B.Sc. Botany

Programme Code : UBO

Programme outcome-PO (Aligned with Graduate Attributes)

Bachelor of Science(B.Sc.,)

Scientific Knowledge and Critical Thinking

Apply the knowledge of Life Science, Physical and Chemical Science, Mathematics, statistics, Computer science and humanities for the attainment of solutions to the problems that come across in our day-to-day life / activities.

Problem Solving

Identify and analyze the problem and formulate solutions for problems using the principles of mathematics, natural sciences with appropriate consideration for the public health, safety and environmental considerations.,

Communication and Computer Literacy

Communicate the fundamental and advanced concepts of their discipline in written and oral form. Able to make appropriate and effective use of information and information technology relevant to their discipline

Life-Long Learning

Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Ethical, Social and Professional Understanding

Commitment to principles, codes of conduct and social responsibility in order to behave consistently with personal respect. Acquire the responsibility to contribute for the personal development and for the development of the community. Respect the ethical values, social responsibilities and diversity.

Innovative, Leadership and Entrepreneur Skill Development

Function as an individual, and as a member or leader in diverse teams and inmultidisciplinary settings. Become an entrepreneur by acquiring technical, communicative, problem solving, and intellectual skills.

B.Sc., Botany

Vision

Provision of knowledge to contribute towards the sustainable utilization of Plant Biosphere

Mission

- To foster an environment of excellence by providing a comprehensive set of courses inplant sciences that enhances the understanding, depth of knowledge and technical competency of the students.
- To provide the students competence for entry-level research and teaching positions in biological sciences.
- To inculcate the students with an environment that fosters the development of appropriate scientific vocabulary, reasoning skills, and effective oral and written communication abilities for students.
- To create a holistic understanding of the allied subjects through interdisciplinary learning.

Programme Educational Objectives (PEO)

The objectives of B.Sc., Programme is to prepare and further to equip the Graduates of Botany

PEO1	To develop a strong and competent knowledge in basic Plant Sciences, required for critical learning and to create attitude on research.
PEO2	To develop diversified basic professional skills through various laboratory technical training, communication and presentation skills
PEO3	To make them to possess an ability to identify, formulate, and solve problems, relatedto the subject of Botany and to facilitate them towards community service, by utilizing the professional and private realm
PEO4	To integrate related topics from the course components such as Plant Organization, Techniques related to Taxonomy, Ecology, Anatomy, Cell Biology, Biochemistry, Physiology, Genetics, Embryology, Evolution, Basic Biotechnology and Molecular Biology for their successful career.
PEO5	To create them to be proficient in applying their knowledge to analyze the scope of plant science and address scientifically controversial issues in a rational way

Mapping PEOs against POs

PEO/PO	PO1	PO2	PO3	PO4	PO5	PO6
PEO1	S					
PEO2	S	S	S	S	S	S
PEO3	S	S		S		
PEO4	S	S	S	S		S
PEO5	S			S	S	S

Programme specific outcomes- B.Sc.,Botany

upon successful completion of B.Sc. Botany Programme, the students will be able to

PSO1	Identify various plant life forms, using specific identification key characteristic features
PSO2	Demonstrate the acquired knowledge and to comprehend the core concepts of Botany at organizational (both external morphology, internal morphology), cellular, and molecular levels through which the developmental and physiological functioning of plants
PSO3	Show their skills in practical work, experiments, use of biological tool and techniques, further to orient their attitude towards research
PSO4	Explore various life forms and their intricacies of at the cellular and molecular level
PSO5	Expertise in statistical analyses of data for better interpretations and problem solving

Mapping PSOs against POs

PSO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
PSO1	S	S		S		S
PSO2	S	S		S		S
PSO3	S	S	S			S
PSO4	S	S		S	S	
PSO5	S	S	S		S	S

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B.Sc., Botany (w.e.f. 2020-2021 batch onwards)Programme Code-UBO

SEMESTER –I

Course	Code No	Subject	Hrs/ Week	Cred.	Total Hrs	Max MarkCA	Max Marks SE	Total
Part I	U20P121	Tamil	6	3	90	25	75	100
Part II	U20EN11	English	6	3	90	25	75	100
Core 1	UBO20C11	Algae and Bryophytes	3	3	45	25	75	100
Core 2	UBO20C12	Mycology and Plant Pathology	3	3	45	25	75	100
Core Lab 1	UBO20CL11	Algae, Bryophytes Mycology and Plant Pathology Lab	4	2	60	40	60	100
Generic Elective 1	UZO20GE11B	Economic Zoology	4	4	60	25	75	100
Generic Elective 1 Lab	UZO20GL11B	Economic Zoology Lab	2	-	30			
AECC1	UBO20AE11	EVS	2	2	30	15	35	50
TOTAL			**30**	**20**	450	180	470	650

Semester – II

Course	Code No	Subject	Hrs/ Week	Cred	Total Hrs	Max MarkCA	Max Marks SE	Total
Part I	U20P121	Tamil	6	3	90	25	75	100
Part II	U20EN21	English	6	3	90	25	75	100
Core 3	UBO20C21	Pteridophytes, Gymnosperms and Paleobotany	3	3	45	25	75	100
Core 4	UBO20C22	Cell Biology	3	3	45	25	75	100
Core Lab 2	UBO20CL21	Pteridophytes, Gymnosperms, Paleobotany and Cell biology Lab	4	2	60	40	60	100
Generic Elective 1	UZO20GE21B	Insect Pest Mgmt.	4	4	60	25	75	100
Generic Elective 1 Lab	UZO20GL21B	Insect Pest Mgmt. Lab	2	-	30			
Practical Examination for Eco. Zoo. and Ins. Pest Mgmt.				2		40	60	100
AECC		VE	2	1	30	15	35	50
TOTAL			**30**	**21**	450	**220**	**530**	750

Semester – III

Course	Code No	Subject	Hrs/ Week	Cred	Total Hrs	Max MarkCA	Max Marks SE	Total
Part I Tamil	U20P131	Tamil	6	3	90	25	75	100
Part II English	U20EN31	English	6	3	90	25	75	100
Core 5	UBO20C31	Plant Anatomy and Embryology	4	4	60	25	75	100
Core 6	UBO20C32	Bioinstrumentation and Computer applications	4	4	60	25	75	100
Core Lab 3	UBO20CL31	Plant Anatomy and Embryology Lab	2	1	30	40	60	100
Generic Elective 2	UCH20GE31B	Chemistry for Life Sciences	4	4	60	25	75	100
Generic Elective 2 Lab	UCH20GL41B	Chemistry for Life Sciences Lab	2	--	30			
NME1	UBO20NE31	Horticulture	2	2	30	15	35	50
TOTAL			**30**	**21**	450	**180**	**470**	650

Semester – IV

Course	Code No	Subject	Hrs/ Week	Cred	Total Hrs	Max MarkCA	Max Mark SE	Total
Part I Tamil	U20P141	Tamil	6	3	90	25	75	100
Part II English	U20EN41	English	6	3	90	25	75	100
Core 7	UBO20C41	Microbiology	4	4	45	25	75	100
Core 8	UBO20C42	Herbs and drugs	4	4	45	25	75	100
Core Lab 4	UBO20CL41	Microbiology Lab	2	1	30	40	60	100
Generic Elective 2	UCH20GE41B	Industrial Chemistry	4	4	60	25	75	100
Generic Elective 2 Lab	UCH20GL41B	Industrial Chemistry lab	2		30			
ical Examination for Chem. for Life Sci. & Ind. Chem.				2		40	60	100
NME2	UBO20NE41	Mushroom Cultivation	2	2	30	15	35	50
Total			**30**	**23**	**450**	**220**	**530**	**750**

Semester – V

Course	Code No	Subject	Hrs/ Week	Cred	Total Hrs	Max MarkCA	Max Marks SE	Total
Core 9	UBO20C51	Morphology and Taxonomy of Angiosperms	4	4	60	25	75	100
Core 10	UBO20C52	Plant Biochemistry	4	4	60	25	75	100
Core 11	UBO20C53	Genetics, Evolution and Biostatistics	3	3	45	25	75	100
Core 12	UBO20C54	Biofertilizers and Organic farming	3	3	45	25	75	100
Core Lab 5	UBO20CL51	Morphology and Taxonomy of Angiosperms Lab	3	2	45	40	60	100
Core Lab 6	UBO20CL52	Plant Biochemistry Lab	3	2	45	40	60	100
Core Lab 7	UBO20CL53	Genetics, Evolution and Biostatistics Lab	3	2	45	40	60	100
C Elective1	UBO20CE51(H)/ UBO20CE52(P)	Horticulture and Plant Breeding / Nutraceuticals	5	5	75	25	75	100
SBE1	UBO20SE51(A)/ UBO20SE51(B)/ UBO20SE51(C)	Histology and staining techniques/ Mushroom Technology/ Bioremediation	2	2	30	15	35	50
Internship	UBO20IN	Internship training*		2		15	35	50
Total			**30**	27	450	310	590	900

*Internship report based on the training undergone during Vacation after 4th Semester

Semester – VI

Course	Code No	Subject	Hrs/ Week	Cred	Total Hrs	Max Mark CA	Max Marks SE	Total
Core 13	UBO20C61	Plant Physiology	4	4	60	25	75	100
Core 14	UBO20C62	Plant Biotechnology	4	4	60	25	75	100
Core 15	UBO20C63	Plant Ecology and Biodiversity	3	3	45	25	75	100
Core 16	UBO20C64	IPR and Bio-safety	3	3	45	25	75	100
Core Lab 8	UBO20CL61	Plant Physiology Lab	3	2	45	40	60	100
Core Lab 9	UBO20CL62	Plant Biotechnology Lab	3	2	45	40	60	100
Core lab 10	UBO20CL63	Plant Ecology and Biodiversity Lab	3	2	45	40	60	100
M Elective2 (theory)	UBO20CE61(B)/ UBO20CE61(P)	Basics of Molecular Biology/ Plant resources and Utilization	5	5	75	25	75	100
SBE2	UBO20SE61(A)/ UBO20SE61(B)/ UBO20SE61(C)	Seed and nursery Technology/ Sea weed Technology/ Biopesticides	2	2	30	15	35	50
TOTAL			**30**	27	450	260	590	850

TOTAL CREDITS FOR SEMESTERS I to VI	**139**	**(20+21+21+23+27+27)**
PART V	**01**	
Total Credits for B.Sc. programme	**140**	

Generic Elective offered to B.Sc. Zoology students

Course	**Code No**	**Subject**	**Hrs/ Week**	**Cred.**	**Total Hrs**	**Max MarkCA**	**Max Marks SE**	**Total**
SEMESTER III								
GE	UBO20GE31Z	Plant Life forms	4	4	60	25	75	100
	UBO20GL41Z	Plant Life forms Lab	2	-	30	-	-	-
SEMESTER IV								
GE	UBO20GE41	Plant Pathology	4	4	60	25	75	100
	UBO20GL41Z	Plant Pathology Lab	2	-	30	-	-	-
	UBO20GL41Z	Plant Life forms and Plant Pathology Lab		2		40	60	100

A) Consolidation of contact hours and credits: UG

Semester	Contact Hours/Week	Credits
I	30 hrs	20
II	30 hrs	21
III	30 hrs	21
IV	30 hrs	23
V	30 hrs	27
VI	30 hrs	27
PART - V	--	01
Total		140

B) Curriculum Credits: Part wise

		No of Courses	Credits per Course	Total Credits
PART I	Tamil	04	3	12
PART II	English	04	3	12
PART III	Core Theory	16	3/4	56
	Core Lab	10	1/2	18
	Core Elective	02	5	10
	Generic Elective Theory	04	4	16
	Generic Elective Lab	02	2	04
PART IV	Ability Enhancement Compulsory Course	01	2	02
	Non Major Elective	02	2	04
	Skill Enhancement Course	02	2	04
	Value Education	01	1	01
Total		49		139
PART V	(NSS/NCC/Physical Education)			01
	GRAND TOTAL			140

Mapping Courses Against POsB.Sc., Botany Programme

		COURSE TITLE	PO1	PO2	PO3	PO4	PO5	PO6
YEAR I	SEMESTER I	Algae and Bryophytes	S					
		Mycology and Plant Pathology	S					
		Algae, Bryophytes Mycology and Plant Pathology Lab	S		S	S		
		AECC1 - EVS		S			S	
		GE1 Course 1 Zoology	S					
		GE1 Course 1 Zoology Lab	S					
	SEMESTER II	Pteridophytes, Gymnosperms and Paleobotany	S					
		Cell Biology	S	S				
		Pteridophytes, Gymnosperms and Paleobotany and Cell Biology Lab	S		S	S		
		AECC2 – VE		S			S	
		GE1 Course 2 Zoology	S					
		GE1 Course 2 Zoology Lab	S					
YEAR II	SEMESTER III	Plant Anatomy and Embryology	S			S	S	S
		Bioinstrumentation and Computer applications	S					
		Plant Anatomy and Embryology Lab	S	S		S	S	S
		GE2 Course 1 Chemistry	S					
		GE2 Course 1 Chemistry Lab	S	S				
		Non Major Elective -1						
	ESTER IV	Microbiology	S	S	S		S	S
		Herbs and Durgs	S			S		S
		Microbiology Lab	S	S	S			S
		GE2 Course 2 Chemistry	S					
		GE2 Course 2 Chemistry Lab	S					
		Non Major Elective -2						
YEAR III	SEMESTER V	Morphology and Taxonomy of Angiosperms	S	S				
		Plant Biochemistry	S	S		S	S	
		Genetics, Evolution and Biostatistics	S	S	S	S		
		Biofertilizers and Organic farming	S	S		S		S
		Morphology and Taxonomy of Angiosperms Lab	S	S	S			S
		Plant Biochemistry Lab	S	S	S			S
		Genetics, Evolution and Biostatistics Lab	S	S	S		S	S
		Core Elective 1 Horticulture and Plant Breeding/ Nutraceuticals	S	S			S	
		Skill based Elective 1 Histology and staining techniques/ Mushroom Technology/Bioremediation	S	S			S	
	SEMESTER VI	Plant Physiology	S	S				
		Plant Biotechnology	S	S			S	
		Plant Ecology and Biodiversity	S	S				S
		IPR and Biosafety	S	S		S	S	S
		Plant Physiology Lab	S	S	S			
		Plant Biotechnology Lab	S	S	S		S	
		Plant Ecology and Biodiversity Lab	S	S	S			S
		Core Elective 2 Basics of Molecular Biology/ Plant resources and Utilisation	S				S	
		Skill Based Elective 2 Seed and nursery Technology/ Sea weed Technology/Biopesticides	S				S	S

Mapping Courses Against PSOs
B.Sc., Botany Programme

		COURSE TITLE	PSO1	PSO2	PSO3	PSO4	PSO5
YEAR I	SEMESTER I	Algae and Bryophytes	S				
		Mycology and Plant Pathology	S				
		Algae, Bryophytes Mycology and Plant Pathology Lab	S		S	S	
		AECC1 - EVS		S			S
		GE1 Course 1 Zoology	S				
		GE1 Course 1 Zoology Lab	S				
	SEMESTER II	Pteridophytes, Gymnosperms and Paleobotany	S				
		Cell Biology	S	S	S	S	
		Pteridophytes, Gymnosperms and Paleobotany and Cell Biology Lab	S		S	S	
		AECC2 – VE					S
		GE1 Course 2 Zoology	S				
		GE1 Course 2 Zoology Lab	S				
YEAR II	SEMESTER III	Plant Anatomy and Embryology	S			S	S
		Bioinstrumentation and Computer applications	S				S
		Plant Anatomy and Embryology Lab	S	S		S	S
		GE2 Course 1 Chemistry	S				
		GE2 Course 1 Chemistry Lab	S	S			
		Non Major Elective -1					
	ESTER IV	Microbiology	S	S	S		S
		Herbs and Durgs	S	S			
		Microbiology Lab	S	S	S		
		GE2 Course 2 Chemistry	S				
		GE2 Course 2 Chemistry Lab	S				
		Non Major Elective -2					
	SEMESTER V	Morphology and Taxonomy of Angiosperms	S	S			
		Plant Biochemistry	S	S		S	S
		Genetics, Evolution and Biostatistics	S	S	S	S	
		Biofertilizers and Organic farming	S	S	S		
		Morphology and Taxonomy of Angiosperms Lab	S	S	S		
		Plant Biochemistry Lab	S	S	S		
		Genetics, Evolution and Biostatistics Lab	S	S	S		S
		Core Elective 1 Horticulture and Plant Breeding/ Nutraceuticals	S	S			S
		Skill based Elective 1 Histology and staining techniques/ Mushroom Technology/Bioremediation	S	S			S
	SEMESTER VI	Plant Physiology	S	S			
		Plant Biotechnology	S	S			S
		Plant Ecology and Biodiversity	S	S			
		IPR and Biosafety	S		S	S	S
		Plant Physiology Lab	S	S	S		
		Plant Biotechnology Lab	S	S	S		S
		Plant Ecology and Biodiversity Lab	S	S	S		
		Core Elective 2Basics of Molecular Biology/ Plant resources and Utilisation	S				S
		Skill Based Elective 2 Seed and nursery Technology/ Sea weed Technology/Biopesticides	S				S

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Course Code	Course Title	Category	L	T	P	Credit
UBO20C31	**Plant Anatomy and Embryology**	**Core- 5**	**4**	**-**	**-**	**4**

Year	Semester	Int. Marks	Ext. Marks	Total
Second	**Third**	**25**	**75**	**100**

Preamble

To provide the idea about the organization of plants at cellular as well as tissue level and to equip the students with the basics of plant Embryology.

Course Outcomes

On the completion of the course the student will be able to

#	Course Outcome	Expected Proficiency	Expected Attainment
CO1	Explain different types of plant tissues through their structural organization and functions	80%	70%
CO2	Elucidate the development of shoot and root	70%	70%
CO3	Distinguish secondary growth and anatomy of nodes	60%	80%
CO4	Compare the structure and development of microsporangium and megasporangium	70%	80%
CO5	Find out the types of pollination, fertilization and Endosperm	80%	70%

Mapping of COs with POs

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

Strong(S), Medium(M), Low(L)

Mapping of COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**S**	**S**	**S**	**S**	**L**
CO2	**M**	**S**	**S**	**S**	**M**
CO3	**S**	**S**	**S**	**S**	**M**
CO4	**S**	**S**	**S**	**S**	**M**
CO5	**M**	**S**	**S**	**S**	**M**

Strong(S), Medium(M), Low(L)

Blooms taxonomy

	CA		End of Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%

Title of the Course: Plant Anatomy and Embryology

Unit I: Meristematic tissues – Characters and types – structure and function of apical meristems – root apex and shoot apex – theories of meristems: Root apex-Histogen theory and Shoot apex- Tunica-Corpus theory. Structure and function of simple tissues– parenchyma, collenchyma, sclerenchyma. Secretory tissues -Structure of surface appendages, trichomes, glands. Stomata - Structure and function.

Unit II: Complex tissues- xylem, phloem.. Primary structures of dicot root (*Vigna*), monocot root (*Maize*), dicot stem (*Vigna*), monocot stem (*Maize*), dicot leaf (*Tridax*) and monocot leaf (Grass). Nodal anatomy: unilacunar node (*Polyalthia*), trilacunar node (*Azadirachta*) and multilacunar node (*Coriandrum sativum*)

Unit III: Secondary growth: normal secondary growth in dicot stem. Anomalous secondary growth in *Boerhaavia*. Types, structure and function of cambium.

Unit IV: Flower: Essential and Nonessential parts-Sepals, Petals (non-essential), Androecium and Gynoecium (essential) – Androecium of flowers: Anther and pollen grains – Structure and development of microsporangium – Development of male gametophyte. Gynoecium of flowers: Structure and development of mega sporangium- Development of female gametophyte, Structure and types of ovules.

Unit V: Pollination: Kinds of pollination (Self and Cross)- Fertilzation: Types of fertilization(Porogamy, Chalazogamy and Mesogamy), Process and significance of double fertilization and triple fusion, Post fertilization changes; Endosperm: Types-Nuclear, Cellular and Helobial, Embryo: Structure and Development – Monocot embryo- Luzula, Dicot embryo-Capsella- Polyembryony - types and significance.

Text Books:

1. Pandey, B.P. 2010. Plant Anatomy, S. Chand and Co. Ltd., New Delhi
2. Rahavan, V. 1976. Experimental Embryogenesis in vascular plants, Academic Press, London.
3. Bhojwani S.S and Bhatnagar, S.P. The Embryology of Angiosperms - Vikas Publishing House P.ltd., NewDelhi
4. Vashista, P.C. (1968) A Text book of anatomy, S.Negin&Co.

References:

1.Fahn, A. 1990. Plant Anatomy, Pergman press, Oxford, London.

2. B M Johri Embryology of Angiosperms

3.Maheswari, P. 1963. An Introduction to Embryology of Angiosperms, TATA McGraw Hill Publishing ltd., New Delhi.

Web Resources:

- https://www.wiley.com/en-us/Flowering+Plant+Embryology%3A+With+Emphasis+on+Economic+Species-p-9780470752678
- https://www.routledge.com/Embryology-of-Flowering-Plants-Terminology-and-Concepts-Vol-3-Reproductive/Batygina/p/book/9781578082650
- https://link.springer.com/article/10.1007/BF02488572

Course Designers:

1. Dr T. M. Jothimani

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Course Code	Course Title	Category	L	T	P	Credit
UBO20CL31	Plant Anatomy and Embryology Lab	**Core Lab 3**	-	-	2	1

L - Lecture T - Tutorial P - Practicals

Year	Semester	Int. Marks	Ext. Marks	Total
Second	**Third**	**40**	**60**	**100**

Preamble

To equip the students with the basic techniques of plant anatomical sections and observe the structure microscopically.
To equip the students with the basic principles of plant embryology and updated techniques in applied aspects of methodologies for isolation and culture of plant cells.

Course Outcomes

On the completion of the course the student will be able to

#	Course Outcome	Expected Proficiency	Expected Attainment
CO1	Identify the sectioning of plant parts	80%	70%
CO2	Distinguish between primary and secondary growth	70%	70%
CO3	Infer the sectioning of nodal and internodal regions	60%	80%
CO4	Discriminate different parts of flower	70%	80%
CO5	Dissect and show the embryo and endosperm from seed	80%	70%

Mapping of COs with POs

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

Strong(S), Medium (M), Low (L)

Mapping of COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	S	L
CO2	S	S	M	S	M
CO3	S	S	M	S	M
CO4	S	S	S	M	S
CO5	S	S	S	S	S

Strong(S), Medium (M), Low (L)

Title of the Course :Plant Anatomy and Embryology Lab

1. Anatomy of Dicot root – *Vigna*
2. Monocot root- *Maize*
3. Dicot stem – *Vigna*
4. Monocot stem – *Maize*
5. Dicot leaf – *Tridax*
6. Monocot leaf- Grass
7. Normal secondary growth: *Tecoma* stem
8. Anomalous secondary growth: *Boerhaavia* stem
9. Nodal Anatomy – *Polyalthia, Azadirachta, Coriandram sativum*
10. Study of slides showing developmental stages of anther, embryo sac, endosperm and embryo
11. Study of different types of ovules
12. Dissection of endosperm haustoria –*Cucumis*
13. Dissection of embryo –*Tridax*

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Course Code	Course Title	Category	L	T	P	Credit
UBO20C32	**Bioinstrumentation and Computer Application**	**Core 6**	**4**	**-**	**-**	**4**

L - Lecture T - Tutorial P - Practicals

Year	Semester	Int. Marks	Ext. Marks	Total
Second	**Third**	**25**	**75**	**100**

Preamble

To equip the students with basic principles and to apply with standard methods, basic and advanced instrumentation techniques and computer in field of plant biology

Course Outcomes

On the completion of the course the student will be able to

#	Course Outcome	Knowledge Level	Expected Proficiency	Expected Attainment
CO1	Explain the basic principles of microscopy and colorimetry	K1	80%	70%
CO2	Distinguish the modes of separation of biomolecules	K2	70%	70%
CO3	Demonstrate the identification of various biomolecules	K2	60%	80%
CO4	Depict the organization of computers	K2	70%	80%
CO5	Preparation and presentation of data using application software	K3	80%	70%

Mapping of COs with POs

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

Strong(S), Medium (M), Low (L)

Mapping of COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	L	L	L	L	L
CO2	M	S	M	L	M
CO3	L	L	S	S	M
CO4	S	L	M	L	L
CO5	L	L	S	L	S

Strong(S), Medium (M), Low (L)

Blooms taxonomy

	CA		End of Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%

Title of the Course: Bioinstrumentation and Computer Application

Unit I: Microscopy – working principle, instrumentation and applications of light, phase contrast, dark field, electron microscopy (TEM and SEM) and Confocal microscopy. pH meter – principle, techniques and maintenance, Colorimetry- Light spectrum, absorption by substances, Beer and Lamberts' law, principle, components and working principle and applications of colorimeter.

Unit II: Chromatography – Principle – adsorption, affinity and ion exchange types; paper chromatography – ascending, descending, radial types and 2D method,Gas Chromatography, column chromatography, TLC techniques. Electrophoresis – principle – paper electrophoresis - types and gel electrophoresis (AGE and PAGE) – casting, sample loading, power requirement, staining and band analysis

Unit III: Centrifugation- principle, types - bench top, refrigerated, high speed and ultra centrifuge- instrumentation and applications. Radiation detection methods – Autoradiography, Scintillation and GM counter – working principle and application – X ray crystallography – overview and application.

Unit IV: Computers: Historical background, Generations of Computer, basic working principle - binary bits and bytes. Organisation of a computer – Hardware – input and output devices, Memory – RAM, ROM, Inbuilt memory and external storage devices – operating system

Unit V: Computer application Programmes – MS Office – MS word, MS Excel, MS Power point, Google docs, Google classroom. Intranet, Internet- Email, Browser and its types; Application in various fields of plant biology (over view of softwares used in biological industries, plant systematics, drug discovery and bioinformatics)

Text Books:

1. Jain, J. L. 2000. Fundamentals of Biochemistry. S. Chand & Co. Ltd., New Delhi.
2. Satyanarayana, U. and U. Chakrapani, 2013. Biochemistry. Elsevier Co-published with, Books and Allied Press, New Delhi
3. Suresh K, Pasandra. 1997. Computer today. Galcotia Publications, New Delhi.
4. Saxena, S. 2009. MS-Office for everyone, Vikas publishing House Pvt. Ltd., Noida, UP.
5. Sunkin, M.G. 1992. Introduction to computer information System for business. S.Chand& Co., New Delhi

References:

1. Nelson, D. L. and M. M. Cox. 2008. Lehninger Principles of Biochemistry. W. H. Freeman Publishers, New York.
2. Berg, J. M., J. L. Tymoczko and L. Stryer, 2010. Biochemistry, W. H. Freeman, Publishers, New York.
3. Mousumi-Debnath. 2005. Tools and Techniques of Biotechnology. Pointer publisher, Jaipur.
4.Taxali, R.K. 2000. PC software for Windows – Made simple, Tata McGraw-Hill publishing, company Ltd., New Delhi.

Web Resources:

www.easybiologyclass.com
www.slideshare.com
www.bio.libretexts.org

Course Designers:

1.Dr. D. Kannan
2. Dr.M.Rama Prabha

Thiagarajar College (Autonomous): Madurai – 625 009
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Department of Botany
(For those who joined Under Graduate Programmes on or after June 2020)

Course Code	Course Title	Category	L	T	P	Credit
UBO20NE31	Horticulture	NME I	2	-	-	2

L – Lecture T – Tutorial P –Practicals

Year	Semester	Int. Marks	Ext. Marks	Total
Second	Third	15	35	50

Preamble

To acquire basic knowledge, skills and creating interest among the students as entrepreneurs in the field of Horticulture

Course Outcomes

On the completion of the course the student will be able to

#	Course Outcome	Expected Proficiency	Expected Attainment
CO1	Students will acquire knowledge about the fundamental aspects of Horticulture and its various branches	80%	70%
CO2	Comprehend the various categories of gardens	70%	70%
CO3	Application of the acquired knowledge over the essential requirements of garden making and maintenance	60%	80%
CO4	Examine the different propagation methods in Horticulture	70%	80%
CO5	Develop competency in the applications of Horticulture as entrepreneurial skill and to generate additional income	80%	70%

B.Sc. P.O.

Mapping of COs with POs

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

Strong(S), Medium(M), Low(L)

B.A. P.O.

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

B.B.A. P.O.

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

B.Com. P.O.

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

Mapping of COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**S**	**S**	**M**	**L**	**M**
CO2	**S**	**M**	**S**	**S**	**L**
CO3	**S**	**S**	**M**	**L**	**M**
CO4	**S**	**L**	**M**	**M**	**S**
CO5	**S**	**S**	**S**	**S**	**S**

Blooms taxonomy

	CA		End of Semester
	First	**Second**	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%

Title of the Course: **Horticulture**

Unit I: Fundamentals of Horticulture – Scope; Branches in horticulture crops- importance and different values in horticulture – types of garden and suitable plants - Formal and Informal, indoor garden, outdoor garden, Arboretum. Lawns, Golf ground, Topiary, Water Garden, Rock Garden, kitchen garden- Terrace Garden, conservatory garden-Green House; Special Techniques - Terrarium, Hanging pots, *Bonsai;* Basic Gardening requirements – Selection of space, soil mix, containers, root trainers, seedling beds, organic manures and fertilizer, garden tools-pest and disease management- (15 Hrs.)

Unit – II: Propagation of Horticulture crops and Products - Propagation techniques- Vegetative methods- Root, Stem and Leaf cutting; Budding; Grafting methods and layering; Flower bed, fresh and dry flower arrangements, Flower bouquets, Vegetable Carving-Greeting card making –Ingredients, Processing and preservation: Fruit Jam, Jelly, Squash, Tomato Ketchup, Pickles, Entrepreneurial skill development and practices in horticulture. (15 Hrs.)

Text Books:

Kumar, N. 2010. Introduction to Horticulture (7th Ed.), Oxford & IBH Publishing & Co., New Delhi
S.N. Gupta, 2020. Instant Horticulture (17th Edition), Jain Book Publishers, New Delhi
K L Chadha, 2019, Hand Book on Horticulture, ICAR Publications, New Delhi

Reference Book:

Acquaah, G. 2009. Horticulture Principles and Practices (4th Ed.,), PHI Learning Private Ltd., New Delhi.

Course Designed by:

1. Dr. D. Kannan &
2. Dr. R. Aruna

Thiagarajar College (Autonomous): Madurai – 625 009
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Department of Botany
(For those joined B.Sc. Botany on or after June 2020)

Course Code	Course Title	Category	L	T	P	Credit
UBO20C41	Microbiology	Core-7	4	-	-	4

L - Lecture T - Tutorial P - Practicals

Year	Semester	Int. Marks	Ext. Marks	Total
II	IV	25	75	100

Preamble

To acquire the basic knowledge on microbes and acquire the microbiological techniques

To equip the students to practice the different microbial cultural methods and its preservation techniques

Course Outcomes

On the completion of the course the student will be able to

#	Course Outcome	Expected Proficiency	Expected Attainment
CO1	Explain the classification of microbes	80%	70%
CO2	Understand the bacterial structure and its reproduction	70%	70%
CO3	Aware the viruses and its transmission	60%	80%
CO4	Perform the basic techniques in microbial culture production	70%	80%
CO5	Demonstrate the methods of culture preservation	80%	70%

Mapping of COs with POs

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

Strong(S), Medium(M), Low(L)

Mapping of COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	M	M	L
CO2	S	S	S	M	L
CO3	S	M	S	M	L
CO4	S	S	M	S	M
CO5	S	S	S	M	S

Strong(S), Medium(M), Low(L)

Blooms taxonomy

	CA		End of Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%

Title of the paper

Unit I: General account on microbes-history of microbiology-Invention of microscopes- Reddy's experiments-Louis Pasteur's Fermentation- Koch's postulates-Virus discoveries- discovery of antibiotics, Microbial classification of Organisms – Whittaker's five kingdom, Recent classification by Bergey.
Unit II: Bacteria – Ultra structure and reproduction-binary fission- Genetic recombination in Bacteria - Conjugation, Transformation, Transduction (Brief account only). Bacterial nutrition, Sigmoid growth curve and Factors affecting growth.
Unit III: Virus –structure, classification and replication-bacterio phage, Influenza virus, Corona virus and TMV- general mode of viral transmission. General applications of virus: plant-based vaccines.
Unit IV: Types of culture media, Sterilization methods-physical and chemical methods, Pure culture techniques and plating methods-Streak plate, Pour plate, spread plate and stab culture.
Unit V: Staining techniques: Simple and Gram's staining, endospore staining, Fungal staining, Preservation of microbial cultures-Low temperature, cryopreservation-and Lyophilization, Beneficial role of microbes in various fields-agricultural, environmental, medicinal and industrial applications.

Text Books:

1) Ananthanarayanan, R. and C.K. JayaramPaniker. 1996, 2000, 2005.Text book of Microbiology. Orient Longman, Hyderabad.
2) Aneja, K.R. 1996. Experiments in Microbiology, Plant pathology, Tissue culture and Mushroom Cultivation. VishwaPrakashan (New Age International (p) Ltd.) New Delhi.

3) Kalaichelvan, P.T.2008. Microbiology and Biotechnology-a lab Manual. Lab Man Series, MJP Publishers.
4) Vijaya Ramesh, K. 2008.Environmental Microbiology. MJP Publishers
5)Puvanakrishnan, R., Sivasubramanian, S. And T. Hemalatha.2015.Microbes and Enzymes-Basics and Applied.MJP Publishers.
6) Maheswari. D.K and Dubey, R.C.2013. A text book of Microbiology.S.Chand.
.

References:

1) Holt, J.G., Krieg, N.R., Sneath, P.H.A., Staley, J.T. and Williams, S.T.2001. Bergey's manual of determinative Bacteriology,9th edn.Garrity, George, M.Springer-verlag-New York.
2) Prescott, L.M., J.P. Harley, and D.A .Klein. 2002. Microbiology, McGraw -Hill Publishing Company, New Delhi.
3) Ingram, J.L. and C.A. Ingram. 2004. Introduction to Microbiology, Thomson Books, UK.
4) Bhatia, A.L. 2005. Handbook of Microbiology, Pointer Publishers, Jaipur.
5) Pelczar, M.J., E.C.S. Chan and N.R Krieg. 2010. Microbiology-Concepts and applications, Tata McGraw-Hill Publishing Company, New Delhi.

Web Resources:

1. http://highered.mheducation.com/sites/0072320419/student_view0/chapter1/chapter_web_links.html

2. http://faculty.fiu.edu/~gantarm/Lecture%20outlines.html
3. https://open.oregonstate.education/generalmicrobiology/Linda Bruslind , 1st Edtn., E-book General Microbiology
4. https://www.youtube.com/watch?v=fU0XO1X1tAE
5. https://www.youtube.com/watch?v=YwdYf4Yd3DE
6. http://shoxet.com/1afsy5

Course Designers:

1.Dr.B.Sadhana

Thiagarajar College (Autonomous): Madurai – 625 009
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Department of Botany
(For those joined B.Sc. Botany on or after June 2020)

Course Code	Course Title	Category	L	T	P	Credit
UBO20CL41	**Microbiology Lab**	**Core Lab-4**	-	-	2	1

L - Lecture T - Tutorial P - Practicals

Year	Semester	Int. Marks	Ext. Marks	Total
II	IV	40	60	100

Preamble

To equip the student to practice the methods and techniques in microbiology.

Course Outcomes

On the completion of the course the student will be able to

#	Course Outcome	Expected Proficiency	Expected Attainment
CO1	Aware the healthy lab practices	80%	70%
CO2	Explain the media preparation for microbial culture	70%	70%
CO3	Practice the staining methods	60%	80%
CO4	Develop the skills for isolation of microbes	70%	80%
CO5	Practice the methods of culture preservation under low temperature	80%	70%

Mapping of COs with POs

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

Strong(S), Medium(M), Low(L)

Mapping of COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**S**	**S**	**S**	**M**	**M**
CO2	**S**	**S**	**S**	**M**	**M**
CO3	**S**	**S**	**S**	**S**	**S**
CO4	**S**	**S**	**S**	**M**	**M**
CO5	**S**	**S**	**S**	**M**	**M**

1. Microbiology Lab Practices: general rules, Do’s and Don'ts and Bio safety.
2. Sterilization techniques: Incineration-fumigation-radiation-Filtration
3. Media preparation: Solid, semi solid and liquid media.
4. Plating techniques-Streak plate, Pour plate, spread plate and stab culture method.
5. Bacterial staining – simple staining, Grams staining and endospore staining
6. Fungal staining-Lacto phenol cotton blue staining.
7. Isolation of microbes from various samples:soil, water and air.
8. Observing bacterial motility by hanging drop method.
9. Demonstration for serial dilution technique.

Reference book and e-resource:

1. Cappuccino, J.G and Sherman, 2013. Microbiology lab manual.
2. file:///C:/Users/admin/Downloads/microbiologylabmanual.pdf
3. https://www.ronaldschulte.nl/files/Laboratory_manual_in_general_microbiology.pdf

Thiagarajar College (Autonomous): Madurai – 625 009
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Department of Botany
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Course Code	Course Title	Category	L	T	P	Credit
UBO20C42	Herbs and Drugs	**Core-8**	**4**	**-**	**-**	**4**

L - Lecture T - Tutorial P - Practicals

Year	Semester	Int. Marks	Ext. Marks	Total
Second	**Fourth**	**25**	**75**	**100**

Preamble

To realize the significance of medicinal plants.

Course Outcomes

On the completion of the course the student will be able to

#	Course Outcome	Expected Proficiency	Expected Attainment
CO1	To know about the traditional systems of medicine	80%	70%
CO2	To understand the chemical constituents of the medicinal plants	70%	70%
CO3	Recognize the basic medicinal plants	60%	80%
CO4	Identify the raw materials for drug preparation and Industries	70%	80%
CO5	To study common ethnomedicinal plants and its usage	80%	70%

Mapping of COs with POs

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

Strong(S), Medium(M), Low(L)

Mapping of COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**S**	**S**	**S**	**S**	**S**
CO2	**S**	**M**	**S**	**S**	**M**
CO3	**S**	**M**	**M**	**M**	**S**
CO4	**S**	**S**	**M**	**S**	**L**
CO5	**S**	**S**	**M**	**L**	**M**

Strong(S), Medium(M), Low(L)

Blooms taxonomy

	CA		End of Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%

Title of the paper

Unit I

Classification of drugs based on morphology, pharmacological and chemical nature. – Traditional systems of medicine and overview of AYUSH (Traditional Indian Systems of Medicine); -

Unit II

Chemical nature of natural medicines: Brief study on general properties, Classification, uses and chemical test of the following: Alkaloids, Terpenoids, Glycosides, Phenols, Volatile oils and tannins.

Unit III

Morphology, Phytochemical constituents and uses of following:

1. Whole plant – *Phyllanthus amarus, Andrographis paniculata*
2. Root – *Withania somnifera, Hemidesmus indicus*
3. Rhizome – *Zingiber officinale, Curcuma longa*
4. Bark –*Cinchona succirubra, Terminalia arjuna*
5. Leaves – *Adhatoda vasica, Piper betle,* Tulsi
6. Fruit & Seeds - *Piper nigrum, Cuminum cyminum*, Fenugreek

Unit IV

Description of raw materials used for colours, perfumes, antioxidants, antimicrobials. Utilization of medicinal plants in treating common cold, cough, headache and stomach problems

Unit V

Ethnobotany- Introduction, hot spots of medicinal plants in India, sacred grooves in Tamilnadu. Cultivation - harvesting - processing – storage-export of herbs and herbal products.

Text Books:

1.Kumar, N.C. 1993. An introduction to medical Botany and Pharmocognosy. Emkay publication, New Delhi
2. Kokate, C.K, Purohit, A.P. Gokhale, C.B.2003. Pharmacognosy Niraliprakashan, Pune.
3. Pal, D.C. and Jain, S.K. 1998. Tribal medicine, Nayaprokash, Calcutta

References:

1. Wallis, T.E.1985. Text Book of Pharmacognosy. CBS publishers and Distributors, Delhi.
2. Mohammed Ali, 1998 Text Book of Pharmacognosy CBS publishers and Distributors, New Delhi.

Course Designers:

1. Dr.M.Rama Prabha
2. Dr.R.Aruna

Thiagarajar College (Autonomous): Madurai – 625 009
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Department of Botany
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Course Code	Course Title	Category	L	T	P	Credit
UBO20NE41	Mushroom Cultivation	NME2	2	-	-	2

L - Lecture T - Tutorial P - Practicals

Year	Semester	Int. Marks	Ext. Marks	Total
II	IV	15	35	50

Preamble

To acquire the knowledge and developing through skill based training on mushroom cultivation

Course Outcomes

On the completion of the course the student will be able to

#	Course Outcome	Expected Proficiency	Expected Attainment
CO1	Made aware of the types of mushrooms and its structure	80%	70%
CO2	Realize and explain nutritive value of edible mushrooms	70%	70%
CO3	Develop the basic skills in mushroom spawn production	60%	80%
CO4	Practice commercial cultivation methods for mushrooms	70%	80%
CO5	Analyze post harvest techniques in mushroom cultivation	80%	70%

Mapping of COs with POs

B.Sc., P.O.

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

Strong(S), Medium(M), Low(L)

B.A. P.O.						
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	M	L	L	L	L	L
CO2	M	L	L	L	L	L
CO3	M	L	L	L	L	L
CO4	M	L	L	M	L	S
CO5	M	L	L	L	L	L

B.B.A.						
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	L	L	L	L	L	L
CO2	L	L	L	L	L	L
CO3	L	L	L	L	L	L
CO4	L	L	L	L	L	M
CO5	L	L	L	L	L	L

B.Com.					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**
CO1	**M**	**L**	**L**	**L**	**L**
CO2	**M**	**L**	**M**	**L**	**L**
CO3	**M**	**L**	**M**	**L**	**L**
CO4	**M**	**L**	**M**	**M**	**L**
CO5	**M**	**L**	**L**	**L**	**L**

Mapping of COs with PSOs

	PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	**S**	**S**	**S**	**M**	**M**
CO2	**S**	**S**	**S**	**M**	**M**
CO3	**S**	**S**	**S**	**S**	**M**
CO4	**S**	**S**	**S**	**S**	**S**
CO5	**S**	**S**	**M**	**M**	**L**

Blooms taxonomy

	CA		**End of Semester**
	First	**Second**	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%

Title of the Course: Mushroom Cultivation

Unit I: Mushrooms-Introduction-Types, characteristics and nutritive valuesand economic importance of mushrooms: Edible, non-edible and poisonous mushrooms. Morphology and internal structure of mushrooms. Favorable conditions for mushroom cultivation and its food recipes: Mushroom biryani, soups, gravy, fries, salads and Continentals dishes.

Unit II: Mushroom spawn-methods of spawn production, Inoculation and sterilization technique, plant and animal-based substrates-Commercial cultivation of mushrooms: *Agaricusbisporus*and *Pleurotusostreatus, P. florida*– problems in cultivation-pests and diseases and their control measures. Post harvest technology and storage methods for mushrooms.

Text Books:

1.Kapoor, J.N. 1989. Mushroom Cultivation, ICAR, New Delhi.
2. NitaBahl. 1996, Hand Book on Mushrooms. Oxford and IBH Publishing Company Ltd., New Delhi.
3.Tripathi, D. P. 2005. Mushroom Cultivation. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

References:

1.Aneja, K.R.1993. Experiments in Microbiology, Plant pathology, Tissue culture and mushroom cultivation, WishwaPrakashan, New Age International (P) Ltd., New Delhi.
2.Chang,S. and Miles, P.G. 2004. Mushrooms: Cultivation, Nutritional Value, Medicinal Effect and Environmental Impact, CRC Press online.

3. Board, N.2016. Hand Book on mushroom cultivation and processing (with dehydration, preservation and Canning).Asia Pacific Business Press, National Institute of Industrial Research, New Delhi.

Web Resources:

1.https://www.researchgate.net/publication/316967767_Mushroom_Cultivation_Book_Preprint_version
2.https://www.agrimoon.com/mushroom-culture-horticulture-icar-pdf-book/
3. https://www.amazon.in/Mushroom-Cultivation-Illustrated-Growing-Mushrooms-ebook/dp/B07CZT44QP

Course Designers:

1.Dr.B.Sadhana
2.Dr.R.Aruna

Generic Elective Courses for II B.Sc. Zoology

Thiagarajar College (Autonomous):: Madurai – 625 009
(Re-Accredited with 'A^{++}' Grade by NAAC)
Department of Botany
(For those joined B.Sc. Zoology on or after June 2020)

Course Code	Course Title	Category	L	T	P	Credit
UBO20GE31Z	**Plant Life Forms**	**Generic Elective Theory**	**4**	**-**		**4**

L - Lecture T - Tutorial P - Practicals

Year	Semester	Int. Marks	Ext. Marks	Total
II	**III**	**25**	**75**	**100**

Preamble

To make the students to know the diversity of plant kingdom and its significance

Course Outcomes

On the completion of the course the student will be able to

#	Course Outcome	Expected Proficiency	Expected Attainment
CO1	Know the diversity of plants	80%	70%
CO2	Understand the role of different groups of plants	70%	70%
CO3	Relate the structure and adaptations	60%	80%
CO4	Explore the structural modifications of angiosperms	70%	80%
CO5	Recognize the floral arrangement and its uniqueness	80%	70%

Mapping of COs with POs

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

Strong(S), Medium(M), Low(L)

Mapping of COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**S**	**S**	**S**	**M**	**L**
CO2	**S**	**S**	**S**	**S**	**M**
CO3	**S**	**S**	**S**	**S**	**M**
CO4	**S**	**S**	**S**	**S**	**L**
CO5	**S**	**S**	**S**	**S**	**L**

Strong(S), Medium(M), Low(L)

Blooms taxonomy

	CA		End of Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%

Title of the Course: **Plant Life Forms**

Unit I: Classification of Plant Kingdom by O. Tippo (1942) - General characteristic features and economic importance of Algae and Bryophytes (Excluding the development details of sporophyte and gametophyte). External Morphology and life cycle study (Excluding the development details) of the following plants:Algae–*Gracilaria*,Bryophyte–*Marchantia*

Unit II: General characteristic features and economic importance of Fungi and Lichens (Excluding the development details of sporophyte and gametophyte). External Morphology and life cycle study (Excluding the development details) of the following plants: Fungi–*Agaricus*, Lichens–*Usnea.*

Unit III: General characteristic features and economic importance of Pteridophytes and Gymnosperms (Excluding the development details of sporophyte and gametophyte).External Morphology and life cycle study (Excluding the development details) of the following plants: Pteridophytes–*Lycopodium*, Gymnosperms–*Pinus.* Palaeobotany – Fossils and their types (Brief account only),Digital herbarium.

Unit IV: Angiosperms- Dicots and Monocots: Generalcharacters – Morphology of Angiosperms: Root, Stem and Leaf Modification. Bentham and Hooker System of Classification. ICBN - Binomial Nomenclature, Herbarium- Digital Herbarium

Unit V: External morphology and floral characteristic features and economic importance of the following Families:Nymphaeaceae, Bignoniaceae, Euphorbiaceae and Musaceae

TextBooks:

1. Pandey,B.P.2010,College Botany,Volumes.I,IIandIII,S.Chand & Company Ltd.,NewDelhi.
2. Singh, V., Jain, D.K. and Pande, P.C. 2010. A Text Book of Botany: Angiosperms, Rastogi Publications, Meerut.
3. Pandey, B.P. 2012. Economic Botany, S.Chand & Company Ltd, New Delhi.
4. Sambamurthy, A.V.S.S. and Subramanyam, N.S. 1989. A Text Book of Economic Botany, Wiley-Eastern Ltd., New Delhi.

ReferenceBooks:

1. Colin R.Townsend,2007. Ecological Applications:Towards a Sustainable World,Wiley Blackwell,UK.
2.Kochhar,S.L.1995.Economic Botany in theTropics, Macmillan India Ltd.,Delhi.
3.Sharma,O.P.1996.Economic Botany,Tata McGraw Hill Co.Ltd.NewDelhi.

Web Resources:

1. https://www.coolgalapagos.com/biology/classification_plants.php
2. https://www.bulbapp.com/u/the-five-basic-groups-of-plants
3. https://courses.lumenlearning.com/wmopen-biology2/chapter/seed-plants/
4. https://www.toppr.com/guides/biology/biological-classification/kingdom-plantae/
5. https://www.ncbi.nlm.nih.gov/books/NBK9980/

Course Designer:
Dr.K.Saraswathi

Thiagarajar College (Autonomous): Madurai – 625 009
(Re-Accredited with 'A^{++}' Grade by NAAC)
Department of Botany
(For those joined B.Sc. Zoology on or after June 2020)

Course Code	Course Title	Category	L	T	P	Credit
UBO20GE41Z	Plant Pathology	**Generic Elective Theory**	**4**			**4**

L - Lecture T - Tutorial P - Practical

Year	Semester	Int. Marks	Ext. Marks	Total
II	**IV**	**25**	**75**	**100**

Course Outcomes

On the completion of the course the student will be able to

#	Course Outcome	Expected Proficiency	Expected Attainment
CO1	Know about plant pathology techniques	80%	70%
CO2	Comprehend about epidemiology	70%	70%
CO3	Explore about the genomes	60%	80%
CO4	Recognize the plant disease symptoms	70%	80%
CO5	Enumerate the plant control strategies	80%	70%

Mapping of COs with POs

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

Strong(S), Medium(M), Low(L)

Mapping of COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**L**	**M**	**M**	**L**	**L**
CO2	**L**	**M**	**S**	**M**	**M**
CO3	**M**	**S**	**M**	**M**	**L**
CO4	**M**	**L**	**S**	**S**	**S**
CO5	**S**	**S**	**L**	**L**	**M**

Blooms taxonomy

	CA		End of Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%

Title of the Course: Plant Pathology

Unit I History and importance of Plant pathology, Disease classification and diagnosis, Inoculum, penetration, infection, invasion, and dispersal .Disease development and plant defense mechanism.

Unit II Epidemiology: Severity, progressiveness and decline of epidemics, methods of plant disease forecasting and image processing techniques. Concepts of post-harvest disease management.

Unit III Symptomatology, disease cycle and control measures of 1. Citrus canker 2. Tikka disease of groundnut 3. Cucumber Mosaic virus 4. Mycoplasma - little leaf of Brinjal 5. Red rot of Sugar cane

Unit IV Symptomatology, disease cycle and control measures of 1. Mango nut weevil: *Sternochaetus mangiferae* 2.Cabbage borer: *Hellula undalis*, 3.Hairycaterpillar *Eupterote mollifera* of Drumstick
4. Stem borer of rice *Scirpophaga incertulas* 5.Mealybug- Pseudococcidae

Unit V Strategies for Plant disease control– plant quarantine principles. Crop rotation, field sanitation, soil and seed treatment. Image processing technique for disease detection. Disease Management strategies: physical chemical, and biological. Engineered resistance against fungal, viral and bacterial pathogens.

Text Books:

1. Mehrotra. R.S. 1980. Plant pathology. Tata McGraw Hill, New Delhi.
2. Rangaswamy, G. 1975. Diseases of crop plants in India. 2nd Edn. Prentice Hall, India Books.

References:

1. Bilgrami, K.S. and Dube, H.C. 1976. A text book of modern plant pathology. Vikas Publishing House Pvt. Ltd., New Delhi.
2. Pandey B.P. 1989. A text book of plant pathology, pathogen and plant diseases. S. Chand and Company Ltd., New Delhi.
3. Mukerji, K.G. &Bhasin , J. 1972. Plant diseases of India – A source book.Tata McGraw Hill, New Delhi.

Web Resources:

http://www.ipsdis.org/

Course Designers:

1. Dr. V. Karthikeyan

Thiagarajar College (Autonomous): Madurai – 625 009
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Department of Botany
(For those joined B.Sc. Zoology on or after June 2020)

Course Code	Course Title	Category	L	T	P	Credit
UBO20GL41Z	**Plant Life Forms Plant Pathology Lab**	**Generic Elective Lab**		-	2+2	2

Year	Semester	Int. Marks	Ext.Marks	Total
II	III and IV	40	60	100

Preamble

To make students to be aware of morphological and anatomical variations of various groups of plants

Course Outcomes

On the completion of the Plant Life Forms and Plant Pathology lab course the student will be able to

#	Course Outcome	Expected Proficiency	Expected Attainment
CO1	Identify Algae, Fungi, Lichens, Bryophytes, Pteridophytes and gymnosperms based on their morphology and anatomy	80%	70%
CO2	Distinguish the fossil forms	70%	70%
CO3	Acquire the skill of micro preparation of tender thallus	60%	80%
CO4	Exhibit the economic and yield loss to the plants due to pathological problems	70%	80%
CO5	Analyze various techniques used for disease dispersal	80%	70%

Mapping of COs with POs

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

Strong(S), Medium(M), Low(L)

Mapping of Course Outcomes with Programme Specific Outcomes

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	L	M	L
CO2	S	S	S	S	L
CO3	S	S	M	M	S
CO4	M	S	S	S	L
CO5	S	S	S	M	M

S-Strong M-Medium L-Low

Plant LifeForms Experiments(IIISemester)

1.*Gracilaria*-Morphology and Anatomy of thallus structure
2.*Aspergillus*– Mounting and observation of Conidiophore
3.*Usnea*–Apothecium structure Examination using permanent slide
4.*Marchantia*–Morphology and Anatomy of thallus structure
5. *Lycopodium* - Morphology and Anatomy of sporophyte
6.*Pinus*–Anatomy of needle and morphology of male and female cones
7.Paleobotany–Observation ofCompressionImpressionand petrified fossilspecimens
8.Morphological and floral characteristicstudyusing plant specimens of the families Nymphaceae,Bignoniaceae,Euphorbiaceae and Musaceae
9.Specimens and slides samples pertinent to the syllabus on the economic utilization of plants

Plant Pathology Experiments (IV Semester)

1. Symptomatology study of Bacteria fungi, virus and insects problems of plants
2. Observation of general symptoms
3. Effect of fungicides- dual culture techniques
4. Isolation of plant pathogens from infected plant materials.
5. Isolation of AM spores by wet sieving-decanting method.
6. Study of diseased materials- Rust by Puccinia.
7. Red rust and White rust.
8. Leaf spot of ground nut.

Course Designers
1.Dr. V. Karthikeyan
2.Dr. K. Saraswathi

M.Sc., Botany

Programme Code : PBO

Programme outcome-PO (Aligned with Graduate Attributes)- Master of Science (M.Sc.,)

Knowledge

Acquire an overview of concepts, fundamentals and advancements of science across a range of fields, with in-depth knowledge in at least one area of study. Develop focused field knowledge and amalgamate knowledge across different disciplines.

Complementary skills

Students will be able to engage in critical investigation through principle approaches or methods and through effective information search and evaluation strategies. Employ highly developed conceptual, analytical, quantitative and technical skills and are adept with a range of technologies

Applied learning

Students will be able to apply disciplinary or interdisciplinary learning across multiple contexts, integrating knowledge and practice. Recognize the need for information; effectively search for, evaluate, manage and apply that information in support of scientific investigation or scholarly debate

Communication

Communicate effectively on scientific achievements, basic concepts and recent developments with experts and with society at large. Able to comprehend and write reports, documents, make effective presentation by oral and/or written form.

Problem solving

Investigate, design and apply appropriate methods to solve problems in science, mathematics, technology and/or engineering.

Environment and sustainability

Understand the impact of the solutions in ethical, societal and environmental contexts and demonstrate the knowledge of and need for sustainable development.

Teamwork, collaborative and management skills

Recognize the opportunities and contribute positively in collaborative scientific research. Engage in intellectual exchange of ideas with researchers of other disciplines to address important research issues

Programme Educational Objectives (PEO)M.Sc., Botany Programme

The objectives of this Programme are to equip/prepare the Post Graduates of Botany:

PEO1 To develop competent knowledge in the subject of Plant Sciences, required for in-depth learning and research.

PEO2 To develop diversified basic professional skills through various laboratory technical training, communication and presentation skills.

PEO3 To facilitate the post graduates, with an ability to identify, formulate and solve problems, related to Plants, to contribute to community in both the professional and private realm.

PEO4 To integrate allied topics from the components of the course such as levels of plant organization, cell biology, ecology, evolution, biochemistry, embryology, basic biotechnology, physiology, molecularbiology, and taxonomy for successful career.

PEO5 To be proficient in assessing the scope of applying the gained knowledge in plant sciences, to address scientifically to the benefit of science and community.

Mapping PEOs against POs

PEO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
PEO1	S						
PEO2	S	S	S	S	S		S
PEO3	S	S	S	S	S		
PEO4	S	S	S	S		S	S
PEO5	S		S		S	S	S

Programme specific outcomes(PSOs)M.Sc., Botany

On successful completion of M.Sc., Botany, the students will be able to

PSO1 Carry out a thorough analysis on various plant life forms, using specific identification key characteristic features and also at micro level

PSO2 Comprehend the core concepts of Botany at organizational (both external morphology, internal morphology), cell and molecular levels, through which the developmental and physiological functioningof plants

PSO3 Demonstrate the principles of inheritance, basis for plant breeding, through macro propagation and using plant tissue culture and the latest concepts of molecular biology and biotechnology

PSO4 Exhibit proficiency in the areas of biostatistics and computer applications in modern topics ofLife Sciences

PSO5 Reveal proficient laboratory skills and in contemporary and advance technique

Mapping PEOs against POs

PSO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
PSO1	S						
PSO2			S		S		
PSO3		S					
PSO4	S	S	S	S		S	
PSO5					S	S	

THIAGARAJAR COLLEGE, MADURAI – 9.

(Re-Accredited with 'A++' Grade by NAAC)DEPARTMENT OF BOTANY

Master of Science (M.Sc.,) Botany (w.e.f. 2020-2021 batch onwards)

Programme Code-PBO

Programme Scheme

SEMESTER –I

Course	Code No.	Subject	Contact Hrs/ Week	Credits	Total No of hours allotted	Max. Marks		Total
						CA	SE	
Core - 1	PBO20C11	Plant Diversity	5	4	75	25	75	100
Core - 2	PBO20C12	Plant Biochemistry and Biotechniques	5	4	75	25	75	100
Core - 3	PBO20C13	Developmental Botany	4	4	60	25	75	100
Elective 1	PBO20CE11	Entrepreneurial Botany	5	5	75	25	75	100
Core Lab- 1	PBO20CL11	Plant Diversity Lab	4	2	60	40	60	100
Core Lab- 2	PBO20CL12	Plant Biochemistry and Biotechniques Lab	4	2	60	40	60	100
Core Lab3	PBO20CL13	Developmental Botany lab	3	2	45	40	60	100
		Total	**30**	**23**	**450**	**220**	**480**	**700**

SEMESTER –II

Course	Code No.	Subject	Contact Hrs/ Week	Credits	TotalNo. of hours allotted	Max. Marks		Total
						CA	SE	
Core - 4	PBO20C21	Plant Cell and Molecular Biology	5	4	75	25	75	100
Core - 5	PBO20C22	Microbiology and Plant Pathology	5	4	75	25	75	100
Core - 6	PBO20C23	Computer Applications in Biology and Biostatistics	4	4	60	25	75	100
Elective 2	PBO20CE21	Research Methodology	5	5	75	25	75	100
Core Lab- 4	PBO20CL21	Plant Cell and molecular Biology Lab	4	2	60	40	60	100
Core Lab- 5	PBO20CL22	Microbiology and Plant Pathology Lab	4	2	60	40	60	100
Core Lab 6	PBO20CL23	Computer Applications in Biology and Biostatistics Lab	3	2	45	40	60	100
		Total	**30**	**23**	**450**	**220**	**480**	**700**

SEMESTER –III

Course	Code No.	Subject	Contact Hrs/ Week	Credits	TotalNo.of hours allotted	Max. Marks		Total
						CA	SE	
Core - 7	PBO20C31	Angiosperm Taxonomy	6	5	90	25	75	100
Core -8	PBO20C32	Plant Physiology	6	5	90	25	75	100
Core - 9	PBO20C33	Biophysics and Bioenergetics	4	4	60	25	75	100
Elective - 3 IDC	PZO20CE31 B	Inter Disciplinary Course – Applied Zoology	6	5	90	25	75	100
Core Lab 7	PBO20CL31	Angiosperm Taxonomy Lab	4	2	60	40	60	100
Core Lab 8	PBO20CL32	Plant Physiology Lab	4	2	60	40	60	100
			30	23	450	180	420	600

SEMESTER –IV

Course	Code No.	Subject	Contact Hrs/ Week	Credits	TotalNo.of hours allotted	Max. Marks		Total
						CA	SE	
Core –10	PBO20C41	Plant Biotechnology	6	5	90	25	75	100
Core -11	PBO20C42	Plant Ecology and Environmental Management system	6	5	90	25	75	100
Core - 12	PBOC2043	IPR and Biosafety	4	4	60	25	75	100
Core Lab 9	PBO20CL41	Plant Biotechnology Lab	4	2	60	40	60	100
Core Lab 10	PBO20CL42	Plant Ecology, Environment lab	4	2	60	40	60	100
Elective-4	PBO20PJ41	Project and Viva voce	6	3	90	40	40+20	100
			30	21	450	195	405	600
Total No of Credits 23+23+23+21= 90				**Total Marks = 2600**				

Number Core Theory courses: 12
Number of Core Practical Course: 10
Number of Core Elective Courses: 3 (Including Project)
Number of Interdisciplinary elective Course: 1

Credit Distribution:

I year:	46	Core theory courses:	52
II year:	44	Core lab courses:	20
Total:	**90**	Elective courses:	15
		Project:	3
		Total:	**90**

Theory: Internal: 25 Marks [Assignment 10 marks; Seminar 10 marks; Test 30marks(duration 2hrs). Total marks of 50 reduced to 25].
External: 75 marks (duration 3 hrs).

Practical: Internal: 40 marks (Record 15 marks; Test / Continuous Assessment: 25 marks).
External: 60 marks (duration 3 hrs).

Project: Internal 40 + External 40 + External Viva (closed) 20 = 100.

Interdisciplinary Course: Plant Tissue Culture **(PBO20CE31Z) offered by the Department of Botany to M. Sc., Zoology** students in Semester III

Thiagarajar College (Autonomous): Madurai – 625 009
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Course Code	Course Title	Category	L	T	P	Credit
PBO20C31	**Angiosperm Taxonomy**	**Core-7**	**5**	**1**	**-**	**5**

Preamble

To equip the students with the basic principles of Angiosperm taxonomy, methodologies, techniques pertinent to Angiosperm taxonomy

Course Outcomes

On the completion of the course the student will be able to

#	Course Outcome	Expected Proficiency	Expected Attainment
CO1	Recall the classification of Angiosperm plants	90%	80%
CO2	Demonstrate nomenclature, principles and typification concepts	80%	70%
CO3	Examine polypetalae families, based on their key vegetative and floral characters	80%	80%
CO4	Evaluate the key characteristic features and affinities among the select Gamopetalae Families	80%	80%
CO5	Analyze the Key features of select families of monochlamydeae and monocotyledons group of angiosperms	90%	70%

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	**M**	**S**	**S**	**L**	**S**	**S**
CO2	S	**M**	**S**	**L**	**L**	**L**	**M**
CO3	**L**	**M**	**S**	**L**	S	M	M
CO4	**L**	**S**	**L**	**M**	S	S	S
CO5	**S**	**L**	**M**	**M**	S	S	S

Mapping of COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	**S**	**L**	**S**	**S**
CO2	S	**S**	**L**	**M**	**S**
CO3	**L**	**L**	**L**	**L**	S
CO4	**L**	**L**	**L**	**L**	S
CO5	**S**	**L**	**L**	**L**	S

Blooms Taxonomy			
	CA		End of Semester Marks
	I Internal Marks	II Internal Marks	
Knowledge -K1	15% (9)	15% (9)	20% (30)
Understand -K2	15% (9)	15% (9)	20% (30)
Apply-K3	30% (18)	30% (18)	20% (30)
Analyze-K4	20% (12)	20% (12)	20% (30)
Evaluate-K5	20% (12)	20% (12)	20% (30)
TOTAL	**60**	**60**	**150**

Unit I: Angiosperm classification: Basic principle, outline, merits and demerits for the following Systems: Bentham and Hooker, Charles E. Bessey, Engler and Prantl and Hutchinson. Angiosperm Phylogeny group (APG III, 2009 and updated APG IV 2016): Features, merits and demerits

Unit II: ICBN–Nomenclature Principles–Nyms concept: Synonym, Homonym, Tautonym–Principle of priority – Effective and valid publication – Author citation – Retention and rejection of names; Typification concept and application; Chemotaxonomy and numerical taxonomy – DNA bar coding – Taxonomy data bases.Virtual herbarium

Unit III: Key family characters, floral characters, floral variations, affinities with other familiesand economic importance of the following families, grouped under Polypetalae of dicotyledons: Magnoliaceae, Nymphaceae, Capparidaceae, Sterculiaceae, Sapindaceae, Zygophyllaceae, Rhamnacaeae, Combretaceae, Aizoaceae, Passifloraceae

Unit IV: Key family characters, floral characters, floral variations, affinities with other familiesand economic importance of the following families, grouped under Gamopetalae of dicotyledons: Rubiaceae, Asteraceae, Apocynaceae, Gentianceae, Boraginaceae, Bignonaceae, Scrophulariaceae, Verbenaceae

Unit V: Key family characters, floral characters, floral variations, affinities with other families andeconomic importance of the following families, grouped under Monochlamydeae of Dicots and Monocotyledonous families: Nyctaginaceae, Piperaceae, Loranthaceae, Euphorbiaceae, Typhaceae, Commelinaceae, Araceae, Cyperaceae

Text Books:

1. Vasishta, P.C.1992. Taxonomy of Angiosperms, R.Chand and Co., New Delhi.
2. Lawrence, G.H.M. 1951. Taxonomy of vascular plants. The Macmillion Co., New York.
3. Heywood, V.K. 1967. Plant Taxonomy Edward Arnold Pub.. Ltd. London.
4. Rendle, A.B. 1925. The classification of flowering plants. Vol II Dicotyledons. Cambridge University Press. London.

Reference Books/Research Articles:

1. Simpson, M.G. 2006. Plant Systematics, Academic Press, UK.

2.Pulliah, T. 2007. Taxonomy of Angiosperms, Third Edition, Regency Publication, New Delhi

3. Johri, R.M. 2005. Taxonomy, Vol. I to V, Sonali Publication, New Delhi.

4. Battacharyya, B. 2005. Systematic Botany, Narosa Publishing House, New Delhi

5. Angiosperm Phylogeny Group, 2009. An update of the Angiosperm Phylogeny Group classification for the orders and families of flowering plants: APG III , *Botanical Journal of the Linnean Society,* **161**(2): 105–121, doi:10.1111/j.1095-8339.2009.00996

E-Book

O.P. Sharma, Plant Taxonomy (2nd. Ed.), Tata- McGraw Hill Publishers, New Delhi (Open source; www.libgen.org

Course Designed by:

Dr. D. Kannan

Thiagarajar College (Autonomous): Madurai – 625 009
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Department of Botany
(For those joined M.Sc. Botany on or after June 2020)

Course Code	Course Title	Category	L	T	P	Credit
PBO20CL31	**Angiosperm Taxonomy Lab**	**Core Lab-7**		**-**	**4**	**2**

Preamble

To equip the students with the practical knowledge in Angiosperm taxonomy and to develop skills in plant identification using keys and monographs, with the relevance of regional plant groups

Course Outcomes

On the completion of the course the student will be able to

#	Course Outcome	Expected Proficiency	Expected Attainment
CO1	Identify and explain in technical terms of the plants of Polypetalae families	90%	80%
CO2	Characterize the plants of Gamopetalae	80%	70%
CO3	Explain key features of Monochlamydeae and Monocotyledons	80%	80%
CO4	Prepare yoked and indented key for plant identification	80%	80%
CO5	To prepare herbarium sheets	90%	70%

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	**M**	**S**	**S**	**M**	**M**	**S**
CO2	S	**M**	**S**	**L**	**M**	**S**	**S**
CO3	**M**	**M**	**S**	**L**	S	S	S
CO4	**L**	**S**	**L**	**M**	S	L	S
CO5	**S**	**S**	**M**	**M**	S	S	S

Mapping of COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	**S**	**L**	**L**	**S**
CO2	S	**S**	**L**	**L**	**S**
CO3	**S**	**S**	**L**	**L**	S
CO4	**S**	**S**	**L**	**M**	S
CO5	**S**	**S**	**L**	**L**	S

Course Designed by:

Dr. D. Kannan

PRACTICALS

1) Identification of the family for the given fresh plant specimen by describing the key morphological and floral characters with diagrams and constructing the floral formula of Plants belong to Polypetalae of Dicots:

Magnoliaceae, Nymphaceae, Capparidaceae, Sterculiaceae, Sapindaceae, Zygophyllaceae, Rhamnacaeae, Combretaceae, Aizoaceae, Passifloraceae

Plants belong to Gamopetalae of Dicots: Rubiaceae, Asteraceae, Apocynaceae, Gentianceae, Boraginaceae, Bignonaceae, Verbanaceae

Plants belong to Monochlamydeae of Dicots, and Moncots: Nyctaginaceae, Piperaceae, Loranthaceae, Euphorbiaceae, Typhaceae, Commeliniaceae, Araceae, Cyperacaeae

2) Preparation of Yoked and Indent keys for the given plants to group them into Generic level taxon

3) Identification of the given fresh plants using Presidency of Madras by Gamble (3 Vols.)

4) Identification of the family for a given fresh plant specimen, using Punch Cards

5) Solve the taxonomic problem, based on *Nyms* concept

6) Identify the binomial for the given two fresh plant specimens/herbarium prepared by students

7) Submission of i) Records, ii) Field observation note and iii) minimum of 20 Herbarium sheets stacked with the dried plant specimen with appropriate identification label for external evaluation.

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Course Code	Course Title	Category	L	T	P	Credit
PBO20C32	Plant Physiology	Core - 8	5	1	-	5

Year	Semester	Int. Marks	Ext. Marks	Total
Second	Third	25	75	100

Preamble

To equip the students with the basic principles of plant physiology, mechanisms and hormones involved pre and post reproduction

Prerequisite

Students should complete the course on basics of plant physiology in their undergraduate level.

Course Outcomes

On the completion of the course the student will be able to

#	Course Outcome	Expected Proficiency	Expected Attainment
CO1	Demonstrate the principle involved in water movement and ascent of sap in plants	90%	80%
CO2	Examine the plant cellular metabolism	80%	70%
CO3	Relate the physiological functional analysis and plant growth with relevance to plant growth regulators	80%	80%
CO4	Apply the acquired knowledge in solving the problems with relevance to dormancy, senescence and fruiting in plants	80%	80%
CO5	Analyze the stress related growth and functions in plants	90%	70%

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	L	M	M	L
CO2	S	M	S	L	S	S	M
CO3	M	M	S	M	S	S	L
CO4	S	S	S	S	S	M	M
CO5	S	S	S	M	S	M	S

Strong(S), Medium (M), Low (L)

Mapping of COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	L	S	L	L	L
CO2	S	S	M	L	M
CO3	S	S	L	L	M
CO4	L	S	M	L	M
CO5	L	S	M	L	M

Strong(S), Medium (M), Low (L)

Blooms taxonomy

	CA		End of Semester
	First	**Second**	
Knowledge – K1	15% (9)	15% (9)	20% (30)
Understand – K2	15% (9)	15% (9)	20% (30)
Apply – K3	30% (18)	30% (18)	20% (30)
Analyze – K4	20% (12)	20% (12)	20% (30)
Evaluate – K5	20% (12)	20% (12)	20% (30)
TOTAL	**60**	**60**	**150**

Title of the Course : Plant Physiology

Unit I: Water relation in plants: Mechanism –Ascent of sap, SPAC, apoplast and symplast concepts; Transpiration: Stomatal physiology and mechanism – Transpiration and guttation. Plant Nutrition: Mineral nutrients and its growth, metabolic and physiological role and deficiency symptoms in plants Absorption of mineral salts – Active and passive transport mechanism and theories-Solute Translocation –Source-sink theory; mechanism of organic solute transport - pressure flow, Munch hypothesis .

Unit II : Cellular Metabolism - Photosynthesis: Chloroplast and Pigment systems in Photosystem I and Photosystem II – light reaction – Z – scheme of photosynthetic electron transport chain and cyclic and non-cyclic photophosphorylation mechanisms – Carbon assimilation C3, C4 and CAM pathways – Photorespiration and its significance. Respiration: Mitochondria and its functions-Glycolysis and TCA cycle – Oxidative Phosphorylation – alternative respiration (Cyanide) – HMP pathway-Nitrogen, Phosphorus and sulphur metabolism.

Unit III: Plant Growth Regulators -: Structure, Physiological role and mode of action (in brief) of Auxins, Cytokinis,Gibberellins, and Brassinosteroids – Growth retardants – Abscissic acid,Ethylene, polyamines, and morphactins. Phytochromes: Photochemical and biochemical properties, photomorphogenetic effects, mode of action. Flowering :Photoperiodism– Short day, long day and day neutral plantsPr and Pfr role and its significance, -– regulation of flowering.

Unit IV: Dormancy- causes and methods,Vegetative tissue and Seeds,. Seed germination – hormonal regulation of germination and dormancy. Senescence : Physiology of senescence,Types of Senescence – Fruiting– mechanism of fruiting –role of ethylene- hormonal control of fruiting and storage of fruits.

Unit V: Stress Physiology : Classification of stress – response of plants to salt, heavy metals, drought, freezing, heat, oxidative and UV stresses – mechanism of stress resistance. Biological rhythms: Endogenous clock mechanism – Circadian rhythm.

Text Books:

1. Kumar, A. and S.S.Purohit. 2005. Plant physiology, Agrobios (India), Jodhpur.
2. Mukherji S. and A.K. Ghosh. 2005. Plant Physiology, First Central Edition. New Central Book Agency (P) Ltd., Kolkata.
3. Noggle, G.R. and G.J. Fritz. 1986. Introductory Plant Physiology. Prentice – Hall India Pvt. Ltd., New Delhi.
4. Taiz. L. and E. Zeiger. 2003. Plant Physiology, Third Edition, Panima Publishing Corporation, New Delhi.
5. Salisbury, F.B. and C.N. Ross. 2003. Plant physiology, CBS Publishers and Distributors, New Delhi.

References:

1. Bidwell, R.G.S., 1979. Plant Physiology, Second Edition, McMillan Publishers, New York.
2. Goodwin, F.W. and F.I. Mercer. 1983. Introduction to Plant Biochemistry, Second Edition, Pergamon Press, New York.

3. Wilkins, M.B. 1984. Advanced Plant Physiology, Pitman Publication Limited, London.
4. Hopkins, W.G. 1995. Introduction to Plant Physiology. John Wilery& Sons Inc., USA.
5. Zeiger, L.T.E. 2010. Plant physiology, Sinauer Associates, UK.
6. Nobel, P.S. 2009. Physicochemical and Environmental Plant Physiology, Fourth Edition. Academic press, U.K.

Web Resources:

1.www.plantphysiol.org
2.6e.plantphys.net

Course Designers:

Dr.R.Aruna
Dr.T.M.Jothimani

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Course Code	Course Title	Category	L	T	P	Credit
PBO20CL32	**Plant Physiology Lab**	**Core Lab-8**	**-**	**-**	**4**	**2**

L - Lecture T - Tutorial P - Practicals

Year	Semester	Int. Marks	Ext. Marks	Total
Second	Third	**40**	**60**	**100**

Preamble

To equip the students with the basic principles of plant physiology, mechanisms and hormones involved pre and post reproduction

Prerequisite

Required basic knowledge about plant movements, growth and development Students are able to distinguish the plant hormones and pigments

Course Outcomes

On the completion of the course the student will be able to

#	Course Outcome	Expected Proficiency	Expected Attainment
CO1	Demonstratethe principle involved in ascent of sap in plants	90%	80%
CO2	Estimate the pigment contents in leaves	80%	70%
CO3	Find out the stomatal frequency	80%	80%
CO4	Calculate the proline contents in stressed plants	80%	80%
CO5	Analyze the absorption spectrum of plant pigments	90%	70%

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	**S**	**L**	**M**	**L**	**M**	**M**	**S**
CO2	**S**	**S**	**S**	**M**	**L**	**M**	**L**
CO3	**S**	**S**	**M**	**L**	**M**	**L**	**L**
CO4	**S**	**M**	**S**	**S**	**S**	**S**	**S**
CO5	**M**	**M**	**S**	**M**	**S**	**S**	**M**

Strong(S), Medium (M), Low (L)

Mapping of COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**L**	**S**	**S**	**S**	**M**
CO2	**S**	**S**	**M**	**L**	**M**
CO3	**S**	**S**	**L**	**S**	**M**
CO4	**L**	**S**	**M**	**L**	**M**
CO5	**L**	**S**	**M**	**S**	**M**

S:Strong M: Medium L: Low

Experiments

1. Water potential by gravimetric method.
2. Water potential by falling drop method.
3. Osmotic potential by plasmolytic method.
4. Quantitative estimation of total chlorophyll content in leaves.
5. Quantitative estimation of carotenoid content in flowers
6. Absorption spectrum of chlorophylls and Action spectrum of Photosynthesis
7. Absorption spectrum of β – carotene.
8. Effect of temperature on membrane permeability
9. Effect on detergent on membrane permeability
10. Estimation of proline content in normal and senescent leaves
11. Estimation of Phosphorus in the root and leaf samples
12. Determination of Nitrate reductase activity of the leaf and root samples.
13. Measurement of Stomatal Index of dicot and monocot leaf samples
14. Measurement of Stomatal area
15. Mesophyll cell isolation and chlorophyll fluorescence
16. Differentiation of C3and C4 plants by starch test.

Course Designer:

1. Dr.R.Aruna
2. Dr.T.M.Jothimani

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Course Code	Course Title	Category	L	T	P	Credit
PBO20C33	**Biophysics and Bioenergetics**	**Core - 9**	**4**	**-**	**-**	**4**

Year	Semester	Int. Marks	Ext. Marks	Total
Second	**Third**	**25**	**75**	**100**

Preamble

To equip the students with the basic principles of Biophysics, Energetics of Biological reactions

Course Outcomes

On the completion of the course the student will be able to

#	Course Outcome	Expected Proficiency	Expected Attainment
CO1	Demonstrate the principles involved light energy and Redox potential	90%	80%
CO2	Analyze the Biophysical Properties of water	80%	70%
CO3	Explain the Laws of thermodynamics	80%	80%
CO4	Relate the structure of mitochondria and its functions	80%	80%
CO5	Apply the acquired knowledge in solving the problems related to energetics of Lipid and amino acid metabolism	90%	70%

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	**S**	**S**	**S**	**L**	**M**	**M**	**L**
CO2	**S**	**M**	**S**	**L**	**S**	**S**	**M**
CO3	**M**	**M**	**S**	**M**	**S**	**S**	**L**
CO4	**S**	**S**	**S**	**S**	**S**	**M**	**M**
CO5	**S**	**S**	**S**	**M**	**S**	**M**	**S**

Strong(S), Medium (M), Low (L)

Mapping of COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**L**	**S**	**L**	**L**	**L**
CO2	**S**	**S**	**M**	**L**	**M**
CO3	**S**	**S**	**L**	**L**	**M**
CO4	**L**	**S**	**M**	**L**	**M**
CO5	**L**	**S**	**M**	**L**	**M**

Strong(S), Medium (M), Low (L)

Blooms taxonomy

	CA		End of Semester
	First	Second	
Knowledge – K1	15% (9)	15% (9)	20% (30)

Understand – K2	15% (9)	15% (9)	20% (30)
Apply – K3	30% (18)	30% (18)	20% (30)
Analyze – K4	20% (12)	20% (12)	20% (30)
Evaluate – K5	20% (12)	20% (12)	20% (30)
TOTAL	**60**	**60**	**150**

Title of the Course : Biophysics and Bioenergetics

Unit: I Light –sources and properties of light – solar energy – electromagnetic spectrum – UV – white light – IR and other forms –Absorption and transmittance – active and action spectrum – ground and excitation state – electron transfer – redox potential – oxidation and reduction system.

Unit:II Water: Physicochemical properties of water, Molecular structure, Nature of hydrophobic interactions. Solutes: Small Hydrophilic and Hydrophobes, Large Hydrophobic Solutes and Surfaces, Aqueous Environment of the Cell, State of water in bio- structures & its significance

Unit:III Thermodynamics and Bioenergetics. Laws of thermodynamics, concept of free energy, Entropy, Negative entropy change in living system, Energy generation & energy transfer processes in biochemical reactions. Energy requirements in cell metabolism,

Unit:IV Structure & role of mitochondria, High energy compounds in biological system, ATP and phosphoryl group transfers, Metabolism of glucose & formation of ATP, Chemi-osmotic theory, Redox potential in biological system, Oxidation- reduction reactions: FAD+ and NAD+. Overview of major metabolic pathways- Glycolysis, Kreb's cycle, oxidative phosphorylation, electron transport chain, Constituents of ETC & their sequence.

Unit:V.

Bioenergetics and intermediary metabolism; Oxidative degradation of fatty acids and amino acids , Correlation between carbohydrates, amino acids and fatty acid degradation, anabolic pathways.

Text Books

1. Taiz, L. and Zeiger, E. (2010). Plant Physiology. Sinauer Associates, India. 9.
2. Verma, S.K. (1999). Plant Physiology. S. Chand & Co., New Delhi. 1. Casey, E.J. (1962). Biophysics: Concepts and Mechanics. Van Nostrand Reinhold Co. and East-West Press, New Delhi.
3. Salil Bose, S. (1982). Elementary Biophysics. Vijaya Printers, Madurai.
4. Elachi, C. 1978. Introduction to Physics and Techniques of Remote sensing. John Wiley Publication.

Reference Books

1. Robert K Murray, David A Bender, Kathleen M Botham, Peter J Kennelly, Victor W Rodwell, P Anthony Weil (2009). Harper's Illustrated Biochemistry (27th ed.). McGraw Hill, New Delhi.
2. Salisbury, F.B. and Ross, C.W. (1992). Plant Physiology. Wadsworth Publishing Company, Belmont, California, USA.
3.Lehninger, A.L. (1971). Bioenergetics: The Molecular Basis of Biological Energy Transformation. Addison Wiley.

Course Designers: **Dr.E.Mohan**
Dr.K.Jegatheesan

Thiagarajar College (Autonomous): Madurai – 625 009
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Course Code	Course Title	Category	L	T	P	Credit
PBO20C41	Plant Biotechnology	Core-10	5	1	-	5

L - Lecture T - Tutorial P - Practicals

Year	Semester	Int. Marks	Ext. Marks	Total
II	IV	25	75	100

Preamble

To equip the students with the basic principles of Biotechnology, methodologies, techniques applied aspects of Biotechnology.

Course Outcomes

On the completion of the course the student will be able to

#	Course Outcome	Expected Proficiency	Expected Attainment
CO1	Perform the techniques involved in plant genetic engineering	90%	80%
CO2	Explain the transgenic plants and plant tissue culture experiments	80%	70%
CO3	Apply the knowledge of biotechnology in exploitation of plants for human welfare	80%	80%
CO4	To know about the applications of Biotechnology	80%	80%
CO5	Study about industrial applications of Biotechnology	90%	70%

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	L	M	M	L
CO2	S	M	S	L	S	S	M
CO3	M	M	S	M	S	S	L
CO4	S	S	S	S	S	M	M
CO5	S	S	S	M	S	M	S

Strong(S), Medium (M), Low (L)

Mapping of COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	L	S	L	L	L
CO2	S	S	M	L	M
CO3	S	S	L	L	M
CO4	L	S	M	L	M
CO5	L	S	M	L	M

Strong(S), Medium (M), Low (L)

Blooms taxonomy

	CA		End of Semester
	First	**Second**	
Knowledge – K1	15% (9)	15% (9)	20% (30)
Understand – K2	15% (9)	15% (9)	20% (30)
Apply – K3	30% (18)	30% (18)	20% (30)
Analyze – K4	20% (12)	20% (12)	20% (30)
Evaluate – K5	20% (12)	20% (12)	20% (30)
TOTAL	**60**	**60**	**150**

Title of the Course : Plant Biotechnology

Unit I: Genetic Engineering: Scope, applications and limitations. Tools: Type-I, II and III Restriction Endonucleases, Modification Methylases, Alkaline phosphatases, Ligases, Reveresetranscriptases. Vector: Plasmid and Bacteriophage vectors. Transformation Techniques: Transformation, transduction and conjugation.: Selection of recombinant clones: Insertional inactivation and Replica plating .

Unit II: Plant Tissue culture: Totipotency and plasticity, Media preparation (MS medium), Applications of plant tissue culture, Explants preparation, Culture types: Callus culture , suspension culture, Meristem culture, Anther and Embryo culture , Micropropagation, Organogenesis, Somatic hybridization, Somatic embryogenesis, protoplast isolation and protoplast fusion and Germplasm conservation.

Unit III: Agricultural Biotechnology: Transgenic plants: Diseases resistance- Bt Cotton, strain improvement – Golden rice. Molecular farming: Plantigens, Plantibodies, Edible Vaccines, Bioplastics. Biofertilizers: Mass cultivation and application of nitrogenous and phosphatic biofertilizers- Rhizobium and Azospirilum , AM fungi and Psedeuomonas Applications of Biotechnology in crop improvement: Antisense RNA Technology-Flavr savr, Terminator seed Technology – Role of MNCs in Agribusiness.

Unit IV: Industrial Biotechnology: Fermentor- Structure, Design and Types - Microbial fermentation process: Production of industrial alcohol, wine, beer. Production of Amino acids - Glutamic acid, Production of organic acids- Citric acid, Production of Industrial enzymes- Amylases and proteases. Production of Antibiotics- Penicillin, Streptomycin. Bacterial biomass-Lactobacillus, Spirulina for Single cell protein. Production of dairy products- Cheese

Unit V: Environmental Biotechnology : Biodegradation and Bioconservation. Biomass and Bioenergy: Petrocrops (Euphorbia, Hevea rubber, Algal hydrocarbons), Gasification, pyrolysis. Biofuels: Photobiological hydrogen production. Biogas: Models of biogas plants, Mechanisms and techniques of biogas production, Bio dyes. Sewage and effluent treatment: Activated sludge treatment

Reference

Text books:

1. Kumar H.D. 2001. A textbook on Biotechnology. East-west Press, New Delhi.
2. Dubey, R.C.2002. A textbook of Biotechnology. S. Chand and Company, New Delhi.
3. Ignacimuthu, S.J. 1997. Plant Biotechnology. Oxford and IBH Publishing Company, New Delhi.
4. Nirmala,C.B., G. Rajalakshmi, Chandra Karthick. 2009. Plant Biotechnology. MJP publishers, Chennai
5. Singh,R. 2011. ―Plant Biology and Biotechnology‖ , Educational Publishers and Distributors, New Delhi.
6. Smith , R. H . 2000 ―Plant Tissue Culture - Techniques and Experiments‖ , Academic Press, New York.
7. Trivedi, P.C. 2010. ―Plant Tissue Culture and Biotechnology‖ , Second Edition, Pointer Publication, Jaipur. 915

8. Rana, S.V.S. 2012. ―Biotechnology-Theory and practical‖ , Third Edition, Elective Press, Meerut. 9. Gupta, P. K . 2000. Elements of Biotechnology, Rastogi Publications, Meerut.

Reference books:

1. Subba Rao, N.S. 2001. Soil Microbiology, Oxford and IBH Publishing Company, New Delhi
2. Yeoman, J.R.M.M. 1982. Cell and Tissue culture, Narosa Publishing House. New Delhi
3. Chawla, H.S. 2008. Introduction to plant Biotechnology. Oxford & IBH publishing co., Pvt.Ltd. New Delhi.
4. Glick, B.R. and J.J. Pasternak. 2003. Molecular Biotechnology – Principles and Applications of Recombinant DNA, Third Edition, ASM Press, Washington, USA
5. Primrose, S., R.Twyman and P.Old.2005. Principles of Gene Manipulation, Blackwell Science Ltd, Oxford.

Course Designer: Dr.M.Viji

Thiagarajar College (Autonomous): Madurai – 625 009
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Course Code	Course Title	Category	L	T	P	Credit
PBO20CL41	Plant Biotechnology Lab	**Core Lab- 9**	-	-	**4**	**2**
Year	Semester	Int.Marks	Ext.Marks	Total		
Second	Four	**40**	**60**	**100**		

Preamble

To acquire practical knowledge of Biotechnology

Course Outcomes

On the completion of the course the student will be able to

#	Course Outcome	Expected Proficiency	Expected Attainment
CO1	To study basic techniques in Biotechnology	90%	80%
CO2	Demonstration about Biofertilizers, vermicomposting	80%	70%
CO3	Study about Immobilization technique	80%	80%
CO4	Isolation of nitrogen fixing bacteria, cellulolytic organisms, protoplast	80%	80%
CO5	Production of citric acid and Fermentation by Yeast	90%	70%

Mapping of COs with POs

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

Mapping of COs with PSOs

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

List of Experiments

1. Fermentation by Yeast – Estimation of alcohol content.
2. Citric acid production by *Aspergillus niger* - Estimation of citric acid content.
3. Isolation of cellulolytic organisms by enrichment culture method.
4. Isolation of Amylase producing organisms.
5. Measurement of yeast biomass production by turbidity method. .
5. Immobilization of microbes in calcium alginate beads.
6. Effect of biofertilizers on plant growth and biomass.
7. Seed pelleting with Biofertilizers .

8. Isolation of nitrogen fixing bacteria from soil.
9. Isolation of and phosphate solubilizing bacteria from soil
10. Demonstration of Vermicomposting.
11. Induction of callus in *Daucas, Datura* and *Nicotiana*
12. Isolation of Protoplasts and protoplast fusion
13. Cell suspension culture

Course Designer: Dr.M.Viji

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Course Code	Course Title	Category	L	T	P	Credit
PBO20C42	Plant Ecology and Environmental Management System	**Core - 11**	**5**	**1**	**-**	**5**

Preamble

To facilitate the students to practice with Ecological Concepts and to learn the Environmental Management Process to have a holistic knowledge and to develop skills to address the local, regional, national and global environment related issues

Course Outcomes

On the completion of the course the student will be able to

#	Course Outcome	Expected Proficiency	Expected Attainment
CO1	Reveal the facts related to environmental components	90%	80%
CO2	Identify values of biodiversity and to evolve conservation strategies	80%	70%
CO3	Comprehend the natural and anthropogenic risks related to environment	80%	80%
CO4	Comprehend the facts on Natural and Man-made disasters and to understand the possible mitigation and rehabilitation	80%	80%
CO5	Evaluate the Environmental Impact Assessment process and apply the knowledge in EIA preparation for various industrial projects	90%	70%

Mapping of COs with Pos

#	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	**L**	**M**	**M**	**S**	**S**
CO2	S	S	**L**	**M**	S	S	S
CO3	**M**	**L**	S	S	**M**	**S**	**S**
CO4	**M**	**L**	S	S	S	S	S
CO5	**L**	**M**	S	S	S	S	S

Mapping of COs with PSOs

#	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	L	**L**	**M**	**S**
CO2	S	L	**L**	**L**	S
CO3	**L**	**L**	S	M	**L**
CO4	**L**	**L**	S	S	S
CO5	**L**	**L**	S	S	S

Blooms Taxonomy			
	CA		End of Semester Marks
	I Internal Marks	II Internal Marks	
Knowledge -K1	15% (9)	15% (9)	20% (15)
Understand -K2	15% (9)	15% (9)	20% (15)
Apply-K3	30% (18)	30% (18)	20% (15)
Analyze-K4	25% (12)	20% (12)	20% (15)
Evaluate-K5	15% (12)	20% (12)	20% (15)
TOTAL	**60**	**60**	**130**

Unit I: Basic concepts in Ecology: Ecosystem Dynamics –Components explaining the functioning of ecosystem - biosphere–biotic interactions; Ammensalism, Commensalism, Predation, Symbiosis, Parasitism –habitat and niche – ecosystem structure and function: Grassland, pond and estuarine – Mineral cycling: carbon, nitrogen and phosphorus; role in ecological stability and contribution to climate change – ecological succession: concept – categories - significance

Unit II: Population and Community Ecology: Characteristics of a population–population growth curves – population regulation – life history strategies (r and k selection) – Communities; nature and structural attributes – methods of studying floristic communities – Quadrat and transect methods – Physiognomy classification of vegetation community – Phyto diversity indices: Jaccard's Similarity Co-efficient, Berger and Parker Index, Shannon's Diversity Index, Simpson's Dominance Index, and Margalef's Richness Index.

Unit III: Biodiversity and Conservation: Categories of biodiversity–species concepts: keystone, flagship, dominant and co-dominant – Biogeography: Major terrestrial biomes –Biogeographical zones of India – Biodiversity Conservation- Principle and Approaches: *In-situ* conservation: National parks, Wildlife Sanctuaries, Biosphere reserves; *Ex-situ* conservation: Arboretum and Botanical Garden, zoological parks; Legislative Measures - Environmental (Protection Act), 1984, Biodiversity Act 2010.

Unit IV: **Environmental and Man-made Disasters and Mitigation**: Natural - Strom and cyclones Floods, El-nino, *La-Nina*, Tsunami, Forest fire and Landslides Climate Change due to natural causes and anthropogenic activities – Land-use pattern change, natural habitat destruction, Urbanization, Uncontrolled domestic and industrial pollution. Nuclear Reactor Accidents and explosion - Chernobyl disaster; Oil spills in ocean and coastal regions; Natural resources, and biodiversity exploitation – Disaster warning, mitigation and rehabilitation – Case studies on *Gaja* Cyclone 2018, *Nivar* Cyclone 2020 and mitigation activities, rescue operations.

Unit V: EIA and Environmental Activism – EIA- Basics, Concept and Evolution; Categories- Rapid ElA, Comprehensive EIA, Strategic EIA, Data Collection, EIA Assessment: Air, water, land quality changes, Biodiversity loss and disruption, Noise disruption; Socioeconomic and cultural Impacts, Health impacts EIA case studies: Mining projects, Nuclear power projects, Chemical Dyeing and distillery industries Environmental Activism - Community Participation against man-made disasters through case studies in Koodankulam power plant; Individual's Movement - Medha Patkar on Narmadha Sarovar Project; successful activity - Molai Forest Maker - Jadav Payeng

Text Books:

1. Subramanyam, N.S. and A.V.S.S. Sambamurthy. 2000. Ecology, Narosa Publishing House, New Delhi.
2. Chiras, D.D. 2012. Environmental Science, 9th edition, Jones and Bartlett India Pvt.Ltd., New Delhi.
3. Verma, P.S. and V.K. Agarwal. 2006. Cell Biology, Genetics, Molecular Biology, Evolution and Ecology, S.Chand& Company Ltd., New Delhi.
4. Krishnamurthy, K.V. 2004. Text Book of Biodiversity, Oxford and IBH Publishing Company Pvt. Ltd, New Delhi.
5. Dobzhansky, T., F.J. Ayala, G.L.Stebbins and J.W. Valentine. 1973. Evolution, Surjeet Publications, Delhi.
6. Bhatta, B. 2009. Remote Sensing and GIS, Oxford University Press, New Delhi.
7. A. K. Shrivastava, 2003. Environmental Impact Assessment, , APH Publishing Corporation, New Delhi.

Reference Books:

1. Peter Stiling, 2002. Ecology, Theories and Applications, Prentice-Hall of India, New Delhi.
2. Jeffries, M.J. and M.J. Jeffries. 2005. Biodiversity and Conservation, Routledge Taylor & Francis Group, UK.
3. Saha, T.K. 2011. Ecology and Environmental Biology, Books and Allied (P) Ltd, Delhi.
4. Townsend, C.R., M. Begon and J.L.Harper, 2000. Essentials of Ecology, Blackwell Publishing Company, USA.
5. Russell, P.J., S.L.Wolfe, P.E. Hertz, C.Starr and Mcmillan.2008. Ecology, Cengage Learning India Pvt. Ltd, New Delhi.

Training Material / E-learning Material

1. EIA Training Resource Material, UNEP Publications (2000) https://wedocs.unep.org/bitstream/handle/20.500.11822/26503/EIA_Training_Resource_Manual.pdf?sequence=1&isAllowed=y
2. https://en.wikipedia.org/wiki/Jadav_Payeng

Course Designer:

1. Dr. D. Kannan

Thiagarajar College (Autonomous): Madurai – 625 009
(Re-Accredited with 'A^{++}' Grade by NAAC)
Department of Botany
(For those joined M.Sc. Botany on or after June 2020)

Course Code	Course Title	Category	L	T	P	Credit
PBO20CL42	Plant Ecology and Environmental Management System Lab	**Core Lab- 10**	**-**	**-**	**4**	**2**

Preamble

To facilitate the students to realize the components, their progress, current status and solutions to environment related issues

Course Outcomes

On the completion of the course the student will be able to

#	Course Outcome	Expected Proficiency	Expected Attainment
CO1	Estimate the physical and chemical qualities of water	90%	80%
CO2	Evaluate the physical and chemical qualities of soil	80%	70%
CO3	Examine biodiversity indices	80%	80%
CO4	Identify Environmental and Man-made disasters	80%	80%
CO5	Application of knowledge in the preparation of EIA report	90%	70%

Mapping of COs with POs

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	S	S	**M**	**M**	**M**	**S**	**S**
CO2	S	S	**M**	**M**	S	S	S
CO3	**M**	**L**	S	S	**M**	**S**	**S**
CO4	**M**	**M**	L	S	S	S	S
CO5	**L**	**M**	S	S	S	S	S

Mapping of COs with PSOs

	PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	L	L	**L**	**M**	**S**
CO2	L	L	**L**	**M**	S
CO3	**S**	**L**	L	S	**S**
CO4	**M**	**L**	L	S	S
CO5	**L**	**L**	L	S	S

Experiments

1. Water analysis: Salinity, Alkalinity, BOD, DO, free CO_2 and productivity
2. Soil analysis: Soil moisture, Soil pH, Organic Carbon ,
3. Vegetation analysis using Quadrat and Transect (Line & Belt) method. Calculation of Frequency, Abundance and Density
4. Classification of plant life-forms using Raunkaier's frequency class distribution.
5. Determination of Biodiversity indices: Shannon's – Weiner index, Simpson's index, Jaccard's Similarity co-efficient and Margleaf's Species Richness index
6. Construction of Survivorship curve using available data
7. EIA report on any developmental project / contaminated site / industrial operation.

Submission

1. Record Note
2. Report on case study on environmental management system

Comprehensive *Viva-voce*

Course Designer:
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Course Code	Course Title	Category	L	T	P	Credit
PBO20C43	**IPR AND BIOSAFETY**	**L**	**4**	**-**	**-**	**4**

L - Lecture T - Tutorial P - Practicals

Year	Semester	Int. Marks	Ext. Marks	Total
II	**IV**	**25**	**75**	**100**

Preamble

To facilitate students to know the basic concepts of IPR and Biosafety.

Course Outcomes

On the completion of the course the student will be able to

#	Course Outcome	Expected Proficiency	Expected Attainment
CO1	Acquire knowledge on various concepts of IPR.	90%	80%
CO2	Apply the knowledge of Patenting.	80%	70%
CO3	Analyze the concepts of copyright	80%	80%
CO4	Make use of knowledge in trademark and practices	80%	80%
CO5	Evaluate biosafety measures	90%	70%

Mapping of COs with POs

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

Strong(S), Medium(M), Low(L)

Mapping of COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**S**	**M**	**S**	**S**	**S**
CO2	**S**	**L**	**M**	**S**	**S**
CO3	**S**	**M**	**S**	**M**	**S**
CO4	**S**	**L**	**M**	**S**	**M**
CO5	**S**	**M**	**S**	**S**	**S**

Blooms taxonomy

	CA		End of Semester
	First	**Second**	
Knowledge	15% (9)	15% (9)	20% (30)
Understand	15% (9)	15% (9)	20% (30)
Apply	30% (18)	30% (18)	20% (30)
Analyze	20% (12)	20% (12)	20% (30)
Evaluate	20% (12)	20% (12)	20% (30)
	60	**60**	**150**

Title of the paper: IPR and Biosafety

Unit I: Principles of IPR - Introduction to Intellectual Property Rights - Concept and Theories - Kinds of Intellectual Property Rights - Need for Private Rights versus Public Interests - Advantages and Disadvantages of IPR.

Unit II: Patent law and Practices - Introduction to Patents - Concepts, Novelty, Utility, Inventiveness, Patent Act 1970 –Recent amendments - Patentable and non-Patentable inventiond ; Pharmaceutical products, Software, Micro-organism - Rights of patentee - Procedure for granting a patent and obtaining patents - Working of Patents, Compulsory License, Acquisition, Surrender, Revocation, restoration, Transfer of patent rights.

Unit III: Copyright and Practices: Concept and Principles - Copyright Law - Universal Copyright Convention, International Copyright Act - Copyright Act, 1957 - Terms and conditions for grant of copyright - extent of rights exception to copyright protection, - licensing.

Unit IV: Trademark and Practices –Introduction of the trademark and trade secret -Need for Protection. Kinds of trademarks, Concept of Well known trademark, Registration of trademark - registration of trademark.

Unit V: Bio-safety: Introduction - Institutional biosafety Committee (IBSC) – Functions of IBSCs – Organization network.- National Good Laboratory Practice Programme – GLP authority functions – standard tests for clinical trials.

Text Books:

1. Senthil Kumar Sadasivam and Mohammed Jaabir M. S. (2008). IPR, Biosafety and Biotechnology Management, Jasen Publications, India
2. N.S. Gopalakrishnan& T.G. Agitha, Principles of Intellectual Property (2009), Eastern Book Company, Lucknow
3. DeepaGoel and ShominiParashar IPR, Biosafety and Bioethics (2013), Pearson Publishers.

References:

1. Brian C. Reid, A Practical Guide to Patent Law, 2nd Edition, 1993
2. BAREACT, Indian Patent Act 1970 Acts & Rules, Universal Law Publishing Co. Pvt. Ltd., 2007

Web Resources:

1. https://www.coursera.org/learn/patenting-bio-ipr
2. https://onlinecourses.nptel.ac.in/noc20_bt42/preview
3. http://web.princeton.edu/sites/ehs/biosafety/biosafetypage/section 3.html
4. http://www.cbd.int/biosafety/background.shtml

Course Designers:

1.Dr.E.Mohan
2.Dr.R.Aruna

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(For those joined M.Sc. Zoology on or after June 2020)

Course Code	Course Title	Category	L	T	P	Credit
PBO20CE31Z	**Plant Tissue Culture**	**Elective – 3 Inter-Disciplinary Course**	**5**	**1**	**-**	**5**

Year	Semester	Int. Marks	Ext.Marks	Total
Second	Third	25	75	100

Preamble
To equip the students with the basic principles of plant tissue culture

Course Outcomes
Upon successful completion of the course students will be able to

#	Course Outcome	Expected Proficiency	Expected Attainment
CO1	Explain the basic principles and techniques in tissue culture	90%	80%
CO2	perform various techniques employed in plant tissue culture	80%	70%
CO3	Do anther culture and produce haploids	80%	80%
CO4	Depict the production of alkaloids	80%	80%
CO5	Analyse the various conservation practices	90%	70%

Mapping of COs with POs
S:Strong M:Medium L: Low

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	**S**	**L**	**S**	**L**	**M**	**M**
CO2	**S**	**M**	S	**S**	**M**	**L**	**S**
CO3	S	**M**	**M**	**M**	**L**	**L**	**M**
CO4	**S**	**S**	M	**S**	**L**	**M**	**L**
CO5	**S**	**M**	S	**S**	**M**	**L**	**M**

Mapping of COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	**S**	**S**	**S**	**S**
CO2	**S**	**M**	M	**L**	**M**
CO3	S	**S**	**L**	**S**	**S**
CO4	**S**	**M**	S	**L**	**M**
CO5	**S**	**S**	M	**S**	**L**

S:Strong M:Medium L: Low

Blooms Taxonomy			
	CA		**of Semester Marks**
	I Internal Marks	**II Internal Marks**	
Knowledge -K1	15% (9)	15% (9)	20%(30)
Understand -K2	15% (9)	15% (9)	20%(30)

Apply-K3	30% (18)	30% (18)	20% (30)
Analyze-K4	20% (12)	20% (12)	20% (30)
Evaluate-K5	20% (12)	20% (12)	20% (30)
TOTAL	**60**	**60**	**150**

Unit I: History of plant tissue culture, various types of cultures: callus, cell suspension, root, meristem. *In vitro* culture: physical, genetic, chemical and genotypic factors, *In vitro* differentiation: Organogenesis and somatic embryogenesis, Assessment of growth and development in vitro, Problems in plant tissue culture (Recalcitrance, Contamination, Phenolic browning, and Seasonal variation.

Unit II: Molecular basis of plant organ differentiation: Micro propagation-plant multiplication, hardening, transplantation, Bioreactor, Artificial seeds, Applications of tissue culture, *In vitro* pollination and fertilization, Embryo rescue.

Unit III: Androgenesis, Anther and pollen culture, Gynogenesis, ovule and ovary culture, dihaploids and their applications in genetics and plant breeding, Protoplast isolation and purification, Protoplast viability test, Protoplast culture and regeneration, Somatic hybridization - methods and applications, Cybrids, Somaclonal and gametoclonal variations, *In vitro* selection.

Unit IV: Large scale production of alkaloids and other secondary metabolites through cell culture techniques, high yielding cell lines, factors affecting production, Biotransformation, Hairy root culture and production of secondary metabolites, Immobilization of plant cells.

Unit V: Plant Genetic resources, Germplasm conservation and cryopreservation, Cryoprotectants, Gene bank, Transgenic plants, Selectable marker genes and theiruses.

Text books:

1.Smith, R. H.1992. Plant Tissue Culture: Techniques and Experiments, Academic Press, San Diego.
2.Gupta, P. K . 2000. Elements of Biotechnology, Rastogi Publications, Meerut. 3.Dubey, R .C. 2001. A text book of biotechnology, S Chand & Co., New Delhi. 4.Ignacimuthu, S. J. 2003. Plant Biotechnology, Oxford & IBH Publishing, NewDelhi.
3.JohnJothi Prakash, E.2005. Outlines of Plant Biotechnology, Emkay Publishers, New Delhi
6.Kalyankumar De, 2008. Plant tissue culture, New Central Book Agency, Calcutta.

Reference books:

1.Bhojwani, S. S. and M. K. Razdan. 2004. Tissue Culture: Theory and Practice, Elsevier, New Delhi.
2.Purohit, S. S. 2010. Plant tissue culture, Student edition, S.S. Publication, Jodhpur.
3.Smith, R. 2012. Plant Tissue Culture, Techniques and Experiments, Third Edition, Academic Press, SanDiego.
4.Bhojwani, S. S. and P.K. Dantu. 2013. Plant Tissue Culture: An Introductory Text, Springer, India.

Course Designers:

1.Dr.M.Viji
2.Dr.K.Sathiyadash
3.Dr.K.Saraswathi