 hrs**

Classification - Sporne (1966). Comparative Morphology, Reproduction and Life cycle of Lycopsida, Sphenopsida, Pteropsida. Heterospory and seed habit.

Unit:V Gymnosperms **15 hrs**

Classification of Gymnosperms by Sporne (1965). General account of Coniferales, Taxales, Ginkgoales, Gnetales and Bennettitales including fossils –*Williamsonia, Heterangium, Lagenostoma, Pentoxylon*and*Cordaites.*

Text Books

S.No.	Author name	Title of the book	Publishers name	Year and Edition
1.	Charles Joseph Chamberlain.M,	Gymnosperm- Structure Evolution	CBS Publishers Shadara, Delhi	1986 I Edn.
2.	Singh, R.S	Introduction to principles of Plant pathology	Oxford & IB publishing co. pvt.ltd. New Delhi.	2005. IV Edn.
3.	Vashishta B.R and Sinha A.K	Algae	S. Chand & Company, New Delhi	2008 1Edn.
4.	Vashishta B.R and Sinha A.K	Fungi	S. Chand & Company, New Delhi	2010 1Edn.

Reference Books

S.No.	Author name	Title of the book	Publishers name	Year and Edition
1.	Alexopoulos, C.J and C.W. Mims	Introductory mycology	John Wiley & Sons. Newyork	1985 1Edn.
2.	Chapman V.J and Chapman P.J,	The algae	Mac Milan, Newyork	1973. II Edn.
3.	Chamberlain C.J,	Gymnosperms-Structure Evolution	CBS Publishers, Shahdara, New Delhi	1986 1Edn.
4.	Fritsch F.E.	The structure and reproduction of the algae. Vol I and II	Cambridge University Press, England.	1979
5.	Prempuri	Bryophytes - A Broad Prospective	Atma Ram & Sons, New Delhi	1985 II Edn.

Pedagogy

Lecture,Powerpointpresentation,Seminar,Assignment,Quiz,GroupDiscussion, VideoAnimation

Course Designers

Dr. M. Kanchana, Dr. R. Sumathi, Dr.H. Rehana Banu

COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	CREDIT
MPL2402	Plant Anatomy, Embryology and Tissue Culture	Theory	73	2	-	5

Preamble

Knowledge on Plant Anatomy
Predict anomalous growth in to normal plant anatomy
Compare dicot and monocot embryology
Knowledge on tissue culture

Course Learning Outcomes

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

CLOs	CLO Statement	Knowledge Level
CLO1	Illustrate the internal structure of plant tissue	K2, K3.K4, K5
CLO2	Interpret anomalous secondary growth in plants	K2, K3.K4, K5
CLO3	Critically analyze the embryological process in plants	K2, K3.K4, K5
CLO4	Appraise the knowledge of tissue culture	K2, K3.K4, K5
CLO5	Apply tissue culture techniques to conserve plants	K2, K3.K4, K5

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	S	S	M	S
CLO2	S	S	S	S	S
CLO3	S	M	M	S	M
CLO4	M	M	S	S	M
CLO5	M	M	S	S	M

S- Strong; M-Medium

Syllabus

Unit:I **15 hrs**

Introduction to meristems and its derivatives. Cytological characteristics and growth pattern of meristem. Epidermal tissue system – trichomes, glands, Stomata. Secretory tissues- nectaries and laticifers. Detailed structure of Vascular cambium, Secondary Xylem-Xylem rays, ray tracheids ,wood parenchyma, tyloses, sap and heart wood, false annual rings, ring porous and diffuse porous wood, Compression wood and Secondary phloem, Phylogenetic specialisation.

Unit: II **14 hrs**

Nodal anatomy., Periderm-Structure, morphology, Function and Lenticels, Anomalous secondary thickening in dicots- *Achyranthus, Aristolochia, Bignonia, Leptadaenia*, Mirabilis, Piper and arborescent monocots-*Dracaena*

Unit: III **15 hrs**

Microsporogenesis. Male gametophyte - structure, pollen wall morphogenesis and chemistry. Pollen-stigma interaction and incompatibility. megasporogenesis, Embryo sac structure and types - monosporic, biosporic and tetrasporic. Fertilization and its control, parthenocarpy endosperm - types and haustoria. Structure and development of dicot embryo – *Ceratocephalus falcatum,* monocot embryo – *Najas lacerata,* anomalous embryo development – *Triticum*. Polyembryony and its significance.

Unit:IV **14hrs**

Tissue and cell culture techniques: Types of media, preparation of Murashige and Skoog medium, macro and micro nutrients, Growth hormones. Explant culture: Selectionof explants, preparation of explants for inoculation. Callus production, micropropagation. Organ culture-meristem culture, anther and pollen culture and embryo culture. Cell culture techniques and its applications.

Unit: V **15 hrs**

Protoplast culture -somatic hybridisation, somatic embryogenesis and artificial seed production. Somaclonal variation and its applications. Cryopreservation techniques. Application of tissue culture in the field of Agriculture, forestry and horticulture.

Text Book

S.No.	Author name	Title of the book	Publishers	Year and Edition
1.	Maheswari.P	Introduction to the Embryology of Angiosperms	Tata McGraw Hill Publishing Co., NewDelhi	1991
2.	Pandey.B.P	Plant Anatomy	S.Chand and Compnay Ltd. New Delhi.	2001. 6thEdn
3.	Ramawat, K.G	Plant Biotechnology	S.Chand and Company Ltd. New Delhi	2004.

Reference Books

S.No.	Author name	Title of the book	Publishers	Year and Edition
1.	Katherine Esau	Plant anatomy of Seed Plants	Wiley Eastern Limited, New Delhi	1963. II Edn
2.	Reinert Bajaj	Applied and fundamental aspects of Plant cell, Tissue culture and Organ	Narosa publishers. New Delhi	1977

Pedagogy

Lecture,Powerpointpresentation,Seminar,Assignment,Quiz,GroupDiscussion, Video/ Animation

Course Designers

Dr.C.Krishnaveni Dr.M.Kamalam Dr.E.Uma

COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	CREDIT
MPL2503	Applied Microbiology	Theory	73	2	--	5

Preamble

- To understand the use of microbes at industrial level.
- Application of microbes for environmental aspects.

Course Learning Outcomes

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

CLOs	CLO Statement	Knowledge Level
CLO1	Identify the microbes and to preserve microbes	K2, K3.K4, K5
CLO2	Understand the fermentation technology and its application	K2, K3.K4, K5
CLO3	Know the application of microbial products at pharmaceutical level	K2, K3.K4, K5
CLO4	Use microbes for biofertilizers	K2, K3.K4, K5
CLO5	Apply microbes to clean the polluted environment	K2, K3.K4, K5

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	S	S	S	S
CLO2	S	S	S	M	S
CLO3	M	S	M	S	S
CLO4	S	M	S	S	M
CLO5	M	M	M	S	S

S- Strong; M-Medium

Syllabus

Unit I: Introduction to microbiology **15 hrs**

History and scope of Microbiology, Study of microbial structure - Light Microscopy, Electron Microscopy (SEM, TEM), Super-Resolution Microscopy (STED, PALM, STORM), Cryo-Electron Microscopy (Cryo-EM), NanoSIMS (Nanoscale Secondary Ion Mass Spectrometry), Fluorescence In-Situ Hybridization (FISH), Preservation of microbes: Lyophilization, Cryopreservation. Outline of microbial diversity – Archaea, Gram Bacteria (Non Proteobacteria and Proteobacteria) Gram positive bacteria (Low G+C gram positives, High G+C Gram positives).

Unit II : Industrial microbiology **14 hrs**

Upstream process –Fermentation, Media for industrial fermentation, principles of microbial growth and culture systems,solid substrate fermentation. Fermenters- Principle, Mode of operation, Types of fermenters – Conventional fermenter, Continuous stirred tank fermenter, Airlift fermenter, Packed bed fermenter and Photobioreactor, Smart fermenters. AI and Machine Learning in Bioprocess Optimization. Downstream process –Solid-liquid separation,

Release of intracellular products, Concentration, Purification and Formulation.

Unit III: Microbial products **15hrs**

Microbial products and its uses: Production, harvest, recovery, uses and mode of action of enzymes- lipase and amylase; Pharmaceutical products: Antibiotics- Streptomycin; Vitamins B2; Biofortification using engineered microbes.Ethanol production. Next-gen probiotics: Personalized strains based on human microbiome sequencing. Therapeutic proteins– Recombinant human insulin using E. coli and yeast. Mass culture and utilization of bacteria as SCP.

Unit IV: Agriculture microbiology **14 hrs**

Microbes as Bio-fertilizers. Nitrogenous Biofertilizers – Bacteria, Cyanobacteria, Phosphate solubilisers and mobilisers,Zinc solubilisers, PGPR, Effective microorganisms (EM), Bio-pesticides – Bacteria and Fungi, Nano-biofertilizers. Biofertilizers in Vertical Farming and Hydroponics. Quality control, shelf-life, and biosafety of microbial formulations.

Unit V: Environmental Microbiology **15hrs**

Pollution microbiology- Biodeterioration of Materials: paper, textiles, wood, paints and plastics. Bioremediation techniques using microbes - Oil Spills, Super Bugs, microbes in mining and ore- leaching, Microbial Enhanced Oil Recovery (MEOR). Biodegradation of xenobiotics- Breakdown of synthetic pollutants (e.g., pesticides, plastics, pharmaceuticals, dyes). Nanobioremediation. AI and Biosensors: Predicting bioremediation efficiency and real-time pollutant monitoring using microbe-based biosensors.

Text Books

S.No.	Author name	Title of the book	Publishers	Year and Edition
1.	Casida. L.E. JR	Industrial Microbiology	New age Intl (P) Limited, New York.	2006. I Edn.
2.	Prescott, Harley and Klein	Microbiology	McGraw Hill, Higher education, New York	2005. VI Edn.
3.	Stainer R.Y	General Microbiology	The Macmillan Press Ltd, Hong kong	1984. IV Edn.
4.	Sathyanarayana, U	Biotechnology	Books & Allied (P) Ltd, Kolkata	2012

Reference Books

S.No.	Author name	Title of the book	Publishers	Year and Edition
1.	Dubey, R.C	Text book of Biotechnology	S. Chand and Company Ltd, New delhi	1993. I Edn.
2.	Pelczer,JR	Microbiology	Mc Graw Hill company. New Delhi	1988. V Edn.
3.	Rita singh,	Industrial Biotechnology	Global vision publishing, New delhi	2004 I Edn.

Pedagogy

Lecture,Powerpointpresentation,Seminar,Assignment,Quiz,GroupDiscussion,Video/Animation

Course Designers

Dr. B.S. Chithra Devi

COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	CREDIT
MPL2304	Cell Biology and Genetics	Theory	73	2	-	5

Preamble

- To differentiate the structure and functions of both prokaryotic and eukaryotic cell organelles and cell membrane
- To distinguish the basic processes of cell signaling and signaling pathways
- To differentiate the Mendelian inheritance with non-Mendelian inheritance patterns.
- To detect the mutation types and causes, and identify the structural and numerical changes of chromosomes.
- To examine the different types of gene transfer mechanism and genome variation role in health and disease.

Course Learning Outcomes

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

CLOs	CLO Statement	Knowledge Level
CLO1	Differentiate Structure and functions of cell organelles and cell membrane	K2, K3.K4, K5
CLO2	Relate the cell signaling pathways and cell communication	K2, K3.K4, K5
CLO3	Compare and contrast the mendelian inheritance with non-Mendelian inheritance	K2, K3.K4, K5
CLO4	Classify the mutation types, structural and numerical alterations of chromosomal implication	K2, K3.K4, K5
CLO5	Compare the horizontal and vertical gene transfer mechanism and genetic disorders	K2, K3.K4, K5

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	S	M	S	M
CLO2	M	S	M	M	S
CLO3	S	S	S	M	S
CLO4	S	S	M	M	S
CLO5	M	S	S	S	M

S- Strong; M-Medium

Syllabus

Unit – I **15 hrs**

Structural organization and function of cell organelles - cell wall, nucleus, mitochondria, ER, golgibodies, chloroplast, lysosomes, exosomes, peroxisomes, vacuoles, structure and function of cytoskeleton and its role in motility. Membrane structure and function – lipid bilayer, ion channels, membrane pumps, intracellular transport, electrical properties of membrane. Cell division and cell cycle. Organization of genes and chromosomes – unique and repetitive DNA, interrupted genes, structure of chromatin and chromosomes, transposons.

Unit – II **14 hrs**

Cell signalling: Hormones and their receptors, cell surface receptor, signalling through G- protein coupled receptors, signal transduction pathways, second messengers,

regulation of signalling pathways, bacterial and plant two-component signalling systems.

Unit – III **14 hrs**

Cellular communication: general principles of cell communication, cell adhesion and roles of different adhesion molecules, gap junctions, extra cellular matrix, neurotransmission and its regulation.

Cancer: oncogenes, tumor suppressor genes, cancer and the cell cycle, virus induced cancer, metastasis.

Unit – IV **15 hrs**

Mendelian Genetics- Mendelian Principles and gene interaction; Multiple alleles – ABO blood group, MN blood group, Rh factor; sex limited and sex influenced characters; Linkage and crossing over, linkage maps. Inheritance of mitochondrial and chloroplast genes, maternal inheritance. Mutation – types, causes and detection, structural and numerical alterations of chromosomes and their genetic implications.

Unit – V **15 hrs**

Microbial genetics:Methods of genetic transfers – transformation, conjugation, transduction and sex-duction. Gene mapping,mapping genes by interrupted mating, fine structure analysis of genes. Recombination- homologous and nonhomologous recombination. Human genetic disorders. Population genetics – gene pool, gene frequency, Hardy -Weinberg equilibrium- factors affecting the equilibrium, genetic drift.

Text Books

S.No.	**Author name**	**Title of the book**	**Publishers**	**Year& Edition**
1.	Gupta, P.K	Cell and Molecular Biology	Rastogi publications, UP.	1988. 1 Edn
2.	Sambamurty.A.V.S.S	Genetics.	Narosa Publishers, New Delhi	1999 1 Edn
3.	Verma, P.S. and Agarwal V.K	Cell Biology, Genetics, Molecular Biology, Evolution and Ecology	S.Chand and Co. New Delhi	2004 1 Edn

Reference Books

S.No.	**Author name**	**Title of the book**	**Publishers**	**Year& Edition**
1.	De Robertis and De Robertis.	Cell and Molecular biology	Lippincott Williams and Wilkins. UK.	2005 I Edn.
2.	Gardener, E. J.	Principles of Genetics	John Wiley. New York	1975 V Edn.
3.	Gilmartin and Bowler	Molecular Plant Biology: A practical approach (Vol. I and II)	Oxford University press, UK	2002
4.	JosephK.John.	Biomembranes and Biosignalling.	Campus Books International, New Delhi	2006

Pedagogy

Lecture,Powerpointpresentation,Seminar,Assignment,Quiz,GroupDiscussion, Video/ Animation

Course designers

Dr. K.Gajalakshmi. Dr.K.S.Tamil Selvi, Dr.Subhashini

COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	CREDIT
MPL25P1	**Practical I (Plant Diversity, Plant Anatomy, Embryology and Tissue Culture, Applied Microbiology, Cell Biology and Genetics)**	**Practical**	**-**	**-**	**150**	**5**

Preamble

- To observe, characterize and identify the different forms of Algae, Fungi, Bryophytes, Pteridophytes and Gymnosperms.
- To identify the plants by their anatomical characters.
- To identify the embryological characters of the plants.
- To standardize the media for tissue culture.
- To isolate microorganisms from the various sources and to establish pure cultures.
- To gain knowledge about the fundamental processes of cell division
- To be skilled in solving problems in genetics

Course Learning Outcomes

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

CLOs	CLO Statement	Knowledge Level
CLO1	Learn and compare different life forms of the plants	**K2**
CLO2	Identify the anatomical characters	**K3**
CLO3	Identify the embryological characters	**K3**
CLO4	Examine the explants and callus culture	**K4**
CLO5	Isolation of microbes from various samples in different media	**K5**
CLO6	Assess the biological processes of cells and Calculate and categorize problems in genetics	**K6**

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	M	S	S	S
CLO2	S	S	M	S	S
CLO3	S	M	S	S	S
CLO4	M	S	S	S	M
CLO5	S	M	S	S	S

S- Strong; M-Medium

Syllabus

Plant Diversity - **45 hrs**

Algae - *Scenedesmus, Pithophora, Bulbochaete, Nitella, Diatoms- Cyclotella and Navicula, Padina, Batrochospermum, Gelidium, Scytonema, Gracilaria and Lyngbya*

Mycology -Isolation of coprophilous fungi. *Saprolegnia, Lycoperdon, Phyllochora,*

Cercospora

Plant pathology -Herbarium of Paddy Blast, Angular Leaf spot of Cotton and Cucumber Mosaic Virus.

Bryophytes - Vegetative and reproductive structures of *Reboulia, Lunularia, Anthoceros, Pogonatum* and *Sphagnum*

Pteridophytes - *Selaginella, Isoetes, Osmunda, Adiantum, Angiopteris, Pteris, Azolla*

Gymnosperms - *Cycas, Pinus, Araucaria, Cupressus*

Plant Anatomy, Embryology and Tissue Culture. 45 hrs

Plant Anatomy - Anomalous secondary thickening - *Aristolochia, Bignonia, Piper, Leptadaenia, Mirabilis, Achyranthes, Dracaena*.

Nodal anatomy – unilacunar, trilacunar and multilacunar nodes.

Submission of 5 permanent slides of Stem/ root/ leaf / petiole (**only hand sections**)

Embryology - T. S. of anther - archesporial, pollen mother cell stage and mature anther. Pollen germination. Embryo sac – 4 nucleate and 8-nucleate. Endosperm haustoria, dicot and monocot embryo. Embryo dissection-*Tridax*

Tissue culture - Preparation of MS medium, Inoculation of Explants Callus culture and Micropropagation

Applied Microbiology 30 hrs

1. Demo/Virtual Lab: SEM/TEM/Fluorescence image analysis.
2. Lyophilization (demo)
3. Cryopreservation using glycerol stocks.
4. Isolation of Archaea and Extremophiles (demo/sample analysis).
5. Microbial identification using NCBI BLAST, 16S rRNA sequence analysis.
6. Amylase/Lipase production and activity assay from microbes.
7. Antibiotic Sensitivity Test: Kirby-Bauer method using *Streptomycin*.
8. Ethanol Estimation: Fermentation and alcohol content determination using potassium dichromate method or gas chromatography (demo).
9. Probiotic Viability Assay – Plate counting of commercial probiotic samples.
10. SCP Production: Cultivation of *Spirulina* or yeast as single-cell protein source.
11. Isolation of Nitrogen-Fixing Bacteria: Azotobacter, Rhizobium from soil/roots.
12. Phosphate Solubilization Assay: Plate method using Pikovskaya's agar.
13. Biodegradation Assay: Assessment of plastic degradation or oil degradation by microbial consortia.
14. Biosensor-based Detection (Demo/Project): Simulated study of microbe-based biosensors for heavy metals/pesticides.

AI Tools in Bioremediation (Virtual Activity): Predictive modeling for microbial pollutant degradation using open-source tools.

Cell Biology and Genetics 30 hrs

Mitosis and Meiosis**.**

Spotters – plasma membrane, cell organelles, chromosomes, lamp brush chromosomes.

Simple problems in genetics – Monohybrid cross, dihybrid cross and factor interaction.

Linkage maps, Population genetics.

Course designers

Dr. M. Kamalam, Dr. K.S.Tamil Selvi Dr. R. Sumathi, Dr. E. Uma

COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	CREDIT
MPL2405	Plant Physiology and Biochemistry	Theory	73	2	-	4

Preamble

To understand the fundamental concepts of plant physiology
To analyse the dynamic interactions between structure and functions in plants
To develop analytical skills to interpret biochemical reactions,molecular mechanisms and cellular functions.

Course Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	Understand the plant physiological processes	K2
CLO2	Apply the dynamic interactions in plants	K3
CLO3	Categorize the structural organization of proteins and carbohydrates	K4
CLO4	Analyze the basic principles of lipids and secondary metabolites	K4
CLO5	Evaluate the enzyme kinetics and its regulatory process.	K5

Mapping with Programme Learning Outcomes

S-Strong; M-Medium; L-Low

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	S	S	S	S
CLO2	S	S	S	M	S
CLO3	M	S	M	S	S
CLO4	S	M	S	M	S
CLO5	S	M	M	S	S

Unit-I- Plant physiology **(15 Hours)**

Photosynthetic apparatus, Photosynthetic pigments and absorption of light energy, Fluorescence and Phosphorescence, Quantum requirement and Quantum yield. Red drop and Emerson's enhancement effects. Two pigment system, Action spectrum, Light and dark reactions, Hatch slack pathway. Differences between C3 and C4 plants. Photorespiration and Glycolate metabolism (C2- cycle), Chemosynthesis. Biochemistry and Molecular Biology of RUBISCO

Unit-II **(15 Hours)**

An overview of plant respiration – Glycolysis – TCA cycle– Electron Transport – oxidative phosphorylation and ATP synthesis – Chemiosmotic Theory - Pentose Phosphate Pathway– Nitrogen in plants, Sources of nitrogen to plants. Conversion of nitrate into Ammonia, biological Nitrogen fixation, Mechanism of Biological Nitrogen fixation, Biosynthesis of Amino acids. Synthesis of Proteins in plants

Unit-III - Biochemistry **(15 Hours)**

Classification of carbohydrates; Structure and properties of monosaccharides, Oligosaccharides, Polysaccharides – Glycoproteins. Protein and Amino acids: Structure, Classification and properties; Peptides - Structure: Primary, secondary, Ramachandran plot,

tertiary and quaternary structures.

Unit-IV **(14 Hours)**

Classification of Lipids: Structure and properties of fatty acids, phospholipids, glycolipids, lipoproteins, cholesterol - structure and functions. Secondary Metabolites: Structure, classification and properties of alkaloids, terpenoids, flavonoids. Glycosides - their chemical nature and role.

Unit-V **(14 Hours)**

Enzymes- Classification and nomenclature chemical nature of enzymes – factors affecting enzyme action – Michaelis – Menton constant, Line weaver Burk plot, Enzyme inhibition, co enzymes- mechanism of enzyme action, isoenzymes. Bioenergetics- Concept of energy, Thermodynamic principles in biology, Concepts of entropy, enthalpy, free energy and standard free energy, ATP as energy currency of the cell.

Text Book

S. No	Authors	Title	Publishers	Year and Edition
1.	William, G.H., & Norman, P.A	Introduction to Plant Physiology	John Wiley & Sons	2009 and 4th edn.
2.	Taiz, L., Zeiger, E., Moller, I. M., & Murphy, A	Plant Physiology	Sinauer Associates	2015 and 6th edn.
3.	Lubert, S	Biochemistry	W. H. Freeman and Company	2005 and 1st edn..
4.	Nelson, D. L., Lehninger, A. L. & Cox, M. M.	Lehninger, Principles of Biochemistry,	W. H. Freeman and Company	2008 and 5th edn.
5.	Voet, D., & Voet, J.G	Biochemistry	John Wiley & Sons.	2011 and 14th edn.

Reference Book

S. No	Authors	Title	Publishers	Year and Edition
1.	Noggle, G.R., & Fritz, G.J.	Introductory Plant Physiology	Prentice-Hall	2001 and 1st edn.
2.	Devlin, R. M.	Plant Physiology.	East West Press Pvt. Ltd	2000 and 1st edn.
3.	Salisbury, F. B., & Ross, C. W.	Plant Physiology	Wadsworth Publishing Co.	1992 and 4th edn.
4.	Caret. et al.	Inorganic, Organic and Biological Chemistry	WMC Brown	1993 and 1st edn.
5.	Jeremy, M. B., John, L. T., & Lubert, S.	Biochemistry,	W. H. Freeman	2010 and 17th edn.

Pedagogy

PowerPoint Presentations, Group Discussion, Seminar, Quiz, Assignment, Discussion

Websites and eLearning Sources

1. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5593313/

2. .https://www.nobelprize.org/prizes/chemistry/1997/boyer/25946-the-binding-change-mechanism/
3. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3645666/
4. https://www.frontiersin.org/articles/10.3389/fpls.2018.01771
5. https://www.medicalnewstoday.com/articles/161547#chemistry
6. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2642958/
7. 3.https://bio.libretexts.org/Bookshelves/Biochemistry/Fundamentals_of_Biochemistry_(Jakubowski_and_Flatt)
8. https://infinitabiotech.com/blog/principles-of-enzyme-catalysis/

Course Designers

1. **Dr.C.Krishnaveni**
2. **Dr.R.Sumathi**

COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	CREDIT
MPL2406	Molecular Biology	Theory	73	2	--	4

Preamble

To develop a detailed understanding of the organization of genetic material in prokaryotic and eukaryotic cells.
To acquire a thorough knowledge of DNA replication, repair and recombination
To comprehend the importance of RNA synthesis and processing
To explore the mechanisms of protein synthesis and processing
To understand the various mechanisms of gene regulation.

Course Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	Gain insight into the structure and properties of nucleic acids and genome organization.	K3
CLO2	Comprehend the processes of DNA replication, repair, and recombination.	K3
CLO3	Acquire knowledge of transcription processes	K4
CLO4	Explore and critically analyze how genetic information is translated into proteins.	K4
CLO5	Understanding of the various mechanisms of gene regulation.	K5

Mapping with Programme learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	S	M	M	S
CLO2	S	S	M	M	S
CLO3	S	S	M	S	S
CLO4	S	S	M	M	S
CLO5	S	S	M	M	S

S- Strong; M-Medium

Syllabus

Unit-I **(15 hours)**

Nucleic acid: Nucleic acid as the genetic material (Griffith's experiment, Avery, MacLeod and McCarty's experiment, Hershey-Chase experiment), Nucleic acids types (A, B and Z forms) – Chemistry and structural organization – supercoiling – triple helix of DNA. Denaturation and renaturation of DNA – hyper and hypochromicity – Tm. Structure and functions of t-RNA – hnRNA – and non-coding regulatory RNAs (siRNA– miRNA, etc.). The genomes of bacteria, plasmids, mitochondria, and chloroplasts.

Unit-II **(15 hours)**

DNA replication, repair and recombination: Prokaryotic and eukaryotic DNA replication: Unit of replication, enzymes involved, replication origin and replication fork, fidelity of replication, extrachromosomal replicons, DNA damage and repair mechanisms. **RNA synthesis and processing:** Transcription in prokaryotes & eukaryotes - factors and machinery, formation of initiation complex,

transcription activator and repressor, RNA polymerases, capping, elongation, and termination, RNA processing, RNA editing, splicing and polyadenylation, RNA transport. Inhibitors of transcription

Unit-III **(15 hours)**

Protein synthesis and processing: Ribosome, formation of initiation complex, initiation factors and their regulation, elongation and elongation factors, termination, genetic code, aminoacylation of tRNA, tRNA-identity, aminoacyl tRNA synthetase, translational proof-reading, translational inhibitors, post- translational modification of proteins. Protein targeting (chloroplast, mitochondria and nucleus) and protein degradation.

Unit-IV **(14 hours)**

Transcriptional regulatory mechanism in Prokaryotes: Gene amplification – Regulation of transcription – Post transcriptional regulation – translational regulation – post-translational regulation – Types of regulation of the gene- types of operons – Negative inducible operon (lac operon) – Negative repressible operon (trp operon) – Positive inducible operon (Arabinose operon). Attenuation – mechanism of attenuation – Anti-termination mechanism

Unit-V **(14 hours)**

Transcriptional regulatory mechanism in Eukaryotes: Cis acting regulatory sequences : Promoters – Basal transcription and activated transcription. Silencers - Transcriptionally silent chromatin, mediated by Rap1 and SIR proteins. Enhancers - Heterochromatin and Euchromatin. Transcriptional regulatory proteins – structure and function of transcriptional activators. Gene regulations at DNA level Acetylation/Deacetylation of DNA-DNA methylation. Epigenic inheritance – History, Mechanisms: DNA methylation, Histone modification and non-coding RNA associated genes.

Text Book

S.No.	Author Name	Title	Publishers	Year and Edition
1	Gupta, P.K.	Molecular Biology and Genetic Engineering	Rastogi Publications, Meerut	2004, 1st edn.
2	Veer Bala Rastogi	Fundamentals of Molecular Biology	Ane Books Pvt Ltd.	2010 and1stedn.
3	Satyanarayana, U.	Biotechnology	Books And Allied (P) Limited	2005 and 2nd edn.
4	James D. Watson	Molecular Biology of the Gene	Pearson Publications	2014 , 1st edn.
5	Gerald Karp	Cell and Molecular Biology-Concepts and Experiments	Wiley Publishers	2002 , 1st edn.

Reference Book

S.No.	Author Name	Title	Publishers	Year and Edition
1	De Robertis E.D.P. and De Robertis, Jr. E.M.F.	Cell and Molecular Biology	Lippincott Williams &Wilkins	2001 , 2nd edn.
2	Verma, P.S. and	Molecular Biology	S. Chand Limited	2009, 1st

	Agarwal, V.K.			edn..
3	Dubey, R.C.	A Textbook of Biotechnology	S. Chand Limited	1993, 1st edn.
4	Ramawat K.G. and Shaily Goyal	Molecular Biology and Biotechnology	S Chand Publishing	2010, 1st edn.
5	Burton E. Tropp	Molecular Biology	Jones And Bartlett Publishers	2007 , 1st edn..

Pedagogy

PowerPoint Presentations, Group Discussion, Seminar, Quiz, Assignment, Discussion

Course Designers:

1. Dr. M. Kanchana
2. Dr. K. Sunitha kumari

COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	CREDIT
MPL2507	Bioinformatics and Nanobiotechnology	Theory	73	2	--	5

Preamble

To provide an overview of bioinformatics concepts, databases, and applications in biological sciences.

To train students in sequence analysis, homology searches, and phylogenetic tree construction using computational tools.

To impart knowledge on genomics, gene prediction, genome annotation, and functional analysis.

To develop skills in proteomics, protein structure prediction, and protein–protein interaction studies.

To introduce nanobiotechnology, nanomaterials, and nanoinformatics with applications in medicine, industry, and research.

Course Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	Analyze the scope, need, and applications of bioinformatics, including biological databases	K3
CLO2	Evaluate sequence alignment methods and perform phylogenetic analysis using DNA and protein sequences.	K4
CLO3	Explain genome annotation, gene prediction methods and functional annotation of genes.	K4
CLO4	Evaluate proteomic tools, protein–protein interaction databases , and modeling approaches.	K5
CLO5	Create models of nanomaterials, apply characterization techniques, and assess applications in medicine, biotechnology, and environmental impact.	K5

Mapping with Programme learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	M	S	M	S
CLO2	M	S	S	M	S
CLO3	S	S	M	S	M
CLO4	S	M	S	S	M
CLO5	M	M	M	S	M

S-Strong; M-Medium

Syllabus

Unit-I **14 Hours**

Overview of Bioinformatics, Need for Bioinformatics technology, Data format and processing, secondary resources and applications. Role of structural bioinformatics, Biological data integration system. Bioinformatics and its applications. Biological Database - NCBI, PUBMED, EBI, EMBL, DDBJ and Gen- Bank. Biological Retrieval System- *Entrez* and SRS.

Unit-II **15 Hours**

Database searches for homology using BLAST and FASTA. Proteomic data bases - Swiss-Prot, Uni-Prot and PDB. RNA data bases-Rfam and GtRNA. RNAcentral. Chemical database - PubChem, Chemspider. Phylogenetic analysis- Definition, Method of construction of Phylogenetic trees [distance based method (UPGMA), Maximum Parsimony.

Unit-III **14 Hours**

Genomics– Functional genomics- Introduction of transcriptomics, proteomics, metabolomics. **Comparitive genomics**- Bacterial, Yeast, *Arabidopsis thaliana*. Gene identification and prediction: Basis of gene prediction, codon bias; pattern identification **Annotation of Genome:** structural annotation – gene prediction approaches – Open Reading Frame (ORF) prediction – Hidden Markov Model – Pattern identification – Prediction of promoter sequences. Functional annotation – prediction of gene function.

Unit-IV **15 Hours**

Introduction to Proteomics - Protein arrays: basic principles. Computational methods for identification of polypeptides from mass spectrometry. Tools for analysis of proteomics data at ExPASy Proteomics server and InterPro databases. Protein-protein interactions: DIP and PPI server databases, STRING Databases. Homology modeling and Ab Initio modeling.

Unit-V Nanobiotechnology **15 Hours**

Nanotechnology – definition, origin, scope and importance. Principles: quantization effects - inverse relationship between size and reactive surface area. Properties: surface effects, the effects of size, shape and surface area. Types of nanomaterials: Nanoclusters, thin films, nanocomposites, cores hell nanostructure, nanotubes, liposomes and dendrimers. Essentials of nanostructure generation: top-down vs. bottom-up. Characterization of nanomaterials. Application: medicine, manufacturing & materials, delivery vehicles, cancer therapy, tissue engineering, fluorescent biological labels, biological assays, imaging agents, biosensors, manipulation of cells and biomolecules. Nanoinformatics - NanoHub, Ontologies for nanomaterials (NanoParticle Ontology), Nanomaterial Registry, NBI Knowledge Base

Text Book

S.No.	Authors	Title	Publishers	Year and Edition
1	Alam Khan, I.	Elementary Bioinformatics	Pharma Book Syndicate, Adithya Art Printers, Hyderabad	2005 and 1st edn.
2	Arthur M. and Lesk	Introduction to Bioinformatics	Oxford University Press, UK	2002 and 1st edn.
3	Attwood, T.K. and Parry-Smith, D.J.	Introduction to Bioinformatics	Pearson Education, New Delhi	2002 and 3rd edn.
4	Chowdhary, K.R. and Bansal, V.S.	Bioinformatics and Computational Technologies	Scientific Publishers, New Delhi	2011and 1st edn.

5	Mani, K. and Vijayaraj, N.	Bioinformatics A Practical Approach	Aparnaa Publication, Coimbatore	2004 and 1st edn.
6	Ranga, M.M.	Bioinformatics	Agrobios, Jodhpur	2009 and 2nd dn.
7	Westhead, D.R., Parish, J.H., and Twyman, R.M.	Bioinformatics	Viva Books Private Limited, New Delhi	2003and1st edn.
8	Sharon, M. & Sharon, M.	Bio-Nanotechnology-Concepts and Applications	CRC Press	2012 and1stedn.
9	Atkinson WI	Nanotechnology	Jaico Book House, New Delhi	2011and 1st edn.
10	Imtiaz Alam Khan	Elementary Bioinformatics	Pharma Book Syndicate, Hyderabad	2005 and 1st edn.
11	Rastogi, S.C., Mediratta, N., and Rastogi, P.	Bioinformatics, Methods and Applications	Prentice Hall of India, Pvt. Ltd., New Delhi	2004 and 1stedn.
12	Nalwa H.S.	Handbook of Nanostructured Biomaterials and Their Applications in Nanobiotechnology	American Scientific Publ.	2005 and 1stedn.
13	Niemeyer C.M. & Mirkin C.A.	Nanobiotechnology	Wiley Interscience	2005 and 1stedn.
14	S.M. Lindsay	Introduction to Nanoscience	Oxford Universal Press	2010 and 1st edn.
15	Ben Rogers, Sumita Pennathur, and Jesse Adams	Nanotechnology: Understanding Small Systems	CRC Press	2011and 2nd edn.

Reference Book

S.No.	Authors	Title	Publishers	Year and Edition
1	Dunn, S.R., M.J., and Pennington	Proteomics: From Protein Sequence to Function	Viva Books Pvt. Ltd., New Delhi	2002 and 3rd edn.
2	Liebler, C.D.	Introduction to Proteomics: Tools for the New Biology	Humana Press Inc., New Jersey	2002 and 1st edn.
3	Mehrotra, P., Kumund Sarin, Swapna, and Srivastava	The New Handbook of Bioinformatics	Vikas Publishing House Pvt. Ltd., Noida, Uttar Pradesh	2005 and 1st edn.
4	Barbara Panessa-Warren	Understanding Cell-Nanoparticle Interactions Making Nanoparticles More Biocompatible	Brookhaven National Laboratory	2006 and 1st edn.

5	European Commission, SCENIHR	Potential Risks Associated with Engineered and Adventitious Products of Nanotechnologies	European Union	2006 and 1st edn.
6	Gysell Mortimer	The Interaction of Synthetic Nanoparticles with Biological Systems	School of Biomedical Sciences, Univ. of Queensland	2011 and PhD Thesis
7	Jain, K.K.	Nanobiotechnology Molecular Diagnostics: Current Techniques and Application	Taylor & Francis	2006 and 1st edn.

Pedagogy

PowerPoint Presentations, Group Discussion, Seminar, Quiz Assignment, Experience Discussion

Web Resources

1. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC419715/
2. https://phys.org/news/2014-10-endless-possibilities-bio-nanotechnology.html
3. http://www.particle-works.com/applications/controlled-drug-release/Applications

Course Designers

1. Dr. K.S. Tamil Selvi
2. Dr. K. Gajalakshmi
3. Dr. B.S. Chithra Devi
4. Dr. E. Uma

COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	CREDIT
MPL23CE	**Genomics and Drug Discovery**	**Theory**	**45**	**-**	**-**	**3**

S.No.	Topic of the Course	Link of the Course	Duration in hrs
1.	Drug Discovery	https://www.coursera.org/learn/drug-discovery	**9**
2.	Genomics: Decoding the Universal Language of Life	https://www.coursera.org/learn/genomics-research	**36**

1. Drug Discovery

Week 1 - Pharmaceutical & Biotechnology Industry Landscape **3 hours**
Week 2 - Drug Discovery: Proteomics, Genomics **3 hours**
Week 3 - Challenges in Fragment Based Drug Discovery for Protein Kinases **3 hours**

2. Genomics: Decoding the Universal Language of Life

Week 1 - What Is a Genome and Why Do We Care? **6 hours**
Week 2 - What Were the First Genomes Like and How Do They Work Now? **4 hours**
Week 3 - How Can We Use Genomes to Understand the Healthy Body and Fight Diseases? **5 hours**
Week 4 - What Can Genomes Tell Us About How to Grow New Organs or New Crops?

7hours
Week 5 - How Might Genomes Allow Us to Predict Health Problems Before They Occur? **7 hours**
Week 6 - How Do the Genomes of Ecosystem Members Cooperate or Conflict? **7 hours**

COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	CREDIT
MCP19A1	Clinical Microbiology and Biochemistry	Theory	60	-	-	4

Preamble

To enable the students to understand the principles of clinical chemistry
To gain the importance of hypertension and hypotension
To enable the students to understand the principles and the concepts underlying clinical laboratory tests in clinical chemistry
To differentiate the blotting technique and vaccination types
To acquire knowledge on basic mechanisms involved in the causation and treatment of common disease and their influence on clinical presentation and therapy

Course learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	Differentiate the clinical specimens	K_3
CLO2	Classify the composition of blood, Perform analysis of chemical analytes in blood and other body fluids	K_2 ,K_3
CLO3	Calculate the test results and convert them to form meaningful in patient assessment	K_3
CLO4	Compare and contrast the different types of blotting techniques and vaccination.	K_6
CLO5	Correlate laboratory results with infectious diseases processes	K_4

Mapping with Programme learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6
CLO1	S	M	S	M	S	S
CLO2	S	S	S	S	L	L
CLO3	S	S	M	S	M	M
CLO4	S	M	M	M	S	S
CLO5	S	M	M	S	S	S

S- Strong; M-Medium

Syllabus

Unit I **12 Hrs**

Clinical microbiology: Clinical specimens –Collection- needle aspiration, Incubation, Catheter; handling, transport. Isolation of microbes from specimens-selective media, differential media, enrichment media, characteristic media. Identification of microbes (virus, bacteria, fungi and parasites) through morphological and biochemical characteristics.

Unit II **12 Hrs**

Principles of clinical biochemical analysis: Basis of analysis of body fluids for diagnostic prognostic and monitoring purposes.

Blood Analysis: Composition of blood, blood grouping & matching, physiological function of Plasma protein, role of blood as oxygen carrier, blood pressure - Hypertension & hypotension,

coagulation of blood, Anaemia – causes & control .Urea determination- the urease method, estimation of bile pigment in serum, estimation of total protein in serum, estimation of total proteins and albumin based on biuret method and BCG method.

Unit III **12Hrs**

Clinical Chemistry: Determination of Glucose in Serum by Folin& Wu's method, Determination of Serum Cholesterol - Sackett's method for total cholesterol. Diagnostic test for Sugar in Urine. Test for salt in Serum, Test for Chlorides. Detection of Cholesterol in Urine, Detection of Diabetes . Typical reference ranges for biochemical analyst Viz, sodium, potassium, urea, creatinum, AST, ALT, AP and cholesterol and their significance.Biological role of sodium, potassium, calcium, iodine, copper and zinc.

Unit IV **12Hrs**

Electrophoresis, Blotting and Vaccination : Principles, Techniques: southern, western and northern blotting. Vaccines and immunizations: Active immunization,passive immunization, Type of vaccines-whole organism vaccines, purified macromolecules as vaccines, Recombinant –vector vaccines, DNA vaccines.

Unit V **12 Hrs**

Common Diseases & their treatments: Insect borne diseases: Malaria, Filarisis& Plague. Air Borne diseases: Diphtheria, Whooping cough, Influenza, Measles mumps, Tuberculosis, Water borne diseases: Cholera, Typhoid, &Dysentry. Common disease of the digestive system- jaundice, respiratory system- asthma, nervous system- epilepsy. Some other common diseases-piles, leprosy. First aid for accidents. Common poisons & their antidotes - acid poisoning, alkali poisoning, Poisoning by disinfectants, hallucinogens. Toxic effects of metals: Toxicity of Iron , Copper , Arsenic , Mercury, Lead, Cadmium, Aluminium& Radionuclide & Wilson's disease.

Text Book

S.No.	Authors	Title	Publishers	Year and Edition
1	Ambika Shanmugam	Fundamentals of Biochemistry for Medical Students	Nagaraj and Company Private Limited	2016 and 8th edn.
2	Asim. K. Das	Bioinorganic Chemistry	Books & Allied Pvt Ltd.	2007 and 1st edn.
3	Jayashree Ghosh	Textbook of Pharmaceutical Chemistry	S. Chand & Co.	2003 and 3rd edn.
4	Jayashree Ghosh	Fundamental Concepts of Applied Chemistry	S. Chand & Co.	2006 and 1st edn.
5	Mallikarjuna Rao, N.	Medical Biochemistry	New Age International (P) Limited, Publishers	2006 and 6th edn.
6	Rana, S.V.S.	Bio Techniques: Theory and Practice	Rastogi Publications, Meerut	Reprint 2018 3rd edn.

Reference Book

S.No.	Authors	Title	Publishers	Year and Edition
1	Lensing, M., Prescott,	Microbiology	Tata McGraw	2005 and

	John P., Harley, Donald A. Klein		Hill, New Delhi	6th edn.
2	Keith Wilson, John Walker	Principles and Techniques of Biochemistry and Molecular Biology	Cambridge University Press	2008 and 6th edn.,

Pedagogy

power point presentation, e-content, simulation, numerical exercises, group discussion, assignment, quiz, seminar.

Course Designers:

1. Dr. K. Gajalakshmi, Dr. K. S. Tamilselvi - Department of Botany
2. Dr. N. ShyamalaDevi, Dr. N. Aruna Devi - Department of Chemistry

COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	CREDIT
MPL25P2	PRACTICAL - II	Practical	-	-	120	6

Preamble

To discern and appreciate the physiological and biochemical process in plants
To acquire the capability of identifying and quantifying prokaryotic and eukaryotic genome.
To refine the skills in nano-particle identification
To know the importance of Bioinformatics in Biology

Course learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	Understand and perform key physiological experiments	K3
CLO2	Demonstrate proficiency in biochemical techniques, including the estimation of carbohydrates, proteins, lipids, phenolics, and tannins.	K4
CLO3	Apply molecular biology skills to isolate, purify, and analyze DNA, RNA, and proteins from bacterial and plant sources, techniques such as gel electrophoresis and spectrophotometry.	K5
CLO4	Utilize bioinformatics tools and databases to analyze biological data, including sequence alignment, gene finding, phylogenetic analysis, tools such as JMOL.	K5
CLO5	Develop competence in good laboratory practices, including the preparation of reagents and buffers, adherence to safety protocols	K5

Mapping with Programme learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	S	M	S	S
CLO2	S	S	S	S	S
CLO3	S	S	M	S	S
CLO4	S	S	M	S	S

S- Strong; M-Medium

Syllabus

Physiology and Biochemistry **45 hrs**

Physiology Experiments

1. Separation of leaf pigments (Paper chromatography)
2. Separation of flower pigments (Thin Layer Chromatography)
3. Effects of CO 2 Concentration and light intensity on photosynthesis- Wilmot's bubbler
4. Absorption spectrum of chlorophyll a and b
5. Test for Fat/oils.
6. Test for proteins.
7. Hill's reaction by isolated chloroplast.
8. Column chromatography - leaf pigment separation

Biochemistry Experiments

1. Estimation of total carbohydrates
2. Determination of total proteins
3. Effect of temperature on membrane permeability - beetroot discs.
4. Estimation of total lipids.
5. Thin Layer Chromatography of Sugars
6. Thin Layer Chromatography of amino acids
7. Separation of compounds by High-performance liquid chromatography (HPLC)
8. Analysing particles in liquid by Nanoparticle Tracking Analyser (NTA)

Molecular Biology **45 hrs**

1. Good lab practices: Preparation of buffers and reagents.
2. Growth of bacterial culture and preparation of growth curve
1. Isolation and purification of plasmid DNA from bacteria
2. Isolation and purification of bacterial genomic DNA
3. Isolation and purification of plant DNA (Onion and Cauliflower)
4. Isolation and purification of proteins from plant sources.
5. Analysis of DNA by gel electrophoresis and Nanodrop Spectrophotometer.
6. Isolation and purification of RNA (Demonstration).

Spotters: Structure of Plasmid DNA,
Bacterial genomic DNA and Plant genomic DNA,
Structure of RNA (t-RNA and r-RNA),
Agarose Gel Electrophoresis,
Gel documentation,
Nanodrop Spectrophotometer

Bioinformatics **30 hrs**

1. Familiarizing with biological data bases-nucleic acid databases- NCBI, EMBL and GenBank. Protein databases - SWISS-PROT and PDB. RNA data bases-Rfam, GtRNA, RNAcentral. Chemical database - PubChem, Chemspider.
2. Sequence similarity search using BLAST, MPI Bioinformatics Toolkit
3. Multiple Sequence Alignment- Clustal W, MUSCLE (MUltiple Sequence Comparison
by Log-Expectation), T-Coffee
4. Gene finding tools - Genmark
5. Phylogenetic Analysis of protein and nucleic acids –MEGA (Molecular Evolutionary Genetics Analysis), PhyML, iToL.
6. Prediction of secondary structure of proteins- Jpred4, PSSPred
7. Prediction of tertiary structure of proteins using AlphaFold, SWISS-MODEL.
8. 3-D Molecular visualization using PyMOL, ChimeraX, BIOVIA Discovery Studio Visualizer.
9. Nanoinformatics - NanoHub, Ontologies for nanomaterials (NanoParticle Ontology), Nanomaterial Registry, NBI Knowledge Base

Course designers

1. Dr.C. Krishnaveni,
2. Dr. B. S. Chithra Devi,
3. Dr. R. Sumathi,
4. Dr. M. Kanchana,
5. Dr.H. Rehana banu
6. Dr.E. Uma