PSGR
Krishnammal College for Women

DEPARTMENT OF BOTANY

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

(Semester– I)

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

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.

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

SYLLABUS&SCHEMEOF EXAMINATION
2025-2027 Batch,Semester I

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	-	-	-	-	-	-	-	-

CC – Core CoursesACC – 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

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