Programme outcomes-PO (Aligned with Graduate Attributes)
Bachelor of Science (B.Sc.,)

PO1 Scientific Knowledgeand Critical Thinking
Apply the knowledge ofLife Science, Physical and Chemical Science, Mathematics, statistics, Computerscience and humanities for the attainment of solutions to the problems that come across in our day-to-day life/activities.

PO2 Problem Solving
Identify and analyze the problem and formulate solutionsfor problems using the principles of mathematics, natural sciences with appropriate consideration for the public health, safety and environmental considerations.,

PO3 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

PO4 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.

PO5 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. Respectthe ethical values, socialresponsibilities and diversity.

PO6 Innovative, Leadership and Entrepreneur Skill Development
Function as an individual, and as a member or leader in diverse teams and in multidisciplinary settings. Become an entrepreneur by acquiring technical, communicative, problem solving and intellectual skills.

Programme Educational Objectives (PEOs)

The objectives of the 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 Todevelop 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, related to 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 knowledgeto 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 (PSO)
B.Sc.,Botany

On 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		
PSO5	S	S			S	S

THIAGARAJAR COLLEGE, MADURAI – 9.

(Re-Accredited with 'A^{++}' Grade by NAAC)

DEPARTMENT OF BOTANY

Bachelor of Science (B.Sc.,) (w.e.f. 2023-2024Batch)

Programme Code- UBO

Semester – I

Course		Code No	Subject	Hrs/ Week	Cred.	Total Hrs	Max Mark CA	Max Marks SE	Total
Part - I	Tamil	U23P1TA11B	Tamil	6	3	90	25	75	100
Part - II	English	U23P2EN11	English	4	3	60	25	75	100
Part - III	Core The 1	UBO23CT11	Plant Diversity I - Algae and Bryophytes	4	4	60	25	75	100
	Core The 2	UBO23CT12	Cell Biology	3	3	45	25	75	100
	Core Lab 1	UBO23CL11	Plant Diversity I - Algae and Bryophytes - Practical - I	2	1	30	25	75	100
	G Ele Zoo1 (Elec 1)	UZO23ET11B	Applied Zoology - I	3	2	45	25	75	100
	G.Ele Lab (Elec 1 lab)	UZO23EL11B	Applied Zoology Lab*	2	-*	30			
Part - IV	NME-1	UBO23NT11	Nursery and Landscaping (for other Program students)	2	2	30	25	75	100
	Foundation Course	UBO23FT11	Basics of Botany	2	2	30	25	75	100
	Ability Enhancement Compulsory Course AECC-1	UEN23AT11	Introduction to Personality Development	2	2	30	25	75	100
TOTAL				**30**	**22**	450	225	675	900

*Exam will be conducted in the Even Semester (II Semester)

Semester – II

Course		Code No	Subject	Hrs/ Week	Cred.	Total Hrs	Max Mark CA	Max Marks SE	Total
Part - I	Tamil	U23P1TA21	Tamil	6	3	90	25	75	100
Part - II	English	U23P2EN21	English	4	3	60	25	75	100
Part - III	Core The 3	UBO23CT21	Plant Diversity - II Fungi, Bacteria, Viruses, Plant Pathology and Lichens	4	4	60	25	75	100
	Core The 4	UBO23CT22	Forestry	3	3	45	25	75	100
	Core Lab 2	UBO23CL21	Plant Diversity - II Fungi, Bacteria, Viruses, Plant Pathology and Lichens- Practical - II	2	1	30	25	75	100
	G Ele Zoo 2 **(Elec 2)**	UZO23ET21B	Applied Zoology -II	3	2	45	25	75	100
	G.Ele Lab **(Elec 2 Lab)**	UZO23EL21B	Applied Zoology Lab*	2	-	30			
	Practical Exam Elective 1 and 2 UZO23EL21B			-	2	-	25	75	100
Part - IV	NME-2	UBO23NT21	Mushroom Cultivation (For other Program students)	2	2	30	25	75	100
	Skill Enhancement Course SEC-1	UBO23ST21	Botanical Garden and Landscaping	2	2	30	25	75	100
	Ability Enhancement Compulsory Course AECC-2	UEN23AT21	Employability Skills	2	2	30	25	75	100
TOTAL				**30**	**24**	450	250	750	1000
Extra Credits	**Naan Mudhalvan (Extra Credit)** Language Proficiency for Employability				**02**				

Generic Elective offered to by the dept

Dept	Course Code	Course	Hrs/ Week	Cred.	Total Hrs	Max Mark CA	Max Marks SE	Total

A) Consolidation of contact hours and credits: UG

Semester	Contact Hours/Week	Credits
I	30 hrs	22
II	30 hrs	24
III	30 hrs	22
IV	30 hrs	24
V	30 hrs	24 (including Part V - one credit) (Internship Extra Credits 2)
VI	30 hrs	24
Total		140

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DEPARTMENT OF BOTANY

Bachelor of Science (B.Sc.,) (w.e.f. 2023-2024Batch)

Programme Code- UBO

Course Code	Course Title	Category	L	T	P	Credit
UBO23CT11	Plant Diversity I - Algae and Bryophytes	Core The-1	4	-	-	4

L - Lecture T - Tutorial P - Practicals

Year	Semester	Int. Marks	Ext. Marks	Total
I	I	25	75	100

Preamble

To make the students aware of lower groups of life forms with their significance

Course Outcomes

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

#	Course Outcome	Knowledge Level	Expected Proficiency	Expected Attainment
CO1	Relate to the structural organization and reproduction of algae	K1, K2	100%	80%
CO2	Explore the life cycle patterns of algae and the fundamental concepts in algal growth	K2	100%	80%
CO3	Determine the emerging areas of Algal Biotechnology for identifying commercial potentials of algal products and their uses	K1, K2	80%	80%
CO4	Recognize morphological variations, anatomy reproduction and significance of Bryophytes	K2, K3	80%	70%
CO5	Compare and contrast the variations in the internal cellular organization, evolution of gametophyte and sporophyte of Bryophytes	K2, K3	80%	60%

K1 - Knowledge K2 - Understand K3 – Apply

Mapping of COs with POs

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

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

Mapping of COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	S	S	M	M	M	M
CO2	S	S	M	M	M	M
CO3	S	S	S	S	M	S
CO4	S	S	S	S	M	S
CO5	S	S	S	S	S	S

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

Blooms taxonomy			
	First	Second	
Knowledge -K1	40%	40%	40%
Understand -K2	40%	40%	40%
Apply-K3	20%	20%	20%

Title of the paper: Algae and Bryophytes

Unit I: Algae: General classification of Algae based on Fritsch(1945) system –Thallus organization, Structure and reproduction of Unicellular - *Chlorella*, Diatoms: Colonial - *Volvox*; Filamentous- *Oedogonium;* Siphonous - *Caulerpa;* Parenchymatous- *Chara*

Unit II: Algae: Structure, types **of** Reproduction (Vegetative, asexual, sexual reproduction) and types of life cycles in Algae *Nostoc (*haplontic), *Sargassum* (Diplontic life cycle), *Padina* (Diplohaplontic) and *Gracilaria* (Diplobiontic)

Unit III: Algal cultivation methods - indoor cultivation and mariculture practices. Applications of Algae – industrial uses-Agar-agar, Alginic acid and Carrageenan. Diatomite, fuel production, agriculture and pharmaceutical uses, phytoremediation, bioluminescence, bioindicator

Unit IV: Bryophytes: General characters of Bryophytes, Classification (Watson, 1971) (up to family level). Structure, reproduction and life cycle of the following classes each with a suitable example: Hepaticopsida- *Marchantia*; Anthocerotopsida - *Anthoceros* and Bryopsida- *Funaria*.

Unit V:Bryophytes: Economic importance of Bryophytes: Medicinal uses, horticulture, industrial uses and absorbent bandages. Ecological importance - Pollution indicators and monitoring. Evolution ofBryophytes

TextBooks:

1. Vashishta, B R., **Singh**, V. P. and **Sinha**, A. K .2012. Botany for Degree Students, S. Chand Publishers, Chennai
2. Lynda Ed. West. 2010. Algae, Cambridge University Press, UK.
3. Vashishta, B.R. 1988. Bryophyta, 6th Edition, S. Chand and company, (Pvt.) Ltd., New Delhi.
4. Kumar, H.D. 1990. Introductory Phycology, Affiliated East West Press (P) Ltd., New Delhi.
5. Rashid, A. 1998. An introduction to Bryophyta, Vikas Publishing House (P) Ltd., New Delhi.

References:

1. Tuba, Z., N.G., Sleck and L.R. Stark. 2011. Bryophyte, Cambridge University Press, UK.

Web Resources:

1. https://www.plantscience4u.com/2014/04/fritsch-classification-ofalgae.html#.XnhVix8zbIU
2. https://www.legit.ng/1111992-economic-importance-algae.html
3. http://bryophytes.plant.siu.edu/bryojustified.html
4. **https://www.toppr.com/guides/biology/plant-kingdom/bryophytes/**

Coursedesigner:

Dr. K. Saraswathi

THIAGARAJAR COLLEGE, MADURAI – 9.

(Re-Accredited with 'A^{++}' Grade by NAAC)

DEPARTMENT OF BOTANY

Bachelor of Science (B.Sc.,) (w.e.f. 2023-2024Batch)

Programme Code- UBO

Course Code	Course Title	Category	L	T	P	Credit
UBO23CL11	**Plant Diversity I - Algae and Bryophytes - Practical - I**	Core Lab 1	2	-	-	1

L - Lecture T - Tutorial P - Practicals

Year	Semester	Int. Marks		Ext. Marks	Total
I	I	25		75	100

Preamble

To make the students aware of the structural organization and adaptations of lower groups of life forms

Course Outcomes

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

#	Course Outcome	Knowledge Level	Expected Proficiency	Expected Attainment
CO1	Develop comprehensive skills in sectioning and micro preparation.	K1, K2	100%	80%
CO2	Identify algae based on habitat, thallus structure and the internal organization.	K2	100%	80%
CO3	Explore the algae cultivation techniques and their economic importance	K1, K2	80%	80%
CO4	Distinguish the bryophytes based on anatomical structure	K2, K3	80%	70%
CO5	Find the variations in the sporophyte of Bryophytes	K2, K3	80%	60%

K1 - Knowledge K2 - Understand K3 – Apply

Mapping of COs with POs

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

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

Mapping of COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	S	S	S	M	M	M
CO2	S	S	S	M	M	M
CO3	S	S	M	S	S	M
CO4	S	S	S	M	M	M
CO5	S	S	S	M	M	M

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

Blooms taxonomy

	CA		End of Semester
	First	**Second**	
Knowledge -K1	40%	40%	40%
Understand -K2	40%	40%	40%
Apply-K3	20%	20%	20%

Title of the paper: Algae and Bryophytes

1. Micro-preparation of the following
   a. *Caulerpa*
   b. *Sargassum*,
   c. *Padina*
   d. *Chara*
   e. *Marchantia*
   f. *Funaria*
2. Identifying types of algae in mixture
   g. Identifying the micro slides of *Gracilaria* Cystocarp, *Anthoceros* thallus, *Marchantia* and *Funaria* Sporophyte
3. Economic importance of Algae as: (i) Food (ii) Feed (iii) Biofertilizers (iv) Seaweed liquid fertilizer (v) Hydrogen production by algae (vi) SCP (vii) Agar Agar (viii) Alginate (ix) Diatomaceous earth.
4. Field visit to study fresh water/marine water algal habitats.
5. Visit to nearby industry actively engaged in algal technology.

TextBooks:

1. Vashishta, B R., **Singh**, V. P. and **Sinha**, A. K .2012. Botany for Degree Students, S. Chand Publishers, Chennai
2. Lynda Ed. West. 2010. Algae, Cambridge University Press, UK.
3. Vashishta, B.R. 1988. Bryophyta, 6th Edition, S. Chand and company, (Pvt.) Ltd., New Delhi.
4. Kumar, H.D. 1990. Introductory Phycology, Affiliated East West Press (P) Ltd., New Delhi.
5. Rashid, A. 1998. An introduction to Bryophyta, Vikas Publishing House (P) Ltd., New Delhi.
6. Singh, Pandey and Jain. 2020. A text book of Botany, 5th Edition, Rastogi Publication, Meerut.

References:

1. Tuba, Z., N.G., Sleck and L.R. Stark. 2011. Bryophyte, Cambridge University Press, UK.

Web Resources:

1. https://www.plantscience4u.com/2014/04/fritsch-classification-ofalgae.html#.XnhVix8zbIU
2. https://www.legit.ng/1111992-economic-importance-algae.html
3. http://bryophytes.plant.siu.edu/bryojustified.html
4. **https://www.toppr.com/guides/biology/plant-kingdom/bryophytes/**

Course Designer:

Dr. K. Saraswathi

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DEPARTMENT OF BOTANY

Bachelor of Science (B.Sc.,) (w.e.f. 2023-2024Batch)

Programme Code- UBO

Course Code	Course Title	Category	L	T	P	Credit
UBO23CT12	Cell Biology	Core-2	3	-	-	3

L - Lecture T - Tutorial P - Practicals

Year	Semester	Int. Marks	Ext. Marks	Total
I	I	25	75	100

Preamble

To make acquire knowledge on the structure of plant cell, organelles, and its functions

Course Outcomes

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

#	Course Outcome	Knowledge Level	Expected Proficiency	Expected Attainment
CO1	To enable students to gain insights into cell and cell wall organization and its functions	K1	90%	80%
CO2	To familiarize with various cell organelles exist in plants and their functions	K2	90%	70%
CO3	Reveal the stages of cell cycle	K2	90%	80%
CO4	Examine the different stages of mitotic and meiotic cell divisions	K2	80%	80%
CO5	Utilize the microscopes to identify structural details of cells	K3	80%	70%

K1 - Knowledge K2 - Understand K3 – Apply

Mapping of COs with POs

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

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

Mapping of COs with PSOs

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

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

Blooms taxonomy

	CA		Endof Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total	52	52	140

Title of the paper: Plant Biotechnology

Unit I: Cell biology - History of Cell Biology - Cell theory - Differences between a Prokaryotic and a Eukaryotic cell - Differencesbetween Plant and Animal cell - Structure of Plant cell: Ultra structure, structure and functions of cell wall,Plasma membrane – Fluid mosaic model. Cytosol –cytoskeleton organization. Cell junctions.

Unit II: Structure and function of cytoplasmic organelles - Endoplasmic reticulum – Peroxisomes – Lysosomes Vacuoles – Ribosome – Golgi apparatus - Ergastic substances.

Unit III: Mitochondria – structure and function – Plastids – types - Chloroplast – structure and function - Nucleus –structure and function - Structure and types of chromosomes – Euchromatin – Heterochromatin – Special types of chromosome – Lampbrush and Polytene.

Unit IV: Cell cycle – phases, events and check points and regulation. Cell Division –- Amitosis, Mitosis and Meiosis- significance.

Unit V: Techniques in Cell Biology: Microscopy-Principles, Instrumentation and uses of Light microscope, SEM and TEM, Microtome, Camera Lucida. Squash and Smear preparations - Karyotyping.

TextBooks:

1.Verma P.S. and V. K. Agarwal, 2006. Cytology, S. Chand and Co. Ltd., New Delhi.
2.Pandey, B.P. 2010. Plant Anatomy, S. Chand and Co. Ltd., New Delhi.
3. Powar, C.B. 2009. Cell Biology. Himalayan Publishing House, New Delhi.

References:

1.Becker, W.M., L.J. Kleinsmith and J. Hardin, 2011. The World of the Cell, Dorling Kindersley (India) Pvt. Ltd., New Delhi.
2. Fahn, A. 1990. Plant Anatomy, Pergman press, Oxford, London.
3. Alberts, B. et al., 1994. Molecular Biology of the Cell (3rdedition). Garland Publishing,Inc., New York
4. De Roberties E.D.P and E.M.F.DeRoberties. 2011. Cell and Molecular Biology. (8thedition). B.I. PublicatonsPvt. Ltd., India

Web Sources:

https://youtu.be/URUJD5NEXC8
https://youtu.be/ZyWYID2cTK0
https://youtu.be/Q6ucKWIIFmg
https://youtu.be/8H0q7H1zVEw

Coursedesigners:

1. Dr. T. M. Jothimani

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DEPARTMENT OF BOTANY

Bachelor of Science (B.Sc.,) (w.e.f. 2023-2024Batch)

Programme Code - UBO

Course Code	Course Title	Category	L	T	P	Credit
UBO23NT11	NURSERY AND LANDSCAPING (For Students of Programs other than B.Sc. Botany)	Skill Enhancement Course SEC-1 NME-1	2	-	-	2

Year	Semester	Int. Marks	Ext. Marks	Total
I	I	25	75	100

Preamble

To equip the students with the fundamental concepts of nursery and landscaping.

Course Outcomes

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

#	Course Outcome	Knowledge Level	Expected Proficiency	Expected Attainment
CO1	To recognize the importance of growing plants and practice the knowledge gained by developing kitchen garden and ornamental garden.	K1	100%	80%
CO2	To be able to design gardens and become entrepreneur in Horticulture.	K1	100%	90%
CO3	To study the methods of propagation	K2	100%	100%
CO4	To know about nursery structure.	K2	100%	100%
CO5	To learn about gardening.	K3	100%	80%

K1 - Knowledge K2 - Understand K3 – Apply

Mapping of COs with POs

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

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

Title of the Course: NURSERY AND LANDSCAPING

Unit I: Introduction, prospects and scope of nursery and landscaping.

Unit II: Methods of Propagation – cutting, layering, grafting, budding, Floriculture – Rose, Chrysanthemum, Jasmine – cultivation.

Unit III: Gardening – formal garden, informal garden, vegetable garden, landscaped layout designing – formation and maintenance of lawn.

Unit IV: Nursery structures – Green house – Shade house, Mist chamber – Topiary, Bonsai culture.

Unit V: Manures, composting – vermicomposting.

Text Books

1. Amarnath V. 2006. Nursery and Landscaping, M/s IBD Publishers, New Delhi.
2. Butts, E and Stensson, K. 2012. Sheridan Nurseries: One hundred years of People, Plans, and Plants. Dundurn Group Ltd.
3. Russell, T. 2012. Nature Guide: Trees: The world in your hands (Nature Guides). Mukherjee D. Gardening in India, Oxford IBH publishing co, New Delhi.
4. Kumar, N. 1997. Introduction to Horticulture, Rajalakshmi Publications, Nagercoil.

Reference Books

1. Edmond Musser and Andres, Fundamentals of Horticulture, McGraw Hill Book Co. New Delhi.
2. Agrawal, P.K. 1993. Hand Book of Seed Technology, Dept. of Agriculture and Cooperation, National Seed Corporation Ltd., New Delhi.
3. Janick Jules. 1979. Horticultural Science. (3rd Ed.), W.H. Freeman and Co.,San Francisco, USA.
4. Singh, J. 2018. Fundamentals of Horticulture. Kalyani Publishers.
5. Sharma V. K. 1999. Encyclopaedia of Practical Horticulture, Vol I –IV, Deep And Deep Publ. Pvt. Ltd.

Web Resources

1. https://www.kopykitab.com/higher-education-ebooks/higher-educationebooks/Agricultural-Industry-agriculture-eBooks/Nursery-AndLandscaping-by-V-Amarnath
2. https://www.amazon.in/Nursery-Landscaping-VeenaAmarnath/dp/8177542788
3. https://www.amazon.in/Gardening/b?ie=UTF8&node=1637077031
4. https://in.pinterest.com/pin/496733033900458021/?lp=true
5. https://www.gardenvisit.com/ebooks

Course Designer

Dr. K. Jegatheesan

THIAGARAJAR COLLEGE, MADURAI – 9.

(Re-Accredited with 'A^{++}' Grade by NAAC)

DEPARTMENT OF BOTANY

Bachelor of Science (B.Sc.,) (w.e.f. 2023-2024Batch)

Programme Code- UBO

Course Code	Course Title	Category	L	T	P	Credit
UBO23FC11	**BASICS OF BOTANY**	**Foundation Course**	**2**	**-**		**2**

L - Lecture T - Tutorial P - Practical

Year	Semester	Int. Marks	Ext. Marks	Total
I	**I**	**25**	**75**	**100**

Preamble

To recall the students about the basic aspects of botany.

Course Outcomes

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

#	Course Outcome	Knowledge Level	Expected Proficiency	Expected Attainment
CO1	Increase the awareness and appreciation of human friendly algae and their economic importance.	K1	100%	80%
CO2	Develop an understanding of microbes and fungi andappreciate their adaptive strategies	K1	100%	90%
CO3	Develop critical understanding on morphology, anatomy and reproduction of Bryophytes, Pteridophytes and Gymnosperms.	K2	100%	100%
CO4	Compare thestructure and function of cells and explain thedevelopment of cells.	K2	100%	100%
CO5	Understand the core concepts and fundamentals of plant biotechnology and genetic engineering.	K3	100%	80%

K1 - Knowledge K2 - Understand K3 – Apply

Mapping of COs with POs

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

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

Title of the Course: Basics of Botany

Unit I - **BIODIVERSITY**

Systematics : Two Kingdom and Five Kingdom systems - Salient features of various Plant Groups: Algae, Fungi, Bryophytes, Pteridophytes and Gymnosperms- Viruses - Bacteria.

Unit II - **CELL BIOLOGY**

Cell as the basic unit of life - Prokaryotic and Eukaryotic Cell (Plant Cell) - Light Microscope and Electron Microscope Ultra Structure of Prokaryotic and Eukaryotic Cells - Cell Wall - Cell Membrane Plastids, Ribosomes.

Unit III - **PLANT MORPHOLOGY**

Structure and Modification of Root, Stem and Leaf - Types of Inflorescences; Raceme, Cyme, mixed and Special (Cyathium) – Floral morphology- Parts of a flower, Symmetry, Merosity Aestivation, Epigyny, Perigyny and Hypogyny, Placentation, Drawing Floral diagram and writing floral formula- Types of Fruits.

Unit IV - **GENETICS**

Concept of Heredity and Variation - Mendel's Laws of Inheritance

Unit – V **PLANT PHYSIOLOGY**

Cell as a Physiological Unit : Water relations -Absorption and movement :Diffusion, Osmosis, Plasmolysis, Imbibition -Permeability, Water Potential - Transpiration - Movement - Mineral Nutrition

Text Books

1. Singh, V., Pande, P.C and Jain, D.K. 2021. A Text Book of Botany.Rastogi Publications, Meerut.
2. Bhatnagar, S.P and Alok Moitra. 2020. Gymnosperms, New Age International (P) Ltd., Publishers,Bengaluru.
3. Sharma, O.P. 2017. Bryophyta, MacMillan India Ltd. Delhi.
4. Lee, R.E. 2008. Phycology, IV Edition, Cambridge University Press, NewDelhi.
5. Pandey B.P. 1986, Text Book of Botany (College Botany) Vol I and II,S.Chand and Co. New Delhi.
6. Rao, K., Krishnamurthy, K.V and Rao, G.S. 1979. Ancillary Botany, S.Viswanathan Pvt. Ltd., Madras.

Refrences:

1. Parihar, N.S. 2012. An introduction to Embryophyta –Pteridophytes -Surjeet Publications, Delhi.
2. Alexopoulos, C.J. 2013. Introduction to Mycology. Willey Eastern Pvt. Ltd.
3. Vashishta, P.C. 2014. Botany for Degree Students Gymnosperms. Chand &Company Ltd, Delhi.
4. Coulter, M. Jhon, 2014. Morphology of Gymnosperms. Surjeet Publications,Delhi.
5. Vashishta, P.C. 2014. Botany for Degree Students Algae. 2014. Chand &Company Ltd, Delhi.
6. Parihar, N.S. 2013. An introduction to Embryophyta –Bryophytes -, Surjeet Publications, Delhi.

Web resources:

1. https://www.kobo.com/us/en/ebook/the-algae-world
2. http://www.freebookcentre.net/biology-books-download/Fungi-(PDF- 15P).html
3. http://scitec.uwichill.edu.bb/bcs/bl14apl/bryo1.htm
4. https://www.toppr.com/guides/biology/plant-kingdom/pteridophytes/
5. https://arboretum.harvard.edu/wp-content/uploads/2013-70-4-beyond-pine- cones-an-introduction-to-gymnosperms.pdf
6. https://www.us.elsevierhealth.com/medicine/cell-biology
7. https://www.us.elsevierhealth.com/medicine/genetics

Course Designer

Dr. K. Jegatheesan

Thiagarajar College (Autonomous): Madurai–625009
(Reaccredited with A++ by NAAC)
Department of Botany
(For those who joined B. Sc., Botany on or after June2023)

Course Code	Course Title	Category	L	T	P	Credit
UBO23CT21	Plant Diversity – II Fungi, Bacteria, Viruses, Plant Pathology and Lichens	**Core-3**	**4**	**-**	**-**	**4**

L - Lecture T - Tutorial P - Practicals

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

Preamble

Students should be familiar with the basics of Fungi, bacteria, viruses and Lichens

Course Outcomes

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

#	Course Outcome	Knowledge Level	Expected Proficiency	Expected Attainment
CO1	Recognize the general characters of microbes, fungi and lichens and disease symptoms	K1	90%	80%
CO2	Develop an understanding of microbes, fungi and lichens and appreciate their adaptive strategies	K1	90%	70%
CO3	Identify common plant diseases in different geographical regions and controlmeasures.	K2	80%	70%
CO4	Analyze trends in fungal studies with special reference to agricultural applications.	K1 & K2	80%	60%
CO5	Determine the economic importance of microbes, fungi and lichens.	K3	80%	70%

K1 – Knowledge K2 - Understand K3 – Apply

Mapping of COs with POs

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

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

Mapping of COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**S**	**S**	**S**	**S**	**S**
CO2	**M**	**S**	**S**	**S**	**M**
CO3	**S**	**S**	**M**	**S**	**M**
CO4	**S**	**M**	**S**	**S**	**L**
CO5	**M**	**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%
Total	52	52	140

Title of the paper: Plant Diversity – II Fungi, Bacteria, Viruses, Plant Pathology and Lichens

Unit I: FUNGI

Classification of fungi - (Alexopoulos and Mims, 1979), criteria forclassification, Characteristic features, thallus organization, mode of nutrition, structure, reproduction and life-history of classes, each with one suitable example: Zygomycotina (*Rhizopus*), Ascomycotina (*Aspergillus*), Basidiomycotina (*Agaricus*) and Deuteromycotina (*Cercospora*).

Unit II: ECONOMIC IMPORTANCE OF FUNGI:

Cultivation of mushroom – *Pleurotus* (food). Fungi in agriculture application (biofertilizers): Mycotoxins (biopesticides), Production of industrially important products from fungi- alcohol (ethanol), organic acids (citric acid), enzymes (protease). Vitamins (Vitamin B-complex and Vitamin B-12), Applications of fungi in pharmaceutical products (Penicillin). Harmful effects of Fungi

Unit III: Classification (Bergey's, 1994), Structure and reproduction of bacteria, Mycoplasma. Virology - Viruses general characters, structure and reproduction.

Unit IV: PLANT PATHOLOGY: General symptoms of plant diseases; Geographical distribution of diseases; Etiology; Host-Pathogen relationships; Disease cycle and environmental relation; prevention and control of the following plant diseases.

Bacterial diseases – Citrus canker and Bacterial wilt of Banana
Viral diseases – Tobacco Mosaic and Vein clearing of Papaya
Fungal diseases – Blast disease in rice and Tikka disease

Unit V: LICHEN: Classification (Hale, 1969). Habitat, nature of association, Structure, Nature of Mycobionts and Phycobionts, Study of growth forms of lichens (crustose, foliose and fruticose), types and distribution. Thallus organization, reproduction and ecological significance of lichens with special reference to *Usnea*. Economic importance of Lichens: Beneficial and Harmful aspects (poison from lichens)

TextBooks:

1. Pandey, B.P. 1997. College Botany. Vol. I Fungi & Pathology.
2. Mehrotra, R.S and Aneja, K.R. 2003. An introduction to mycology. Newage International (P) Ltd, Publishers, New Delhi.
3. Poonam Singh and Ashok Pandey. 2009. Biotechnology for agro-Industrialresidues utilization. Springer.
4. Satyanarayana T and Johri B.N. 2005. Microbial diversity, CurrentPerspectives and Potential Applications, IK International.
5. Nair, L.N. 2007. Topics in Mycology and Pathology, New Central Bookagency, Kolkata.
6. Sharma, P.D. 2011. Plant Pathology, Rastogi Publication, Meerut, India.

References:

1. Alexopoulos, C.J., Mims, C.W., Blackwell, M. 1996. IntroductoryMycology. 4th edition. John Wiley & Sons (Asia) Singapore.
2. Webster, J and Weber, R. 2007. Introduction to Fungi. 3rd edition.Cambridge University Press, Cambridge.
3. Sharma, O.P. 2011. Fungi and allied microbes The McGraw –Hillcompanies, New Delhi.
4. Burnett, J.H. 1971.The fundamentals of Mycology. ELBS Publication,London.
5. Bessey, E.A. 1979. Morphology and Taxonomy of fungi, Vikas publishing House Pvt. Ltd, New Delhi.
6. Dharani Dhar Awasthi. 2000. A Handbook of Lichens Vedams eBooks (P) Ltd. New Delhi.
7. Pelzer, M.J., Chan, E.C.S and Krieg, N.R. 1983. Microbiology , Tata MaGraw Hill Publishing House, New Delhi.
8. Pandey, P.B. 2014. College Botany- 1: Including Algae, Fungi, Lichens, Bacteria, Viruses, Plant Pathology, Industrial Microbiology and Bryophyta. Chand Publishing, New Delhi.
9. Mishra, A. and Agarwal, R.P. 1978. Lichens – A Preliminary Text. Oxford and IBH.
10. Pandey, B.P. 2005. College Botany I: Including Algae, Fungi, Lichens, Bacteria, Viruses, Plant Pathology, Industrial Microbiology and Bryophyta. S Chand & Company

Web Resources

1. https://www.amazon.in/Fungi-Sarah-C-Watkinson-ebook/dp/B0199YFDFE
2. http://www.freebookcentre.net/biology-books-download/A-text-book-of- mycology-and-plant-pathology.html
3. http://www.freebookcentre.net/Biology/Mycology-Books.html
4. https://www.kobo.com/us/en/ebook/introduction-to-fungi
5. http://www.freebookcentre.net/biology-books-download/Introductory- Mycology.html
6. http://www.freebookcentre.net/biology-books-download/Fungi-(PDF- 15P).html

Course designers:

1 Dr.V.Karthikeyan
2 Dr.B.Sadhana

THIAGARAJAR COLLEGE, MADURAI – 9.

(Re-Accredited with 'A^{++}' Grade by NAAC)

DEPARTMENT OF BOTANY

Bachelor of Science (B.Sc.,) (w.e.f. 2023-2024Batch)

Programme Code- UBO

Course Code	Course Title	Category	L	T	P	Credit
UBO23CL21	Plant Diversity – II Fungi, Bacteria, Viruses, Plant Pathology and Lichens – Practical II	**Core Lab 2**	**2**	**-**	**-**	**1**

L - Lecture T - Tutorial P - Practicals

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

Preamble

Students should be familiar with the basics of Fungi, bacteria, viruses and Lichens

Course Outcomes

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

#	Course Outcome	Knowledge Level	Expected Proficiency	Expected Attainment
CO1	Identify microbes, fungi and lichens using key identifying characters	K1	90%	80%
CO2	Develop practical skills for culturing andcultivation of fungi.	K1	90%	70%
CO3	Identify and select suitable control measures for the common plant diseases.	K2	80%	70%
CO4	Analyze trends in fungal studies with special reference to agricultural applications	K1 & K2	80%	60%
CO5	Access the useful role of fungi in agricultureand pharmaceutical industry	K3	80%	70%

K1 – Knowledge K2 - Understand K3 – Apply

Mapping of COs with POs

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

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

Mapping of COs with PSOs

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

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

EXPERIMENTS

1. Microscopic observation of vegetative and reproductive structures of type specimen prescribed in theory syllabus through temporary preparations and permanent slides.
2. Identifying the micro slides bacterial and fungal diseases relevant to the syllabus.
3. Herbarium specimens of bacterial diseases/photograph.
4. Inoculation techniques for fungal culture (Demonstration only).
5. Visit to fungal biotechnology laboratories.
6. Micro-preparation of *Usnea* to study vegetative and reproductive structures.
7. Identifying the micro slides relevant to the syllabus.
8. Study of thallus and reproductive structures (apothecium) through permanent slides.

Recommended Texts:

1. Chmielewski, J.G and Krayesky, D. 2013. General Botany laboratory Manual. Author House, Bloomington, USA.
2. Das, S and Saha, R. 2020. Microbiology Practical Manual. CBS Publishers and Distributors (P) Ltd., New Delhi, India.
3. Webster, J and Weber, R. 2007. Introduction to Fungi, 3rd Ed. Cambridge University Press, Cambridge.
4. Nair, L.N. 2007. Topics in Mycology and Pathology, New Central Book agency, Kolkata.

Reference Books:

1. Alexopoulos, J and Mims, W. 1985. Introductory Mycology, Wiley Eastern Limited NewDelhi.
2. Bendre, M. Ashok and Ashok Kumar, A. 2020. Text Book of Practical Botany 1 (10thed).Rastogi Publications, Meerut.
3. Singh, R and U.C. Singh 2020. Modern mushroom cultivation, 3d Edition Agrobios (India), Jodhpur.
4. Poonam Singh and Ashok Pandey. 2009. Biotechnology for agro-Industrial residues utilization. Springer.

Web resources:

1. https://www.amazon.in/Practical-Manual-Fungi-Fungicides/dp/B0025AEFP4
2. https://books.google.co.in/books/about/Practical_Mycology.html?id=5ycJAQAAMAAJ&redir_e sc=y
3. https://www.flipkart.com/colour-handbook-practical-plant-pathology/p/itmefsn6dyhfhs9b
4. https://books.google.co.in/books/about/Practical_Botany.html?id=T5narQEACAAJ&redir_esc=y
5. https://www.kobo.com/us/en/ebook/introduction-to-fungi

Course designers:

Dr.V.Karthikeyan
Dr.B.Sadhana

THIAGARAJAR COLLEGE, MADURAI – 9.

(Re-Accredited with 'A^{++}' Grade by NAAC)

DEPARTMENT OF BOTANY

Bachelor of Science (B.Sc.,) (w.e.f. 2023-2024Batch)

Programme Code- UBO

Course Code	Course Title	Category	L	T	P	Credit
UBO23CT22	Forestry	Core-4	3	-	-	3

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

Preamble

Prior knowledge on trees, forests and their importance.

Course Outcomes

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

#	Course Outcome	Knowledge Level	Expected Proficiency	Expected Attainment
CO1	Relate the basic concepts related to forest distribution, degradation, protection, management and resource utilization.	K1	90%	80%
CO2	Understand complex interactions of humans and forest ecosystems in global context.	K2	90%	70%
CO3	Demonstrate skills for ecological measurements of forest ecology management.	K2	90%	80%
CO4	Examine and decipher factors influencing forest vegetation, forest degradation and methods of wood preservation	K2	80%	80%
CO5	Develop new strategies and apply the knowledge gained for problem- solving analysis in the conservation and management of forest ecosystems.	K3	80%	70%

K1 - Knowledge K2 - Understand K3 – Apply

Mapping of COs with POs

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

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

Mapping of COs with PSOs

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

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

Blooms taxonomy

	CA		Endof
	First	Second	Semester
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total	52	52	140

Title of the paper: Forestry

Unit I: **SILVICULTURE:** Forests - definition. Extent of forests in India and other countries. Forest types of India and Tamil Nadu - revised classification - pure and mixed stands - even and uneven aged stands.. Silviculture - objectives - scope - general principles. Regeneration - natural and artificial. Nursery techniques - containerized seedling production - techniques and methods. Vegetative and clonal propagation techniques - macro and micro propagation techniques.

Unit II: **FOREST MENSURATION AND MANAGEMENT:** Forest Mensuration - Definition and objectives. Measurement of diameter, girth, height, crown and volume of trees - methods and principles - tree stem form - form factor. Volume estimation of stand - age - basal area determinations Stem and Stump Analysis. Forest inventory - sampling techniques and methods - measurement of crops - sample plots. Yield calculation - CAI and MAI - volume, yield and stand tables preparation.

Unit III: **FOREST UTILIZATION AND WOOD TECHNOLOGY:** Logging - extraction of timber - felling rules and methods - conversion methods - conversion season. Implements used - cross cutting system – sawing different types - extraction methods. Grading of timbers. Storage and sales of logs - sales depot - management of depots. Recent trends in logging - Ergonomics and RIL. Forest products – Timber forest products (TFP) - timber, fuel, pulp, paper, rayon and match. Wood Composites - plywood, particle board, fiber boards, MDF, hardboard, insulation boards - production technology. Non timber forest products (NTFP) - collection - processing and storage of NTFP - fibres and flosses - bamboos and canes - katha and bidi leaves - gums and resins - insecticides - lac and shellac tassar silk.

Unit IV: **FOREST BIOLOGY:** Forest ecology - definition - biotic and abiotic components - forest ecosystem forest community - concepts - succession - primary productivity - nutrient cycling. Composition of forest types in India - classification of India's forests species composition - association and diversity. Restoration ecology - global warming - green house effects - ozone layer depletion - acid rain - role of trees in environmental conservation.

Unit V: **FOREST BOTANY:** Importance of botany - taxonomic classification of plant species - identification of species - composition and association. Dendrology - principles and establishment of herbaria and arboreta. Tree Improvement - Forest Genetics and Tree Breeding - Definition and concepts - Steps in tree improvement - Variation and selection - Progeny Evaluation Test (PET) - Candidate Tree, Plus Tree, Elite trees - use of provenances and seed sources - heritability and genetic gains - hybrids in tree improvement – heterosis exploitation. Seed production Area and seed orchards - types.

Text Books:

1. Manikandan, K and S. Prabhu. 2013. Indian forestry, a breakthroughapproach to forest service. Jain Bros.
2. Roger Sands. 2013. Forestry in a global context, CAB international.
3. Balakathiresan. S.1986. Essentials of Forest Management. NatrajPublishers, Dehradun.
4. Agarwala, V.P. 1990. Forests in India, Environmental and ProtectionFrontiers. Oxford & IBH Publishing Co. New Delhi.
5. Chundawat, B.S. and Gautham, S.K. 1996. Text book of Agro forestry.Oxford and IBH publisher, New Delhi.
6. Singhi, G.B. 1987. Forest Ecology of India, Publisher: Rawat.
7. Ramprakash. 1986. Forest management. IBD Publishers, Debra Dun.
8. Tiwari, K.M. 1983. Social forestry in India. Nataraj Publishers, DehraDun.
9. Mehta, T. 1981. A handbook of forest utilization. Periodical Expert Book Agency, New Delhi.
10. Nair, N.C and Henry, A.N. 1983. Flora of Tamilnadu, India. Series: 1,Analysis, Vol.1. BSI, Coimbatore, India.

References:

1. Donald L. Grebner.Jacek P. Siry and Pete Bettinger. 2012. Introduction to forestry and Natural resources Academic press
2. West, P.W. 2015. Tree and forest measurement, Springerinternational publishing Switzerland.
3. Kollmann, F.F.P and Cote, W.A. 1988. Wood science andTechnology. Vol. I & II Springer Verlag, New York.
4. Agarwala, V.P. 1990. Forests in India, Environmental andProtection Frontiers. OxfordIBH Publishing Co., New Delhi.
5. Belcher, B.M. 1998. A production-to-consumption systems approach: Lessons from thebamboo and rattan sectors in Asia. In: Wollenberg, E and A. Ingles (Eds.). Incomes from the forest: methods for the development and conservation of forest products for local communities. Center for International Forestry Research (CIFOR), Bogor, Indonesia.
6. Chomitz, K.M., with P. Buys, G. De Luca, T.S. Thomas, and S. WertzKanounnikoff. 2007. Incentives and constraints shape forest outcomes. In: At loggerheads? Agricultural expansion, poverty reduction and environment in tropical forests. The World Bank, Washington, DC.
7. Rao, K.R. and Juneja, K.B.S. 1992. Field identification of 50 important timbers of India. ICFRE Publi. Dehradun 123 p.

Web Sources:

1. http://wwwwds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2006/10/19/000112742_2006 1019150049/Rendered/PDF/367890Loggerheads0Report.pdf.
2. https://www.britannica.com/science/forestry
3. https://en.wikipedia.org/wiki/Forestry.
4. https://www.biologydiscussion.com/forest/essay-forest-importance.major-products-and-its- conservation/25119
5. https://academic.oop.com
6. https://www.cbd.int>development>doc.
7. https://www.sciencedirect.com/topics/agriculture-and-biological- science-forest-product.

Course designer:

Dr. K. Rajendran

THIAGARAJAR COLLEGE, MADURAI – 9.

(Re-Accredited with 'A^{++}' Grade by NAAC)

DEPARTMENT OF BOTANY

Bachelor of Science (B.Sc.,) (w.e.f. 2023-2024Batch)

Programme Code- UBO

Course Code	Course Title	Category	L	T	P	Credit
UBO23NT21	**Mushroom Cultivation** (For Students of Programs other than B.Sc. Botany)	**Skill Enhancement Compulsory Course-2 NME-2**	**2**	**-**	**-**	**2**

L - Lecture T - Tutorial P - Practical

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

Preamble

To equip the students with the simple commercial technology on mushroom cultivation and enhance the skills for their carrier improvement.

Course Outcomes

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

#	Course Outcome	Knowledge Level	Expected Proficiency	Expected Attainment
CO1	Recognize types of mushrooms and its morphology	K1	100%	80%
CO2	Grasp the nutritive value of edible mushrooms and prepare various mushroom based food recipe.	K2	100%	90%
CO3	Develop basic skills in mushroom spawn production	K3	100%	100%
CO4	Practice the commercial cultivation methods for edible mushrooms using different substrates	K2	100%	100%
CO5	Analyze different factors on mushroom production and apply industrial based post-harvest techniques	K3	100%	80%

K1 - Knowledge K2 - Understand K3 – Apply

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	**S**	**S**	**S**	**S**	**S**	**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**	**S**	**S**	**M**	**L**

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

Mapping of COs with PSOs

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

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

Blooms taxonomy

	CA		End of Semester
	First	Second	
Knowledge	30%	30%	40%
Understand	30%	30%	30%
Apply	40%	40%	30%
Total	100	100	100%

Title of the paper: Mushroom Cultivation

Unit I: Mushrooms-Introduction, Types of mushrooms - edible, non-edible (Poisonous mushrooms) and medicinal mushrooms. Morphology and internal structure of mushrooms.

Unit II: Nutritional value of mushrooms: Nutrient composition of various edible mushrooms-proteins, amino acids, fats, lipids, carbohydrates and minerals. Mushroom recipe-biryani, soups, gravy, fries, candies and continental dishes.

Unit III: Favourable factors for mushroom cultivation.Mushroom spawns - types of spawns, methods of spawn preparation using different substrates.

Unit IV: Commercial cultivation of Oyster mushrooms: *Pleurotusflorida* and *Pleurotusostreatus*, Button mushrooms: *Agaricusbisporus*- Substrates preparation (paddy straw and saw dust), spawn inoculation, incubation, Observing-spawning, pin head formation, basidiocarp formation, harvesting, packing and storage techniques.

Unit V: Mushroom post-harvest technology: factors affecting mushroom cultivation, Pests and diseases in mushrooms. Mushroom marketing and economics.

Text Books:

1. Kapoor, J.N. 1989. Mushroom Cultivation, ICAR, New Delhi.
2. Nita Bahl. 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.
3. Stephen Russel, 2014. The essential guide to cultivating mushrooms, p.1-232.
4. Suman, B.C and Sharma, V.P. 2007.Mushroom cultivation in India, Daya Publishing House, 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. Tradd Cotter, 2014. Organic Mushroom Farming and Mycoremediation: Simple to Advanced and Experimental Techniques for Indoor and Outdoor Cultivation, p.1-400.

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 designer:

1. **Dr.B.Sadhana**

THIAGARAJAR COLLEGE, MADURAI – 9.

(Re-Accredited with 'A^{++}' Grade by NAAC)

DEPARTMENT OF BOTANY

Bachelor of Science (B.Sc.,) (w.e.f. 2023-2024Batch)

Programme Code- UBO

Course Code	Course Title	Category	L	T	P	Credit
UBO23ST21	Botanical Garden and Landscaping	Skill Enhancement Compulsory Course-3	2	-	-	2

L - Lecture T - Tutorial P - Practical

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

Preamble

To equip the Students with the fundamental concepts of gardening and landscaping.

Course Outcomes

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

#	Course Outcome	Knowledge Level	Expected Proficiency	Expected Attainment
CO1	Recognize fundamental concepts of gardening and landscaping.	K1	100%	80%
CO2	Explain about significance of garden adornments and propagation structures.	K1	100%	90%
CO3	Apply techniques of landscaping for aesthetic purposes and gardening for recreation.	K2	100%	100%
CO4	Distinguish between formal, informal and free style gardens and their applications.	K3	100%	100%
CO5	Develop and design outdoor and indoor gardens and inculcate entrepreneurial skills for landscaping.	K3	100%	80%

K1 - Knowledge K2 - Understand K3 – Apply

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	S	S	S	S	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	S	S	M	L

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

Mapping of COs with PSOs

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

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

Blooms taxonomy

	CA		End of Semester
	First	Second	
Knowledge	30%	30%	30%
Understand	30%	30%	30%
Apply	40%	40%	40%
Total	100	100	100%

Title of the paper: Botanical Garden and Landscaping

Unit I: Principles of gardening, garden components, adornments, lawn making, methods of designing rockery, water garden, etc. Special types of gardens, their walkpaths, bridges, constructed features. Greenhouse. Special types of gardens, trees, their design, values in landscaping, propagation, planting shrubs and herbaceous perennials. Importance, design values, propagation, plating, climbers and creepers, palms, ferns, grasses and cacti succulents.

Unit II: Flower arrangement: importance, production and cultural operations, constraints, postharvest practices. Bioaesthetic planning, definition, need, round country planning, urban planning and planting avenues, schools, villages, beautifying railway stations, dam sites, hydroelectric stations, colonies, river banks, planting material for play grounds.

Unit III: Vertical gardens, roof gardens. Culture of bonsai, art of making bonsai. Parks and public gardens. Landscape designs, Styles of garden, formal, informal and free style gardens, types of gardens, Urban landscaping, Landscaping for specific situations, institutions, industries, residents, hospitals, roadsides, traffic islands, damsites, IT parks, corporate.

Unit IV: Establishment and maintenance, special types of gardens, Bio-aesthetic planning, ecotourism, theme parks, indoor gardening, therapeutic gardening, non-plant components, water scaping, xeriscaping, hardscaping.

Unit V: Computer Aided Designing (CAD) for outdoor and indoorscaping Exposure to CAD (Computer Aided Designing).

Text Books:

1. Acquaah, J. 2009. Horticulture – principles and practices, 4th edition, PHI learning Pvt. Ltd.
2. Rao Manibhushan K. 1991. Textbook of horticulture. MaC Millan India Ltd.
3. Gangulee H. C. and Kar A. K. 2004. College Botany Vol II, New Central Book Agency
4. Sharma V. K. 1999. Encyclopaedia of Practical Horticulture, Vol I – IV, Deep And Deep Publ. Pvt. Ltd.
5. Singh, J. 2018. Fundamentals of Horticulture. Kalyani Publishers.

References:

1. Berry, F. and Kress, J. 1991. Heliconia: An Identification Guide . Smithsonian Books.
2. Butts,E. and Stensson, K.2012.Sheridan Nurseries: 100 years of People, Plans and Plants. Dundurn Group Ltd.
3. Russell, T. 2012. Nature Guide: Trees: The world in your hands(Nature Guides).
4. Acquaah, J. 2009. Horticulture – principles and practices, 4th edition, PHI learning Pvt. Ltd.
5. EdmentSenn Andrews. 1994. Fundamentals of Horticulture.Tata. McGraw Hill Publishing Co., Ltd., Delhi.

Web resources

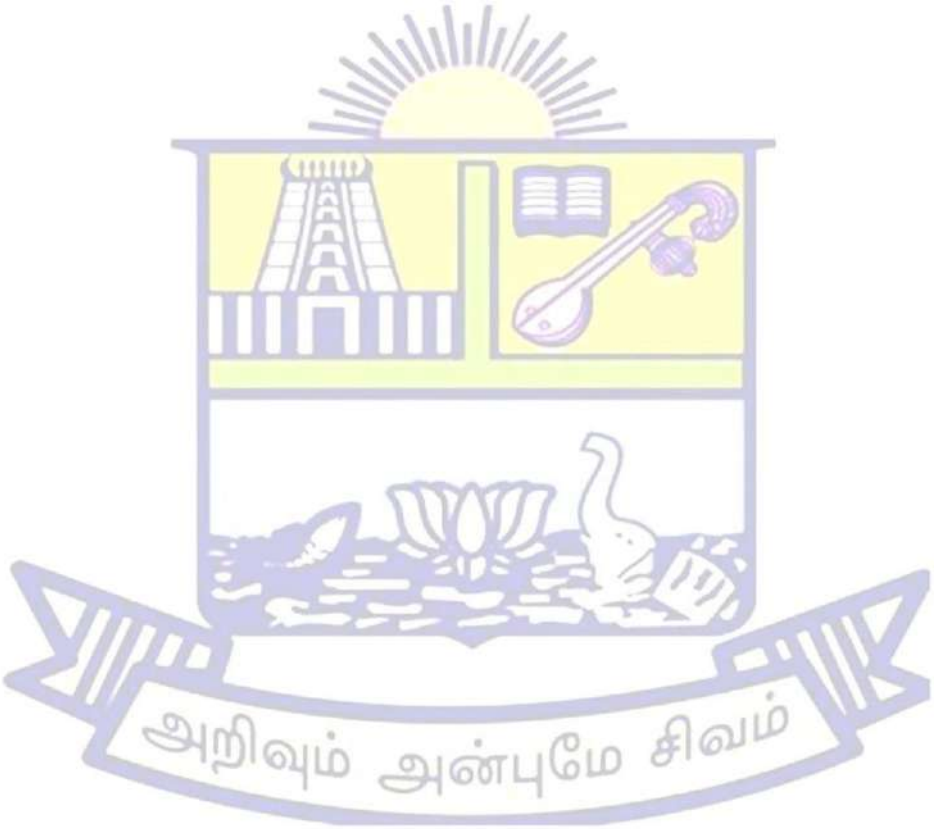
1. https://www.amazon.in/Gardening-Landscape-Design-andBotanicalGarden/s?rh=n%3A1318122031%2Cp_27%3Aand+Botanical+Gard en
2. https://www.overdrive.com/subjects/gardening
3. https://www.scribd.com/book/530538456/Opportunities-inLandscape-Architecture-Botanical-Gardens-and-Arboreta-Careers
4. https://www.scribd.com/book/305542619/Botanic-Gardens
5. https://www.overdrive.com/subjects/gardening

Course designer:

Dr.K.Jegatheesan

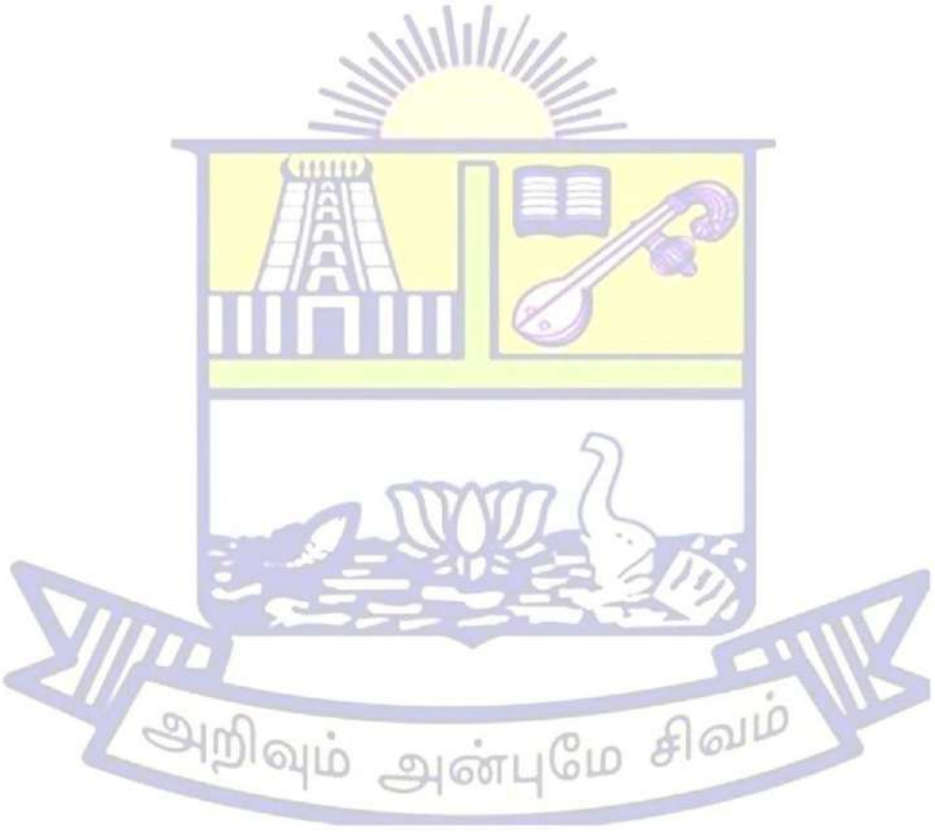
Thiagarajar College, Madurai - 625 009

(An Autonomous Institution Affiliated to Madurai Kamaraj University)
Re-Accredited with "A^{++}" Grade by NAAC



Academic Council Meeting
June 2023

M.Sc., Botany
Programme Code -PBO



Programme outcome - PO (Aligned with Graduate Attributes)

Master of Science (M.Sc.,)

PO1 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.

PO2 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

PO3 Applied learning

Students will be able to apply disciplinary or interdisciplinary learning across multiplecontexts, 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

PO4 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.

PO5 Problem solving

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

PO6 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.

PO7 Teamwork, collaborative and management skills

Recognize the opportunities and contribute positively incollaborative scientific research.Engage in intellectual exchange of ideas with researchers ofother 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 Tointegrate allied topics from the components of the course such as levels of plant organization, cell biology, ecology, evolution, biochemistry, embryology, basic biotechnology, physiology, molecular biology, 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

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 (bothexternal morphology, internal morphology), cell and molecular levels, through which the developmental and physiological functioning of 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 of Life Sciences

PSO5 Reveal proficient laboratory skills and in contemporary and advance technique

THIAGARAJAR COLLEGE, MADURAI – 9.

(Re-Accredited with 'A^{++}' Grade by NAAC)

DEPARTMENT OF BOTANY

Master of Science (M.Sc.,) Botany (w.e.f. 2023-2024 batch onwards)

Programme Code – PBO

SEMESTER –I

Course	Code No.	Subject	Contact Hrs/ Week	Credits	Total No of hours allotted	Max. Marks		Total
						CA	SE	
PART -A								
Core - 1	PBO23CT11	Plant Diversity	5	4	75	25	75	100
Core - 2	PBO23CT12	Microbiology and Plant Pathology	5	4	75	25	75	100
Core Lab - 1	PBO23CL11	Plant Diversity Lab	3	2	45	25	75	100
Core Lab - 2	PBO23CL12	Microbiology and Plant Pathology Lab	3	2	45	25	75	100
Core Elective - 1	PBO23ET11	Developmental Botany	5	4	75	25	75	100
Core Elective 2	PBO23ET12	Ethnobotany, Naturopathy and Traditional Healthcare	5	4	75	25	75	100
PART B								
SEC-1	PBO23ST11	Nursery and Gardening	2	2	30	25	75	100
AECC-1	PBO23AT11	Mushroom Cultivation	2	1	30	25	75	100
		Total	**30**	**23**	**450**	**200**	**600**	**800**

SEMESTER –II

Course	Code No.	Subject	Contact Hrs/ Week	Credits	Total No. of hours allotted	Max. Marks		Total
						CA	SE	
PART- A								
Core – 3	PBO23CT21	Taxonomy of Angiosperms Economic Botany	5	4	75	25	75	100
Core – 4	PBO23CT22	Ecology, Phytogeography and Conservation Biology	5	4	75	25	75	100
Core Lab – 3	PBO23CL21	Taxonomy of Angiosperms and Economic Botany Lab	3	2	45	25	75	100
Core Lab - 4	PBO23CL22	Ecology, Phytogeography and Conservation Biology Lab	3	2	45	25	75	100
Core Elective - 3	PBO23ET21	Research methodology, Computer Applications	5	4	75	25	75	100
Core Elective 4	PBO23ET22	Biostatistics and Bioinformatics	5	4	75	25	75	100
PART - B								
SEC-2	PBO23ST21	Intellectual Property Rights	2	2	30	25	75	100
AECC-2	PBO23AT21	Food Microbiology	2	1	30	25	75	100
		Total	**30**	**23**	**450**	**200**	**600**	**800**
	Internship / Industrial Activity (to be Carried out during Summer Vacation at the end of I year– 30 hours) to be assessed during III Semester							

SEMESTER –III

Course	Code No.	Subject	Contact Hrs/ Week	Credits	Total No. of hours allotted	Max. Marks		Total
						CA	SE	
Part A								
Core - 5	PBO23CT31	Plant Cell and Molecular Biology	5	4	75	25	75	100
Core - 6	PBO23CT32	Genetics and Plant Breeding	5	4	75	25	75	100
Core Lab - 5	PBO23CL31	Plant Cell and molecular Biology Lab	3	2	45	25	75	100
Core Lab - 6	PBO23CL32	Genetics and Plant Breeding Lab	3	2	45	25	75	100
Core Elective - 3	PBO23ET31	Entrepreneurial Opportunities in Botany	5	4	75	25	75	100
Industry Module course	PBO23CI31	Recombinant DNA Technology and Industrial applications	5	4	75	25	75	100
Part – B								
SEC - 3	PBO23ST31	Plant Tissue Culture	2	2	30	25	75	100
AECC - 3	P23AT31	Botany for NET/UGC-CSIR/SET/TRB competitive examinations-I	2	1	30	25	75	100
PBO23IN31	PBO23IN31	Internship /Industrial Activity (Carried out in Summer Vacation at the end of I year– 30 hours)	-	2 (Extra Credits)		100	---	100
		Total	30	23 +2(Extra Credits)	450	300	600	900

SEMESTER –IV

Course	Code No.	Subject	Contact Hrs/ Week	Credits	Total No. of hours allotted	Max. Marks		Total
						CA	SE	
PART - A								
Core - 7	PBO23CT41	Plant Physiology	5	4	75	25	75	100
Core - 8	PBO23CT42	Plant Biochemistry	5	4	75	25	75	100
Core Lab - 7	PBO20CL41	Plant Physiology Lab	3	2	45	25	75	100
Core Lab - 8	PBO20CL42	Plant Biochemistry Lab	3	2	45	25	75	100
Core Elective - 4 Project	PBO23PJ41	Project and Viva voce	5	4	75	25	75	100
Core Elective - 3	PBO23ET41	Biofertilizers and Organic farming	4	3	60	25	75	100
PART -B								
SEC – 4	PBO23ST41	Botany for NET/UGC-CSIR/SET/TRB competitive examinations-II	3	2	45	25	75	100
AECC - 4	PBO23AT41	Forestry and Wood Technology	2	1	30	25	75	100
			30	22	450	200	600	800
Total No of Credits 23+23+23+22= 91				Total Marks = 3300				

Distribution of Courses

Part A Number Core Theory courses: 08
Number of Core Practical Course: 08
Number of Generic Elective Courses: 03
Project 01
Number of Discipline Specific Elective Courses 03
Number of Industry Module Course 01
Part B Number of Skill Enhancement Courses 04
Number of Ability Enhancement Courses 04
Internship/ Industrial Activity (Carried out in Summer Vacation at the end of I year– 30 hours) 01
Total 33

Credit Distribution Year wise Credit distribution Course wise

I year:	46	Core theory courses:	32
II year:	45	Core lab courses:	16
		Generic Elective courses:	12
Total:	**91**	Project	03
		Discipline Specific Elective Course	12
		Industry Module course	04
		Skill enhancement Courses	08
		Ability Enhancement Courses	04
		Total:	**91**

Internship/ Industrial Activity (Carried out in Summer Vacation at the end of I year– 30 hours) 02 (Extra Credit)

THIAGARAJAR COLLEGE, MADURAI – 9.

(Re-Accredited with 'A^{++}' Grade by NAAC)

DEPARTMENT OF BOTANY

Master of Science (M.Sc.,) Botany (w.e.f. 2023-2024 batch onwards)

Programme Code – PBO

Course Code	Course Title	Category	L	T	P	Credit
PBO23CT11	Plant Diversity	Core-1	5	-	-	4
	L - Lecture T - Tutorial	P - Practicals				

Year	Semester	Int. Marks	Ext. Marks	Total
I	I	25	75	100

Preamble

To compare the complexity of different life forms with their significance

Course Outcomes

On completion of the course the student will be able to

#	Course Outcome	Knowledge Level	Expected Proficiency	Expected Attainment
CO1	Relate the structural organization and pattern of reproduction of various groups of plants	K1, K2	100%	80%
CO2	Understand the morphological and anatomical adaptations of various plant life forms	K2	100%	80%
CO3	Comprehend the Economic Importance and Ecological significance of plant groups	K2, K3	80%	80%
CO4	Recognize the evolutionary relationship and conservation of life forms	K4	80%	70%
CO5	Aware of fossilization, fossil forms and their importance	K5, K4	80%	60%

K1 - Knowledge K2 - Understand K3 – Apply K4- Analyze K5 Evaluate

Mapping of COs with POs

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

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	L	L
CO4	S	S	S	M	L
CO5	S	S	S	L	L

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

Blooms taxonomy

	CA		End 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 paper: Plant Diversity

Unit I: Algae: General Characters, Contributions of Indian Phycologist (T.V.Desikachary, V. Krishnamurthy and V.S. Sundaralingam), Classification of algae by F.E. Fritsch (1935-45) and Silva (1982). Salient features of major classes: Cyanophyceae, Chlorophyceae, Phaeophyceae and Rhodophyceae. Diverse habitats, range of thallus organization and reproduction (vegetative, asexual and sexual), life cycle patterns and economic importance of algae. Phylogeny and inter-relationships of algae, origin and evolution of sex in algae.

Unit II: Fungi: General Characters - Contributions of Indian Mycologists (C.V.Subramanian) - Classification of Fungi by Alexopoulos and Mims (1979) and Recent trends in the classification of fungi. General characters of major classes: Mastigomycotina, Amastigomycotina- Zygomycotina, Ascomycotina, Basidiomycotina and Deuteromycotina. Occurrence and distribution, mode of nutrition, heterothallism, sexuality, para sexuality, sex hormones and economic importance of fungi. Phylogeny and inter-relationships of major groups of fungi. Introduction of and Classification Lichen (Hale, 1969). Occurrence and inter-relationship of phycobionts and mycobionts, structure and reproduction in Ascolichens and Basiodiolichens

Unit III: Bryophytes: General characters - Classification of Bryophytes (Watson, 1971). General characters of major groups - Marchantiales, Jungermaniales, Anthocerotales, Sphagnales, Funariales and Polytrichales. Distribution, Structural variations and evolution of gametophytes and sporophytes in Hepaticopsida, Anthoceropsida and Mosses. Spore dispersal mechanisms and spore germination patterns in bryophytes. Economic Importance of bryophytes

Unit IV: Pteridophytes: General characters, Classification (Reimer, 1954). General characters of Psilopsida, Lycopsida, Sphenopsida and Pteropsida.: Range of structure, reproduction and evolution of sporophytes, gametophyte types – sex organs, apogamy and apospory, stelar evolution. heterospory and seed habit, telome theory and morphogenesis. Economic importance of Pteridophytes.

Unit V: Gymnosperms and Paleobotany: General characters - classification (K.R.Sporne, 1965). General characters of the classes: Cycadopsida, Coniferopsida and Gnetopsida. Phylogeny, Structure (Exomorphic and endomorphic) and Economic importance of Gymnopserms. Paleobotany: Geological time scale, radiocarbon dating; contribution of Birbal Sahni to Paleobotany. Gondwana flora of India. Study of fossils in understanding evolution. Fossilization and fossil types.

Text Books:

1. Kumar, H.D.1999. Introductory Phycology. East-West Press, Delhi.
2. Vashista B.R and Sinha, A.K. 2005. Botany for degree students – Algae, S. Chand & Co., New Delhi.
3. Vashista B.R & A.K Sinha 2005. Botany for degree students – Bryophta, S. Chand & Co., New Delhi.
4. ChandrakantPathak 2003. First Edition. Bryophyta, Dominant Publishers and Distributors, New Delhi.

5. Rashid, A. 1998. An introduction to bryophytes. Vikas Publishing House Pvt. Ltd., New Delhi.
6. Ahamadjian, V. 1973. The Lichens. Academic Press. New Delhi.
7. Vashista B.R., Sinha A.K., Kumar A. 2008. Botany for degree students - Pteridophyta, S. Chand & Co., New Delhi.
8. Sharma, O.P. 1990. Textbook of Pteridophyta. MacMillan India Ltd., New Delhi.
9. Vashishta. P.C., A.K. Sinha and Anil Kumar. 2007. Botany for Degree students - Gymnosperms. S. Chand & Co., New Delhi.
10. Meyen, S.V. 1987. Fundamentals of Palaeobotany. Chapman and Hall, New York.

References:

1. Fritsch, F.E. 1935. Structure and reproduction of the algae. Vol. I & II; Cambridge University Press, New York.
2. Sundaralingam, V. 1991. Marine algae. Bishen Singh and Mahendra Pal Singh Publishers,Dehradun.

Web Resources:

http://ndl.iitkgp.ac.in/document/MGJrWlJ5Y0s4MngzNVRtL2V2SGpmNDhoVXA3aCtmazhnWitwQ1h2cCtvQT0
http://ndl.iitkgp.ac.in/document/VVZXUDlSQ2ZNSlVaWUVXT3RFdUhvQTZQT0JDMHM0bmQzdHVNc0pnMWVtUT0
https://www.encyclopedia.com/plants-and-animals/botany/botany-general/pteridophytes
https://plantfacts.osu.edu/resources/hcs300/gymno.htm
https://www.frontiersin.org/articles/10.3389/fmicb.2017.00923/full
https://microbiologyonline.org/file/7926d7789d8a2f7b2075109f68c3175e.pdf.
http://www.cuteri.eu/microbiologia/manuale_microbiologia_pratica.pdf .
https://www.amazon.in/Manual-Practical-Bryophyta-Suresh-Kumar/dp/B0072GNFX
https://www.amazon.in/Practical-Manual-Pteridophyta-Rajan-Sundara/dp/8126106883
https://www.goole.co.in/books/edition/Gymnosperms/3YrT5E3Erm8C?hl=en&gbpv=1&dq=gymnosperms&printsec=frontcover
https://www.amazon.in/Paleobotany-Biology-Evolution-Fossil-Plants/dp/0123739721

Course designer:

Dr. K. Saraswathi

THIAGARAJAR COLLEGE, MADURAI – 9.

(Re-Accredited with 'A^{++}' Grade by NAAC)

DEPARTMENT OF BOTANY

Master of Science (M.Sc.,) Botany (w.e.f. 2023-2024 batch onwards)

Programme Code – PBO

Course Code	Course Title	Category	L	T	P	Credit
PBO23CL11	Plant Diversity Lab	Core Lab-1	-	-	3	2

L - Lecture T - Tutorial P - Practicals

Year	Semester	Int. Marks	Ext. Marks	Total
I	I	25	75	100

Preamble

To familiarize plant diversity, complexity and its significance

Course Outcomes

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

#	Course Outcome	Knowledge Level	Expected Proficiency	Expected Attainment
CO1	Recall and apply the basic keys to distinguish plant forms at species level and identification of important algae and fungi through their structural organizations.	K1, K2	100%	80%
CO2	Demonstrate practical skills in thallophytes, Pteridophytes and Gymnosperms.	K2	100%	80%
CO3	Describe the structure of algae, fungi, lichens, Bryophytes, Pteridophytes and Gymnosperms	K2, K3	80%	80%
CO4	Determine the importance of structural diversity in the evolution of plant forms.	K4	80%	70%
CO5	Formulate techniques to isolate and culture of alga and fungi as well as to understand the diversity of plant forms.	K3, K5	80%	60%

K1 - Knowledge K2 - Understand K3 – Apply K4- Analyze K5 Evaluate

Mapping of COs with POs

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

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

Mapping of COs with PSOs

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

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

Title of the paper: Plant Diversity

1. Study of algal genera included in theory in the field and laboratory of the.
2. Morphology and Anatomy of the vegetative and reproductive structures of the following living forms: *Oscillatoria*, *Scytonema, Ulva*, *Codium*, *Diatoms, Dictyota* and *Gelidium* (depending on availability).
3. To record the local algal flora–Study of their morphology and structure.
4. Identification of algae to Generic level (at least One).
5. Preparation of culture media and culture of green algae and blue green algae in the laboratory (Demonstration).
6. Study of morphological and reproductive structures of the following living forms: *Plasmodiophora, Phytophthora, Rhizopus, Taphrina, Polyporus* and *Colletotrichum*
7. Study of morphological and reproductive structures of the genera *Parmelia.*
8. Morphology and Anatomy of the vegetative and reproductive organs of the following living forms: *Marchantia,Targionia, Lunularia, Porella, Funaria* and *Polytrichum* (depending on availability)
9. Morphology and internal anatomy of the vegetative and reproductive organs of the following living forms: *Lycopodium, Selaginella, Isoetes, Equisetum Angiopteris, Osmunda, Pteris, Pteridium, Marsilea* and *Azolla* (depending on availability of the specimen).
10. Morphology and anatomy of the vegetative and reproductive organs of the following living forms: *Cycas, Pinus, Thuja, Cupressus, Araucaria, Podocarpus, Gnetum* and *Ephedra* (depending on availability).
11. Fossil slides observation*: Rhynia, Lepidodendron, Medullosa, Cordaites* and *Lyginopteris.*

Text Books:

1. Kumar, H.D.1999. Introductory Phycology. East-West Press, Delhi.
2. Vashista B.R and Sinha, A.K. 2005. Botany for degree students – Algae, S. Chand & Co., New Delhi.
3. Vashista B.R & A.K Sinha 2005. Botany for degree students – Bryophta, S. Chand & Co., New Delhi.
4. ChandrakantPathak 2003. First Edition. Bryophyta, Dominant Publishers and Distributors, New Delhi.
5. Rashid, A. 1998. An introduction to bryophytes. Vikas Publishing House Pvt. Ltd., New Delhi.
6. Ahamadjian, V. 1973. The Lichens. Academic Press. New Delhi.
7. Vashista B.R., Sinha A.K., Kumar A. 2008. Botany for degree students - Pteridophyta, S. Chand & Co., New Delhi.
8. Sharma, O.P. 1990. Textbook of Pteridophyta. MacMillan India Ltd., New Delhi.
9. Vashishta. P.C., A.K. Sinha and Anil Kumar. 2007. Botany for Degree students- Gymnosperms S. Chand & Co., New Delhi.
10, Meyen, S.V. 1987. Fundamentals of Palaeobotany. Chapman and Hall, New York.

References:

1. Fritsch,F.E.1935. Structure & reproduction of the algae. Vol. I & II; Cambridge University Press, New York.
2. Sundaralingam, V. 1991. Marine algae. Bishen Singh and Mahendra Pal Singh Publishers,Dehradun.

Web Resources:

http://ndl.iitkgp.ac.in/document/MGJrWlJ5Y0s4MngzNVRtL2V2SGpmNDhoVXA3aCtmazhnWitwQ1h2cCtvQT0

http://ndl.iitkgp.ac.in/document/VVZXUDlSQ2ZNSlVaWUVXT3RFdUhvQTZQT0JDMHM0bmQzdHVNc0pnMWVt
UT0

https://www.encyclopedia.com/plants-and-animals/botany/botany-general/pteridophytes

https://plantfacts.osu.edu/resources/hcs300/gymno.htm

https://www.frontiersin.org/articles/10.3389/fmicb.2017.00923/full

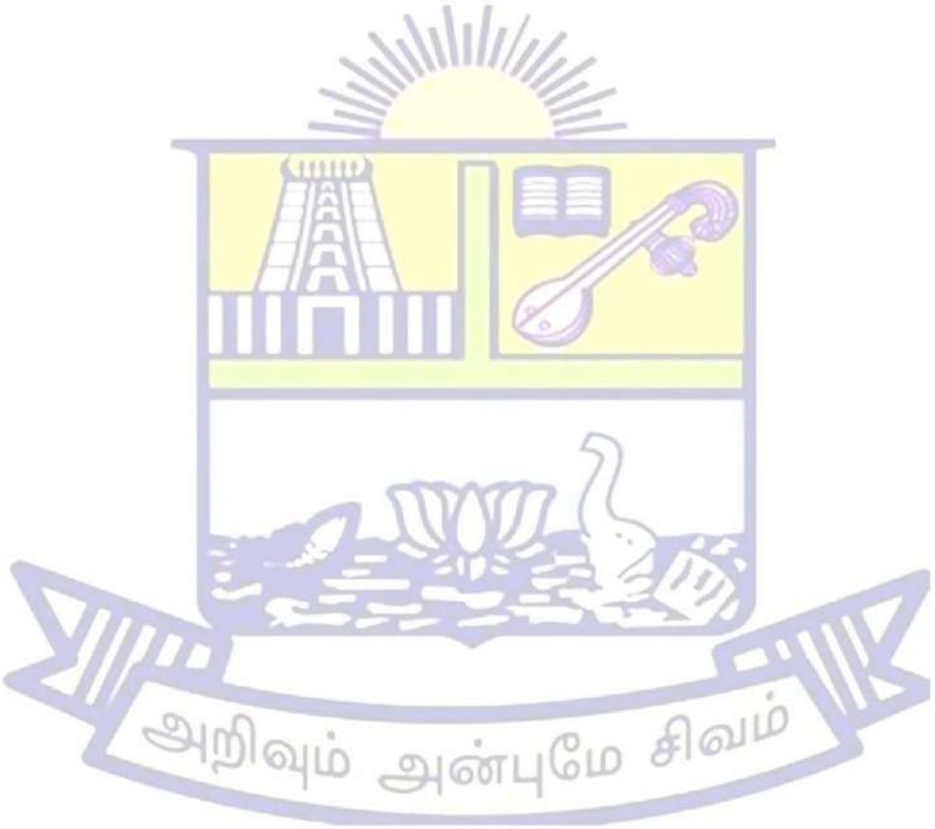
https://microbiologyonline.org/file/7926d7789d8a2f7b2075109f68c3175e.pdf.

http://www.cuteri.eu/microbiologia/manuale_microbiologia_pratica.pdf . https://www.amazon.in/Manual-

Practical-Bryophyta-Suresh-Kumar/dp/B0072GNFX
https://www.amazon.in/Practical-Manual-Pteridophyta-Rajan-Sundara/dp/8126106883
https://www.goole.co.in/books/edition/Gymnosperms/3YrT5E3Erm8C?hl=en&gbpv=1&dq=gymnosperms&printsec=frontcover
https://www.amazon.in/Paleobotany-Biology-Evolution-Fossil-Plants/dp/0123739721

Course designer:

Dr. K. Saraswathi



THIAGARAJAR COLLEGE, MADURAI – 9.
(Re-Accredited with 'A^{++}' Grade by NAAC)
DEPARTMENT OF BOTANY
Master of Science (M.Sc.,) Botany (w.e.f. 2023-2024 batch onwards)
Programme Code – PBO

Course Code	Course Title	Category	L	T	P	Credit
PBO23CT12	Microbiology and Plant Pathology	Core-2	5	-	-	4

L - Lecture T - Tutorial P - Practical

Year	Semester	Int. Marks	Ext. Marks	Total
I	I	25	75	100

Preamble

To equip the students with handling of microbes and its culture methods for analysing various microbial infections and diseases in human, animals and plants.

Course Outcomes

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

#	Course Outcome	Knowledge Level	Expected Proficiency	Expected Attainment
CO1	Classify the microbes according to their basic features	K1	100%	80%
CO2	Practice the isolation of microbes from the natural sources and its preservation	K2	100%	90%
CO3	Analyze the Characteristics of viruses	K3	100%	100%
CO4	Assess the milestones in phytopathology development in Worldwide Classification of plant diseases and symptoms with diagnosis of infected plant propagules.	K4	100%	100%
CO5	Imbibe the knowledge of different control methods of plant diseases and etiology of plant diseases	K5	100%	80%

K1 - Knowledge K2 - Understand K3 – Apply K4- Analyse K5- Evaluate

Mapping of COs with POs

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

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

Blooms taxonomy

	CA		End Semester
	First	Second	
Knowledge K1	15%	15%	20%
Understand K2	15%	15%	20%
Apply K3	30%	30%	20%
Analyze K4	20%	20%	20%
Evaluate K5	20%	20%	20%
Total	60	60	150

Title of the paper: Microbiology and Plant Pathology

Unit I: Microbiology: Introduction-general account on microbes, history of microbiology, Classification-whittaker's five kingdom, Bergey's system of bacterial classification and virus classification.

Unit II: Sterilization methods-physical-chemical, culture Medias, Bacterial growth-phases of growth, factors affecting bacterial growth, turbidometry and haemocytometery. Staining techniques, Pure culture techniques, preservation of microbial cultures.

Unit III: Viruses: General characters, Classification, Structure, Multiplication. Overview of Phycoviruses and Mycoviruses. Viruses of Eukaryotes – Animal & Plant viruses. Cultivation of viruses – in embryonated egg and in plants. Control of viral infections. Bacteriophages- classification, replication of DNA and RNA phages - Lytic and Lysogenic cycle. Viroids and prions. Mycoplasma: Structure and classification**.**

Unit IV: Milestones in phytopathology with particular reference to National and International - classification of plant diseases based on symptoms, Molecular mechanisms of pathogenesis: elicitors, recognition phenomenon, penetration, invasion, primary disease determinant. Defence mechanism: Structural and biochemical. R-Genes, PR proteins, SAR, ISR and HR. Major epidemics and their social impacts.

Unit V: Symptoms, causative organism, disease cycle and control of diseases caused by A) Fungi: Red rot, Paddy Blast, White rust, leaf spot of Ground nut.B) Bacteria: Cotton blight, Citrus canker.C) Virus: Bhendi Yellow vein clearing virus, cucumber mosaic virus.D) Phytoplasma: Brinjal little leaf, Sesamum phyllody.

Text Books:

1. Prescott, L.M. and D.A.Harkey. 1996. Microbiology.Ww. C. Brown Publishers, London.
2. Pommerville, J.C.2006. Alcomals Fundamantals of Microbiology. Jones and Bertlett Publishers, London.
3. Atlas, R.M.1995. Principles of Microbiology. Morby Publishers, St. Louis.
4. Pelczer,M.,E.C.S.Chan nad N.R.Krieg.1993.Microbiology-concepts and Applications. Tata Mc-Graw Hill Ltd., Inc., NewYork.
5. Stanier, R.Y., J.L.Ingrahm, M.L. Wheelis and P.R. Painter.1990. The Microbial World, Prentice Hall of India Pvt. Ltd. New Delhi.
6. Mehrotra, R.S.1980. Plant Pathology. Tata McGraw-Hill Publishing Company Ltd., New Delhi.
7. Pandey, B.R.1997. Plant Pathology. S. Chand and company, New Delhi.
8. Agrios,G.N. 2006. Plant Pathology, Fifth Edition, Academic Press, New York.
9. M.L. Gullinio, spinger, 2014 Detection and diagnosis of plant diseases.

References:

1. Alexopolus, C.J. and Mims, C.W.1979. Introductory Mycology. III Edition. Wiley Eastern Ltd.
2. Rengasamy, G. 1979. Disease of crop plants in India. III edi., Prentice Hall of India, Pvt Ltd,
3. Prescott, L.M., Harley , J.P. nad Klein, P.A. 1993. Microbiology. W.M.C. Brown publishers, IOWA,
4. Patel, A.H. 1985. Industrial Microbiology, Macmillan India Ltd. New Delhi.
5. Purohit, S.S.1995. Microbiology-Fundamantals and applications, V Ed. Agrobotanical Publishers,
6. John, A. Lucas., Wiley and Blackswell, Plant Pathology and Plant Pathogens, ISBN 97981118893869.
7. Rangaswami, Diseases of Crop Plants in India, Mahavevan, ISBN 8120312473.

Web Resources:

1. http://highered.mheducation.com/sites/0072320419/student_view0/chapter1/chapter_web_links.html
2. http://www.freebookcentre.net/medical_books_download/General-Microbiology-by-Rachel-Watson.html
3. https://ocw.mit.edu/courses/biological-engineering/20-106j-systems-microbiology-fall-2006/lecture-notes/
4. https://www.apsnet.org/edcenter/resources/commonnames/Pages/default.aspx
5. https://ohioline.osu.edu/factsheet/plpath-gen-2

Course designer:

1. **Dr.B.Sadhana**
2. **Dr.V.Karthikeyan**

THIAGARAJAR COLLEGE, MADURAI – 9.

(Re-Accredited with 'A^{++}' Grade by NAAC)

DEPARTMENT OF BOTANY

Master of Science (M.Sc.,) Botany (w.e.f. 2023-2024 batch onwards)

Programme Code – PBO

Course Code	Course Title	Category	L	T	P	Credit
PBO23CL12	Microbiology and Plant Pathology lab	Core Lab-2	-	-	3	2

L - Lecture T - Tutorial P - Practical

Year	Semester	Int. Marks	Ext. Marks	Total
I	I	25	75	100

Preamble To equip the students with the training of microbiological culture techniques and identification and pureculturing of isolated microbes from various samples.

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 media preparation for microbial cultures isolation form different sources	K1	100%	80%
CO2	Practice the staining methods,	K2	100%	90%
CO3	Apply the method for observing bacterial growth using quantification and turbidity.	K3	100%	100%
CO4	Analyze and develop the skills for isolation of microbes from infected plant materials and other samples	K4	100%	100%
CO5	Examine the different control measures in field trials.	K5	100%	80%

K1 - Knowledge K2 - Understand K3 – Apply K4- Analyse K5- Evaluate

Mapping of COs with POs

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

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

Mapping of COs with PSOs

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

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

Blooms taxonomy

	CA		End of Semester
	First	Second	
Knowledge	5%	5%	10%
Understand	10%	10%	20%
Apply	10%	10%	20%
Analyze	15%	15%	30%
Evaluate	10%	10%	20%
Total	52	52	104

Title of the paper: Microbiology and Plant Pathology Lab

1. Preparation of media and pure culture technique.
2. Staining methods: Acid fast staining, Gram staining, Negative staining, Endospore staining.
3. Motility of bacteria-Hanging drop method.
4. Determining bacterial growth-turbidometry and haemocytometer counting method.
5. Preservation of microbial cultures.
6. Collection and Preservation 10 (Digital and Herbarium) of Plant disease materials
7. Isolation and purification of plant pathogens from infected plant materials.
8. Isolation of AM spores by wet sieving-decanting method.
9. *Alternaria sp*. leaf spot
10. *Cercospora sp.* leaf spot.
11. *Xanthomonas sp.* Leaf blight
12. *Colletotrichium sp.* Red rot
13. Plant virus, insect, pest and nematode symptoms demonstration study

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. Cappuccino, J.G. and Sherman, N.1987. Microbiology: A Laboratory Manual. State University of Newyork, The Benjamin/Cummings Publishing Company, New York.
3. Manual of General Microbiology, Kannan.
4. A. Mahadevan and R. Sridhar, "Methods in Physiological Plant Pathology," 2nd Edition, Sivakami Publications, Madras, 1982.

Course designers:

1. **Dr.B.Sadhana**
2. **Dr.V.Karthikeyan**

THIAGARAJAR COLLEGE, MADURAI – 9.

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DEPARTMENT OF BOTANY

Master of Science (M.Sc.,) Botany (w.e.f. 2023-2024 batch onwards)

Programme Code – PBO

Course Code	Course Title	Category	Lecture	Tutorial	Practical	Credit
PBO23GT11	Developmental Botany	Generic Elective - 1	5	-	-	4

Year	Semester	Int. Marks	Ext. Marks	Total
I	I	25	75	100

Preamble

To acquire in-depth knowledge of embryological development of angiosperm plant and their components.

Prerequisite

The student must have completed the related course during undergraduate programme.

Course Outcomes

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

CO	Course Outcome	Knowledge Level	Expected Proficiency	Expected Attainment
CO1	Comprehend the contributions by national and international embryologists	K1	100%	80%
CO2	Understand various concepts of microspore and megaspore development in angiosperm plants	K2	100%	90%
CO3	Depict the fertilization and post-fertilization processes, incompatibility and demonstrate the methods of overcoming self-incompatibility	K3	100%	100%
CO4	Demonstrate Embryogenesis, development of fruit, polyembryony, apomixis and role of plant growth substances	K4	100%	100%
CO5	Comprehend the tissue differentiation, plant galls, crown gall tumours and biological significance	K5	100%	80%

K1 - Knowledge K2 - Understand K3 - Apply K4 - Analyze K5 - Evaluate

Mapping of COs with POs

	POI	PO2	PO3	PO4	POS	PO6	PO7
COl	S	L	S	S	L	M	S
CO2	S	M	M	M	L	M	S
CO3	S	S	S	S	M	M	S
CO4	S	M	S	L	M	L	S
CO5	S	S	M	L	L	S	S

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

Mapping of COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSOS
COl	S	S	M	L	M
CO2	S	L	L	L	S
CO3	S	M	S	L	M
CO4	S	S	L	L	M
CO5	S	S	S	L	S

Blooms taxonomy

	CA		End of the Semester
	First	Second	
Knowledge	15%(9)	15%(9)	20%(30)
Understand	15%(9)	15%(9)	20%(30)
Apply	30%(18)	30%(18)	20%(30)
Analyse	20%(12)	20%(12)	20%(30)
Evaluate	20%(12)	20%(12)	20%(30)

Title of the paper

Unit - I: Historical account -Contributions of Indian Plant Embryologists-Maheswari, P, Johri BM,Swamy, BGL.,International Plant Embryologists-Amici, G.B.,Wihalm Hofmeister, Edward Strasburger, Sergius Nawaschin, Wunderlich; Scope of plant embryology :to other branches of botany-taxonomy, cell biology, plant tissue culture, molecular biology and industries -plant breeding, secondary plant metabolites

Unit - II: Microsporogenesis - Microsporangium -Morphology and development of Male gametophyte; wall layers, tapetum, MMC and microspores Megasporogenesis - Megasporangium - structure and organization of embryo sac; positional variation and development

Unit - III: Fertilization and post -fertilization -Pollination - Pollen germination, pollen tube growth and cellular, biochemical changes; Self-incompatibility, Genetic basis of self• incompatibility, Barriers to fertilization, Significance of Incompatibility, Methods to overcome incompatibility Syngamy and types; Double fertilization-Definition, importance; Triple fusion- Endosperm cellular, nuclear and helobial types, endosperm haustoria types and functions

Unit IV- Embryogenesis - Embryo Development stages - cell lineages during late embryo development - Dicot embryo and monocot embryo development – Agamospermy; Polyembryony- **Causes** classification, induction and practical application. Apomixis and its significance. Seed and Fruit development and role of growth substances. Parthenocarpy and Apomixis its importance.

Unit V: Morphogenesis - Definition, scope and importance; Concepts - differentiation, dedifferentiation, re-differentiation, polarity, symmetry - Morphogenetic factors - Physical, mechanical, chemical and genetic factors. Plant Galls- types, causal organisms - phytocecdion, zoocecidion, Development process and crown gall plant tumours -Biological significance

Text Books:

1. Mani,M.S.1964.EcologyofPlantGalls,SpringerSciencesBusinessMedia,Dordrecht,UK.
2. Swamy B.G.Land Krishnamurthy K.V 1990 From flower tofruits, Tata-McGraw Hillpublishing CoLtd, New Delhi
3. Maheswari.P 1991.AnIntroduction toEmbryologyofAngiosperms. Tata-McGraw hillPublishing Co .Ltd. New Delhi
4. Raghavan,V.1997.Molecularembryologyoffloweringplants.CambridgeUniversityPress.UK.
5. Pullaiah, T., Lakshminarayanan, K. andHanumanthaRao, B. 2001. Textbook of embryologyof angiosperms, Regency Publications, New Delhi.
6. Lersten,N.R.2004.FloweringPlantEmbryology.BlackwellPublishing,Australia.
7. Powar, C.B. 2009. Cell Biology. Himalayan Publishing House, New Delhi.
8. Bhojwani,S.S.Bhatnagar,S.P.andDantu,P.K.2015.TheEmbryologyofAngiosperms(6th revised and enlarged edition). Vikas Publishing House, New Delhi.

References:

1. Alberts, B. et al., 1994. Molecular Biology of the Cell (3rdedition). Garland Publishing,Inc., New York
2. De Roberties E.D.P and E.M.F.DeRoberties. 2011. Cell and Molecular Biology. (8thedition). B.I. PublicatonsPvt. Ltd., India
3. Burgess,J.1985 An Introduction to Plant Cell Development. Cambridge UniversityPress, Cambridge
4. Leins,P.,TucKer,S.C.andEndress,P.K.(1988)AspectsofFloralDevelopment,J.Cramer, Germany,
5. Fosker,D.E.1994.Plant Growth and Development. A Molecular Approach. AcademicPress,San Diego,
6. Howell,S.H.1998.MolecularGeneticsofPlantDevelopment. CambridgeUniversitypress, Cambridge,

7. Bhojwani,S.S.andSoh, W.Y.2001.CurrentTrendsintheembryology ofangiosperms. Kluwer Academic Publishers. The Netherlands.

Web Resources:

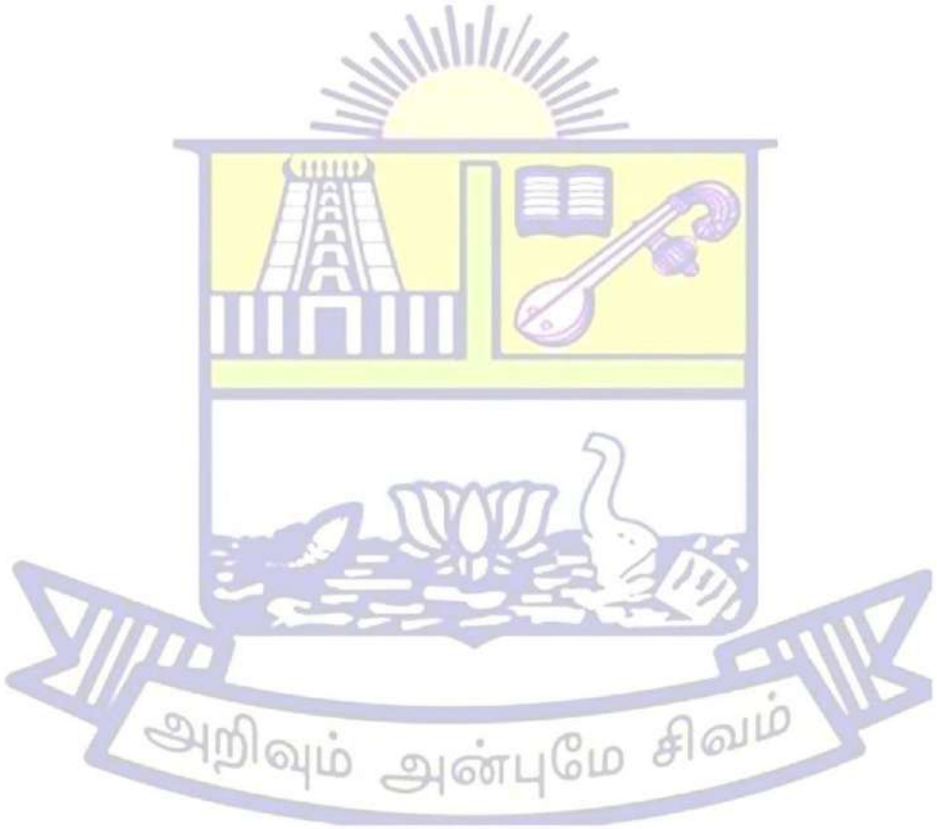
https://www.slideshare.net/HimanshiChauhanl/history-of-embryology-in-plants
https://www.youtube.com/watch?v=dgFY7WUTASQ
https://www.youtube.com/watch?v=a9n2aUJ5Xuw
https://www.youtube.com/watch?v=XoPMy9rPhMo
https://www.youtube.com/watch?v=DPcSTA3EUE4

Course Designer: Dr . D. Kannan

Lecture Schedule

Unit	Topic	Lecture hrs.	Method
1.1	Historical account -Contributions of Indian Plant Embryologists-Maheswari, P, Johri BM,Swamy,BGL.	**3**	**PPT presentation**
1.2	International Plant Embryologists-Amici,G.B.,Wihalm Hofmeister, Edward Strasburger, Sergius Nawaschin, Wunderlich	**3**	**PPT presentation**
1.3	Scope on plant embryology: to other branches of Botany-taxonomy, cellbiology	**3**	**Lecturing,**
1.4	Scope on plant embryology: Plant tissue culture, molecular biology and industries Scope on plant embryology: Plant breeding, secondary plant metabolites	**6**	**Lecturing,**
2.1	Microsporogenesis-Microsporangium-Morphology and development of Male gametophyte; Microsporogenesis - wall layers, tapetum, MMC and microspores	**7**	**Lecturing, PPT presentation**
2.2	Megasporogenesis - Megasporangium - structure and organization of embryo sac; positional variation and development	**5**	**Lecturing, PPT presentation**
2.3	Megasporogenesis - Positional variation and development	**3**	**PPT**
3.1	Fertilization and post -fertilization -Pollination	**3**	**Lecturing,**
3.2	Pollen germination, pollen tube growth and cellular, biochemical changes; Self-incompatibility	**3**	**Lecturing,**
3.3	Genetic basis of self• incompatibility, Barriers to fertilization, Significance of Incompatibility, Methods to overcome incompatibility	**3**	**Lecturing, PPT presentation**
3.4	Syngamy and types; Double fertilization-Definition, importance; Triple fusion-	**3**	**PPT presentation**
3.5	Endosperm cellular, nuclear and helobial types, endosperm haustoria types and functions	**3**	**PPT presentation**
4.1	Embryogenesis - Embryo Development stages - cell lineages during late embryo development	**4**	**PPT presentation**
4.2	Dicot embryo and monocot embryo development	**3**	**Lecturing,**
4.3	Agamospermy and Polyembryony- **Causes** classification, induction and practical application	**3**	**Lecturing,**
4.4	Apomixis and its significance. Seed and Fruit development and role of growth substances Parthenocarpy and Apomixis its importance	**5**	**Lecturing,**
5.1	Morphogenesis - Definition, scope and importance - Concepts - differentiation, dedifferentiation, re-differentiation, polarity,	**7**	**Lecturing,**

5.3	Morphogenetic factors - Physical, mechanical, chemical and genetic factors	**3**	**Lecturing,**
5.4	Plant Galls-types, causal organisms-phytocecdion, zoocecidion, Development process	**3**	**Lecturing,**
5.5	crown gall plant tumours -Biological significance	**2**	**Lecturing,**
Total		**75**	



THIAGARAJAR COLLEGE, MADURAI – 9.

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DEPARTMENT OF BOTANY

Master of Science (M.Sc.,) Botany (w.e.f. 2023-2024 batch onwards)

Programme Code – PBO

Course Code	Course Title	Category	L	T	P	Credit
PBO23ET11	**Ethnobotany, Naturopathy and Traditional health care**	Discipline Specific Elective 1	**5**	**-**	**-**	**4**

L - Lecture T - Tutorial P - Practicals

Year	Semester	Int. Marks	Ext. Marks	Total
I	**I**	**25**	**75**	**100**

Preamble

To equip the students with the concept of Ethnobotany, naturopathy and traditional health care

Course Outcomes

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

#	Course Outcome	Knowledge Level	Expected Proficiency	Expected Attainment
CO1	Understand the concept of ethnobotany and the life style and traditional practices of plants by Indian tribals	K1	100%	60%
CO2	Emphasize the importance of non-timber forest products for Indian tribal people livelihoods	K2	90%	70%
CO3	Evaluate the various research techniques to gather tribal knowledge of ethnobotany.	K2	80%	80%
CO4	Use strategies to turn ethno botanical knowledge into goods with value additions.	K2	80%	80%
CO5	To save and document ethno botanicalsin order to use plant resources sustainably	K3	80%	80%

K1 - Knowledge K2 - Understand K3 – Apply

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	**S**	**S**	**L**	**S**	**M**	**S**	**S**
CO2	**S**	**M**	**L**	**M**	**S**	**S**	**S**
CO3	**S**	**S**	**M**	**S**	**L**	**S**	**S**
CO4	**S**	**M**	**S**	**L**	**L**	**S**	**S**
CO5	**S**	**S**	**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**	**M**
CO2	**S**	**M**	**M**	**M**	**S**
CO3	**S**	**S**	**M**	**S**	**S**
CO4	**S**	**M**	**S**	**M**	**S**
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%
Total	52	52	140

Title of the paper: Ethnobotany, Naturopathy and Traditional health care

Unit I ETHNOBOTANY: Concept, important landmarks in the development, scope, sub disciplines of ethno botany. Interdisciplinary approaches. Knowledge of following sociological and anthropological terms: culture, values and norms, institutions, culture diffusion and ethnocentrism. History of ethnobotany: A brief history of ethno botanical studies in the world and in India.

Unit II PLANTS USED BY TRIBALS OF INDIA: Distribution of tribes in India. Basic knowledge of following tribes of Tamil Nadu: Irulas, Kanis, Paliyars, and Malayalis. Plants used by tribals of Tamil Nadu.

Unit III SOURCES OF ETHNOBOTANICAL DATA: Primary - archeological sources and inventories, Secondary - travelogues, folklore and literary sources, herbaria, medicinal texts and official records. Methods in ethnobotanical research. Prior Informed Consent, PRA techniques, interviews and questionnaire methods, choice of resource persons. Folk taxonomy – plants associated with culture and socio- religious activities. Non – timber forest products (NTFP) and livelihood – Sustainable harvest and value addition.

Unit IV NATUROPATHIC MEDICINE: Role of plants in naturopathy- Importance and relevance of medicinal drugs in India. Indian Systems of Medicine (Ayurveda, Siddha, Allopathy, Homeopathy, Unani, Yoga and Naturopathy). Disease diagnosis, treatment, and cure using natural therapies including dietetics.

Unit V TRADITIONAL HEALTH CARE: Health practices, approaches, knowledge and beliefs incorporating plant, animal and mineral based medicines, spiritual therapies, manual techniques and exercises, applied singularly or in combination to treat, diagnose and prevent illnesses or maintain well-being. **BIOPROSPECTING AND VALUE ADDITION:** Bioprospecting of drug molecules derived from Indian traditional plants; Methods for bioprospecting of natural resources; Ethno botanical databases and Traditional knowledge Digital Library (TKDL).

TextBooks:

1. Subramaniam, S.V and V.R. Madhavan (Eds,). 1983. Heritage of the Tamil Siddha Medicine. International Institute of Tamil Studies. Madras.
2. Jain, A. and Jain, S.K. 2016. Indian Ethno botany - Bibliography of 21st Century Scientific Publishers (India).
3. Gokhale, S.B., Kokate, C.K and Gokhale, A. 2016. Pharmacognosy of Traditional Drugs. 1st ed. NiraliPrakashan, Pune.
4. Gringauz. 2012. Introduction to Medicinal Chemistry: How Drugs Act & Why? Wiley India Pvt Ltd. Noida.

Joshi, S.G. 2018. Medicinal Plants. Oxford & IBH Publishing C., Pvt., Ltd., New Delhi.

References:

1. CSIR. 1940-1976. Wealth of India. A Dictionary of Raw Materials and Industrial Products - Raw Materials. Vol.1-11. CSIR Publication & Information Directorate. New Delhi.
2. Gokhale, S.B., Kokate, C.K and Gokhale, A. 2016. Pharmacognosy of Traditional Drugs. 1st ed. Nirali Prakashan, Pune.
3. Laird, S.A. 2002. Biodiversity and Traditional knowledge equitable partnerships in Practice. Earthscan Publications Ltd., London.
4. Ministry of Environment and Forests. 1994. Ethno biology in India. A Status Report. All India Coordinated Research Project on Ethno biology. Ministry of Environment and Forests. New Delhi.
5. Kumar, N. 2018. A Textbook of Pharmacognosy. Aitbs Publishers, India.
6. Premendra Singh. 2013. Medicinal Plants: Conservation, Cultivation and Utilization. Daya Publishing House, New Delhi.

Course designers:

1. Dr. R.Aruna

THIAGARAJAR COLLEGE, MADURAI – 9.

(Re-Accredited with 'A^{++}' Grade by NAAC)

DEPARTMENT OF BOTANY

Master of Science (M.Sc.,) Botany (w.e.f. 2023-2024 batch onwards)

Programme Code – PBO

Course Code	Course Title	Category	L	T	P	Credit
PBO23ST11	Nursery and Gardening	Skill Enhancement Course-1	2	-	-	1

L - Lecture T - Tutorial P - Practical

Year	Semester	Int. Marks	Ext. Marks	Total
I	I	25	75	100

Preamble

Students should know nursery and gardening practices.

Course Outcomes

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

#	Course Outcome	Knowledge Level	Expected Proficiency	Expected Attainment
CO1	Recognize the basic process required for growing and maintaining plants in nurseries.	K1	100%	80%
CO2	Explain the different methods of plant propagation and various gardening styles.	K2	100%	90%
CO3	Apply techniques for effective hardening of plants and computer applications for creative gardening.	K3	100%	100%
CO4	Compare and contrast cultivation of different vegetables and growth of plants in nursery and gardening.	K4	100%	100%
CO5	Develop new strategies to enhance growth and quality of nursery plants.	K5	100%	80%

K1 - Knowledge K2 - Understand K3 – Apply K4- Analyse K5- Evaluate

Mapping of COs with POs

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

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

Mapping of COs with PSOs

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

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

Blooms taxonomy

	CA		End of Semester
	First	Second	
Knowledge	10%	10%	20%
Understand	10%	10%	20%
Apply	10%	10%	20%
Analyze	10%	10%	20%
Evaluate	10%	10%	20%
Total	52	52	104%

Title of the paper: Nursery and Gardening

Unit I: NURSERY: Definition, objectives and scope and building up of infrastructure for nursery, planning and seasonal activities - Planting - direct seeding and transplants.

Unit II: SEED: Structure and types - Seed dormancy; causes and methods of breaking dormancy - Seed storage: Seed banks, factors affecting seed viability, genetic erosion - Seed production technology - seed testing and certification.

Unit III: VEGETATIVE PROPAGATION: Air-layering, cutting, selection of cutting, collecting season, treatment of cutting, rooting medium and planting of cuttings - Hardening of plants - green house - mist chamber, shed root, shade house and glasshouse.

Unit IV: GARDENING: definition, objectives and scope - different types of gardening - landscape and
home gardening - parks and its components - plant materials and design - computer applications in landscaping.

Unit V: GARDENING OPERATIONS: Soil laying, manuring, watering, management of pests and diseases and harvesting. Sowing/raising of seeds and seedlings: Transplanting of seedlings - Study of cultivation of different vegetables: cabbage, brinjal, lady's finger, onion, garlic, tomatoes, and carrots - Storage and marketing procedures.

Text Books:

1. Bose T.K and Mukherjee, D. 1972. Gardening in India, Oxford & IBH Publishing Co., New Delhi.
2. Sandhu, M.K. 1989. Plant Propagation, Wile Eastern Ltd., Bengaluru.
3. Kumar, N. 1997. Introduction to Horticulture, Rajalakshmi Publications, Nagercoil.
4. Edmond Musser and Andres. 1957. Fundamentals of Horticulture, McGraw Hill Book Co., New Delhi.
5. Agrawal, P.K. 1993. Hand Book of Seed Technology, Dept. of Agriculture and Cooperation, National Seed
Corporation Ltd., New Delhi.

References:

1. N.L. Patel, S.L. Chawla, T.R. Ahlawat: Commercial Horticulture, 2016, ASPEE College of Horticulture,
Navsari Agricultural University, Navsari 396 450, Gujarat,
2. Prasad S & Kumar U. 2005. Greenhouse Management for Horticultural Crops. 2nd Ed. Agrobios.
3. George Acquaah, 2002, Horticulture-principles and practices. Prentice-Half of India pvt. Ltd., New Delhi.
4. Abraham, A and Vatsala, P. 1981. Introduction to Orchids. Trop. Bot. Garden, Trivandrum.
5. Hartman, H.T and Kester, D.E. 1989. Plant propagation. Printice Hall Ltd., New Delhi.

Web Resources:

1. https://www.kopykitab.com/Nursery-And-Gardening-SEC-by-Prof-C-D-Patil-Dr-G-M-Rane-Dr-S-A-Patil
2. https://www.amazon.in/Gardening-Books/b?ie=UTF8&node=1318122031
3 . https://www.worldcat.org/title/handbook-of-horticulture/oclc/688653648

Course designer:

Dr.K.Rajendran

THIAGARAJAR COLLEGE, MADURAI – 9.

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DEPARTMENT OF BOTANY

Master of Science (M.Sc.,) Botany (w.e.f. 2023-2024 batch onwards)

Programme Code – PBO

Course Code	Course Title	Category	L	T	P	Credit
PBO23AT11	Mushroom Cultivation	AECC -1	2	-	-	1

L - Lecture T - Tutorial P - Practical

Year	Semester	Int. Marks	Ext. Marks	Total
I	I	25	75	100

Preamble

To equip the students with the simple technology on mushroom cultivation and develop their entrepreneur skills for their carrier improvement.

Course Outcomes

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

#	Course Outcome	Knowledge Level	Expected Proficiency	Expected Attainment
CO1	Recognize the types of mushrooms and its structure	K1	100%	80%
CO2	Realize the nutritive value of edible mushrooms and prepare various mushroom based food recipe.	K2	100%	90%
CO3	Develop the basic skills in mushroom spawn production	K3	100%	100%
CO4	Practice commercial cultivation methods for edible mushrooms using different substrates	K4	100%	100%
CO5	Analyze different factors on mushroom production and apply the industrial based post-harvest techniques	K5	100%	80%

K1 - Knowledge K2 - Understand K3 – Apply K4- Analyse K5- Evaluate

Mapping of COs with POs

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

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

Mapping of COs with PSOs

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

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

Blooms taxonomy

	CA		End of Semester
	First	Second	
Knowledge	10%	10%	20%
Understand	10%	10%	20%
Apply	10%	10%	20%
Analyze	10%	10%	20%
Evaluate	10%	10%	20%
Total	52	52	104%

Title of the paper: Mushroom Cultivation

Unit I: Mushrooms-Introduction, Types of mushrooms- edible, non-edible and medicinal mushrooms. Morphology and internal structure of mushrooms.

Unit II: Food value of mushrooms: Nutrient composition of various edible mushrooms-proteins, amino acids, fats, lipids and carbohydrates.Mushroom recipe-soups, biryani, fries, candies, continental dishes.

Unit III: Favourable conditions for mushroom cultivation.Mushroom spawns-types of spawns, preparation of spawns using different substrates.

Unit IV: Commercial cultivation of *Pleurotus florida* and *Agaricus bisporus*-Selection of substrates and its preparation, spawn inoculation, incubation, Observing-spawning, pin head formation, basidiocarp formation, harvesting and packing.

Unit V: Factors affecting mushroom cultivation: Physical, chemical and biological factors-Pests and diseases in mushrooms. Economic values of mushrooms-applications in various field of food industries and medicine manufacturing industries.

Text Books:

1.Kapoor, J.N. 1989. Mushroom Cultivation, ICAR, New Delhi.
2. Nita Bahl. 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.

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 designer:

Dr.B.Sadhana

THIAGARAJAR COLLEGE, MADURAI – 9.

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DEPARTMENT OF BOTANY

Master of Science (M.Sc.,) Botany (w.e.f. 2023-2024 batch onwards)

Programme Code – PBO

Course Code	Course Title	Category	L	T	P	Credit
PBO23CT21	Taxonomy of Angiosperms and Economic Botany	Core- 3	5	-	-	4

L - Lecture T - Tutorial P - Practicals

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

Preamble

To equip the students with the basic principles and uses of Angiosperm taxonomy and economic botany, methodologies, techniques pertinent to Angiosperm taxonomy

Course Outcomes

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

#	Course Outcome	Knowledge Level	Expected Proficiency	Expected Attainment
CO1	Recall the classification of Angiosperm plants	K1	90%	80%
CO2	Demonstrate nomenclature, principles and typification concepts	K2	80%	70%
CO3	Examine dicot families, based on their key vegetative and floral characters	K3	80%	80%
CO4	Evaluate the key characteristic features and affinities among the select Families	K4	80%	80%
CO5	Analyze the morphology and uses of economically important plants	K5	90%	70%

K1 - Knowledge K2 - Understand K3 – Apply K4- Analyse K5- Evaluate

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**

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

Blooms taxonomy

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

Unit I: Introduction and scope, **C**lassification of Angiosperms: Basic principle, outline, merits and demerits for the following Systems: Artificial (Linnaeus), Natural (Bentham and Hooker), Phylogenetic (Hutchinson) and Modern (APG IV system 2016)

Unit II: ICBN–Nomenclature - 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, vegetative and floral characters, and economic importance of the following families, grouped under Polypetalae and Gamopetalae of dicotyledons: Capparidaceae, Sterculiaceae, Sapindaceae, Zygophyllaceae, Combretaceae, Aizoaceae, Passifloraceae, Rubiaceae, Asteraceae, Apocynaceae, Gentianceae, Boraginaceae, Bignonaceae, Verbenaceae

Unit IV: Key family characters, vegetative and floral characters, and economic importance of the following families, grouped under Monochlamydeae of Dicots and Monocotyledonous families: Nyctaginaceae, Piperaceae, , Euphorbiaceae, Typhaceae, Commelinaceae, Araceae, Cyperaceae, Poaceae.

Unit V: Economic botany:- Botanical name, Tamil name, English name, Family, morphology of the Useful parts and uses of the following:
1. Cereals: paddy and finger millet.
2. Pulses: pigeon pea and black gram.
3. Nuts: Cashew and ground nut.
4. Vegetables: Root: Radish and carrot.
5. Fruits: Mango and guava.
6. Fibres: Cotton and jute
7. Wood: Teak and Rose wood
8. Fatty oils : Sunflower and gingely
9 Spices & condiments: Pepper and cardamom.
10. Beverages: non -alcoholic: Coffee and Tea

TextBooks:

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.
5. Verma.V.2009. Text book of Economic botany. Ane books Pvt. Ltd, New Delhi

Reference Books

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
6. Pandey, B.P. 1978. Economic botany. S. Chand & company Ltd, New Delhi.

E-Book

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

Course designers

Dr. E. Mohan

THIAGARAJAR COLLEGE, MADURAI – 9.

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DEPARTMENT OF BOTANY

Master of Science (M.Sc.,) Botany (w.e.f. 2023-2024 batch onwards)

Programme Code – PBO

Course Code	Course Title	Category	L	T	P	Credit
PBO23CL21	**Taxonomy of Angiosperms and Economic Botany Lab**	Core Lab- 3	-	-	3	2
	L - Lecture T - Tutorial	P - Practicals				

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

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 and to prepare herbarium sheets	80%	80%
CO5	Analyze the morphology and uses of economically important plants	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**	**S**	**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**

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

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 and Gamopetalae of Dicots:
Capparidaceae, Sterculiaceae, Sapindaceae, Zygophyllaceae, Combretaceae, Aizoaceae, Passifloraceae, Rubiaceae, Asteraceae, Apocynaceae, Gentianceae, Boraginaceae, Bignonaceae and Verbanaceae
Plants belong to Monochlamydeae of Dicots, and Moncots:
Nyctaginaceae, Piperaceae, Euphorbiaceae, Typhaceae, Commeliniaceae, Araceae, Cyperacaeae and Poaceae

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) Identification, Botanical name, Tamil name, English name, Family, morphology of the Useful parts and uses of the economically important plants
   1. Cereals: paddy and finger millet.
   2. Pulses: pigeon pea and black gram.
   3. Nuts: Cashew and ground nut.
   4. Vegetables: Root: Rradish and carrot.
   5. Fruits: Mango and guava.

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

9) Identification, Botanical name, Tamil name, English name, Family, morphology of the Useful parts and uses of the economically important plants
   1. Fibres: Cotton and jute
   2. Wood: Teak and Rose wood
   3. Fatty oils : Sunflower and gingely
   4. 9 Spices & condiments: Pepper and cardamom.
   5. Beverages: non -alcoholic: Coffee and Tea

10) 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.

Course designers:

Dr. E. Mohan

THIAGARAJAR COLLEGE, MADURAI – 9.

(Re-Accredited with 'A^{++}' Grade by NAAC)

DEPARTMENT OF BOTANY

Master of Science (M.Sc.,) Botany (w.e.f. 2023-2024 batch onwards)

Programme Code – PBO

Course Code	Course Title	Category	L	T	P	Credit
PBO23CL22	Ecology, Phytogeography and Conservation Biology	Core-4	5	-	-	4

L - Lecture T - Tutorial P - Practical

Year	Semester	Int. Marks	Ext. Marks	Total
I	I	25	75	100

Preamble

To analyze and comprehend the fundamental ideas of plant ecology as a scientific study of environment.

Course Outcomes

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

#	Course Outcome	Knowledge Level	Expected Proficiency	Expected Attainment
CO1	Understand the scope and importance of population ecology, plant communities and ecosystem ecology.	K1	100%	80%
CO2	Understand the applied aspect of environmental botany.	K2	100%	90%
CO3	Students will spot the sources and pollution and seek remedies to mitigate and rectify them.	K3	100%	100%
CO4	Identify different plant communities, categorize plant biomes and identify threatened, endangered plant species and create awareness program in protection of biodiversity.	K4	100%	100%
CO5		K5	100%	80%

K1 - Knowledge K2 - Understand K3 – Apply K4- Analyse K5- Evaluate

Mapping of COs with POs

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

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

Mapping of COs with PSOs

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

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

Blooms taxonomy

	CA		End of Semester
	First	Second	
Knowledge	10%	10%	20%
Understand	10%	10%	20%
Apply	10%	10%	20%
Analyze	10%	10%	20%
Evaluate	10%	10%	20%
Total	52	52	104%

Title of the paper: Ecology, Phytogeography and Conservation Biology

Unit I: ECOLOGICAL PRINCIPLES: Introduction – History, scope, concepts. Diversity of plant life; growth form, life form. Basic concepts of population ecology– population dynamics – Regulation of population density. Basics concepts of community – characteristics, composition, structure, origin and development – community dynamics – trends of succession.

Unit II: ECOSYSTEM ECOLOGY AND RESOURCE ECOLOGY: Introduction – kinds – major types – functional aspects of ecosystem: Food chain and food web, energy flow, laws of thermodynamics. Productivity – primary and secondary productivity – GPP & BPP.

Unit III: Resource Ecology: Energy resources; renewable and non-renewable. Soil: Formation, types and profile - erosion and conservation, Water resources – conservation and management.

Environment Deterioration: Climate change - Greenhouse effect and global warming, ozone depletion and acid rain. Waste management - Solid and e-waste, recycling of wastes. Eco-restoration remediation ecological foot prints - carbon foot print - ecolabeling - environmental auditing.

Unit IV: PHYTOGEOGRAPHY: Phytogeographical Zones - Vegetation types of India and Tamil Nadu, Distribution: Continuous, Discontinuous and Endemism. Theories of discontinuous distribution: Continental drift, Age and area hypothesis. Geographical Information System (GIS) Principles of remote sensing and its applications.

Unit V: BIODIVERSITY AND CONSERVATION ECOLOGY: Definition, types of biodiversity – values of biodiversity – Hot spots – Threats to biodiversity: habitat loss. Poaching of wild life – Invasion of exotic species, man and wild life conflicts - endangered and endemic plant species of India, Red list categories of IUCN, Biotechnology assisted plant conservation- in situ and ex situ methods.

Text Books:

1. Sharma, P.D. 2017. Ecology and Environment- Rastogi Publication, Meerut.
2. Pushpa Dahiya and Manisha Ahlawat. 2013. Environmental Science- A New Approach, Narosa Pub. House, New Delhi.pp.2.1-2.60.
3. Eugene Odum, 2017. Fundamentals of Ecology 5th Ed. Cengage, Bengaluru.
4. Sharma P.D. 2019. Plant ecology and phytogeography, Rastogi Publications, Meerut.
5. Neeraj Nachiketa. 2018 Environmental & Ecology A Dynamic approach. 2nd Edition GKP Access Publishing.
6. Chandra, A.M and Ghosh, S.K. 2010. Remote sensing and Geographical Information System, Narosa Publishing House Pvt. Ltd. New Delhi.

References:

1. Keddy, P.A. 2017. Plant Ecology: Origins, processes, consequences. 2nd ed. Cambridge University Press. ISBN. 978-1107114234.
2. Krishnamurthy, K.V. 2004. An Advanced Text Book of Biodiversity- Principles and Practices. Oxford and IBH Publications Co. Pvt. Ltd. New Delhi.
3. Kormondy, E.J. 2017. Concepts of Ecology. Prentice Hall, U.S.A. 4th edition.
4. Gillson, L. 2015. Biodiversity Conservation and Environmental Change, Oxford University Press,.

Web Resources:

1. https://www.intechopen.com/chapters/56171
2. https://plato.stanford.edu/entries/biodiversity/
3. https://sciencing.com/four-types-biodiversity-8714.html.
4. https://www.iaea.org/topics/plant-biodiversity-and-genetic-resources
5. http://www.bsienvis.nic.in/Database/Status_of_Plant_Diversity_in_India_17566.aspx
6. https://www.youtube.com/watch?v=qtTLiQoYTyQ
7. https://www.youtube.com/watch?v=208B6BtX0Ps
8. https://www.youtube.com/watch?v=6p1TpVJYTds
9. https://www.amazon.in/Intellectual-Property-Rights-Vijay-Durafe-ebook/dp/B08N4VRQ86

Course designer:

Dr.D.Kannan

THIAGARAJAR COLLEGE, MADURAI – 9.

(Re-Accredited with 'A^{++}' Grade by NAAC)

DEPARTMENT OF BOTANY

Master of Science (M.Sc.,) Botany (w.e.f. 2023-2024 batch onwards)

Programme Code – PBO

Course Code	Course Title	Category	L	T	P	Credit
PBO23CL22	**Ecology, Phytogeography and Conservation Biology Lab**	**Core Lab-4**	-	-	3	2

L - Lecture T - Tutorial P - Practical

Year	Semester	Int. Marks	Ext. Marks	Total
I	I	25	75	100

Preamble

To analyze and comprehend the fundamental ideas of plant ecology as a scientific study of environment.

Course Outcomes

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

#	Course Outcome	Knowledge Level	Expected Proficiency	Expected Attainment
CO1	Understand the scope and importance of population ecology, plant communities and ecosystem ecology.	K1	100%	80%
CO2	Understand the applied aspect of environmental botany.	K2	100%	90%
CO3	Students will spot the sources and pollution and seek remedies to mitigate and rectify them.	K3	100%	100%
CO4	Identify different plant communities, categorize plant biomes.	K4	100%	100%
CO5	Identify threatened, endangered plant species and create awareness program in protection of biodiversity	K5	100%	80%

K1 - Knowledge K2 - Understand K3 – Apply K4- Analyse K5- Evaluate

Mapping of COs with POs

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

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

Mapping of COs with PSOs

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

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

Blooms taxonomy

	CA		End of Semester
	First	Second	
Knowledge	10%	10%	20%
Understand	10%	10%	20%
Apply	10%	10%	20%
Analyze	10%	10%	20%
Evaluate	10%	10%	20%
Total	52	52	104%

Title of the paper: Ecology, Phytogeography and Conservation Biology Lab

List of Experiments

1. Water analysis: Salinity, Alkalinity, BOD, DO, free CO2 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. GPS use & Basic Demography Analysis

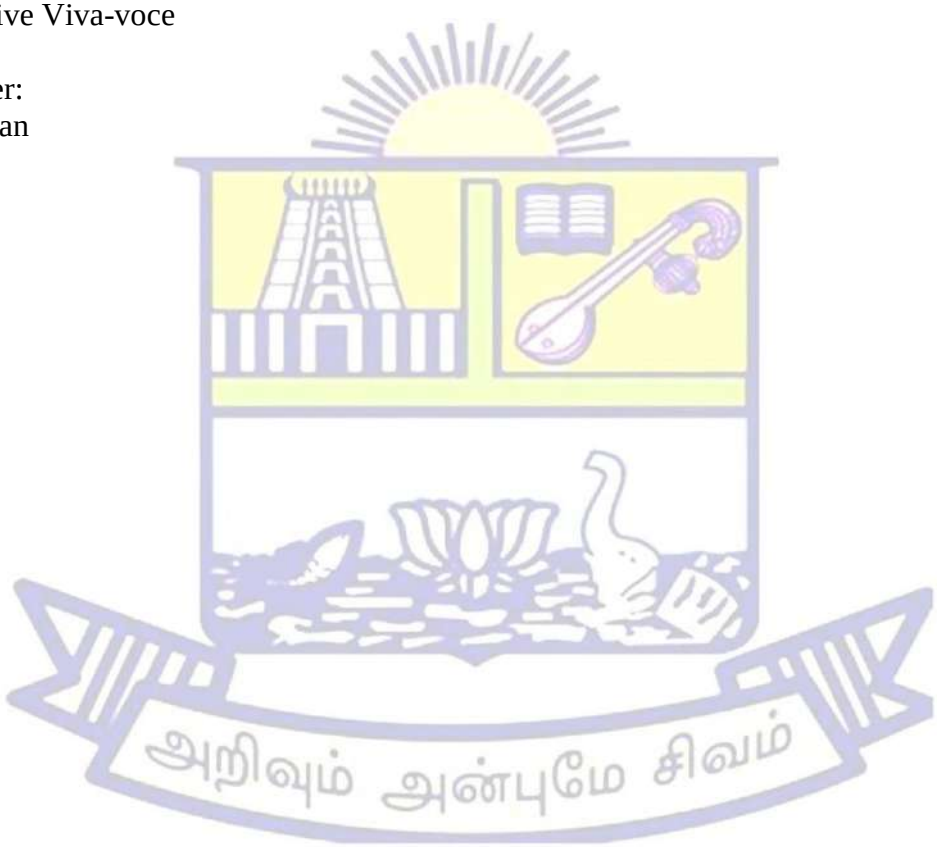
Submission

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

Comprehensive Viva-voce

Course Designer:

1. Dr. D. Kannan



THIAGARAJAR COLLEGE, MADURAI – 9.

(Re-Accredited with 'A^{++}' Grade by NAAC)

DEPARTMENT OF BOTANY

Master of Science (M.Sc.,) Botany (w.e.f. 2023-2024 batch onwards)

Programme Code – PBO

Course Code	Course Title	Category	L	T	P	Credit
PBO23ET21	**Research methodology and Computer Application**	Generic Elective - 2	**5**	**-**	**-**	**4**

L - Lecture T - Tutorial P - Practicals

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

Preamble

To acquire cognitive knowledge in the Research concept and analytical knowledge

Course Outcomes

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

#	Course Outcome	Knowledge Level	Expected Proficiency	Expected Attainment
CO1	Comprehend the organized well defined procedures of scientific research	K1	100%	60%
CO2	Adapt holistic approach towards conducting research, data collection and	K2	90%	70%
CO3	Familiar with the modern biological techniques and instrumentation handling	K3	80%	80%
CO4	Evaluate various applications of computer knowledge in biology	K4	80%	80%
CO5	Acquire talents and skills on basics level computational tools	K5	80%	80%

K1 - Knowledge K2 - Understand K3 – Apply K4 - Analyze K5 - Evaluate

Mapping of COs with POs

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

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

Mapping of COs with PSOs

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

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 paper: Research methodology and Computer Application

Unit I: Research Process: Generating Research Ideas, Developing a research project structure of a research proposal, Organising Survey and Interviews; Research Design - Deduction and Induction causality - Dialectical Materialism – Models - Research methods - historical, theoretical and empirical - case study - objectivity in research; Sampling Methods – Number and Complete Random Block Design Data collection – Random and Non-random methods

Unit II: Literature collection and citation: bibliography —bibliometrics (scientometrics): definition-laws - citations and bibliography - biblioscape— plagiarism— project proposal writing — dissertation writing – paper presentation (oral/poster) - E-learning tools- monograph — introduction and writing-Standard operating procedure (SOP) – introduction and preparation — Research Institutions - National and International.

Unit III: Basic principles and applications of pH meter, UV-visible spectrophotometer, centrifuge, lyophilizer, chromatography- TLC, Gas chromatography with mass spectrum (GC/MS), and HPLC-Scanning electron microscopy-Agarose gel Electrophoresis — Polyacrylamide GelElectrophoresis

Unit IV: Introduction to computers. Types of hardware and software operating systems. Fundamentals of networking, operation of networks, telnet, ftp, www, Internet. Biological Research on the web: Using search engines, finding scientific articles.

Unit V: Tools in computer**:** MS word **–** formatting paper- alignment, foot notes.Data representation in MS Excel– Table – simple and multiple forms, Graphical forms – Scatter, Line, Bar, pie chart, histogram, polygon, area, standard error bar, Significance and confidence level and its representation.

Text Books:

1. P.S. Narayana, D. Varalakshmi, T. Pullaiah, 2016, Research Methodology in Plant Science, Scientific Publishers, Jaipur, Rajasthan
2. Arumugam, N. Research Methodology for Life Sciences, Saras Publications,
3. Mishra Shanthi Bhusan, 2015, Handbook of Research Methodology - A Compendium for Scholars & Researchers , Ebooks2go Inc.
4. Gurumani, N. 2019. Research Methodology: For Biological Sciences, MP. Publishers
5. SreeRamulu, V.S.1988. Thesis Writing, Oxford& IBH Pub. New Delhi
6. Veerakumari, L. 2017. Bioinstrumentation. MJP Publisher, India. p578.

References:

1. Vogel "(2004). Text book of Quantitative inorganic analysis, Bencetts J Denney, R.C. Jeffery, G.H. and Mendham J. Longman Scientific and Technical U.K.
2. Joseph Brook and David W Russell, Molecular cloning – A laboratory manual 3 rd edition- Cold Spring Harbor Laboratory Press, New York.
3. Richa Arora, 2004, Encyclopaedia of Research Methodology in Biological Sciences, Anmol Publishers, New Delhi
4. Arthur Conklin W.M and Greg White, 2016. Principles of computer security. TMH. McGraw-Hill Education; 4 edition.

Course designers:

1. Dr. M. Rama Prabha

THIAGARAJAR COLLEGE, MADURAI – 9.

(Re-Accredited with 'A^{++}' Grade by NAAC)

DEPARTMENT OF BOTANY

Master of Science (M.Sc.,) Botany (w.e.f. 2023-2024 batch onwards)

Programme Code – PBO

Course Code	Course Title	Category	L	T	P	Credit
PBO23ET21	**Biostatistics and Bioinformatics**	Discipline Specific Elective - 2	**5**	**-**	**-**	**4**

L - Lecture T - Tutorial P - Practicals

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

Preamble

To acquire knowledge on fundamentals of bioinformatics and statistical calculation skills

Course Outcomes

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

#	Course Outcome	Knowledge Level	Expected Proficiency	Expected Attainment
CO1	Recognize various database and applications of bioinformatics	K1	100%	100%
CO2	Evaluate the tools and programmes of bioinformatics in their research	K2	90%	90%
CO3	Perform basic statistical analysis of data	K3	80%	80%
CO4	Apply appropriate statistical tool in the problem solving	K4	80%	80%
CO5	Acquire talents and skills on basics and advance level computational biostatics to their research projects	K5	80%	80%

K1 - Knowledge K2 - Understand K3 - Apply K4 - Analyze K5 – Evaluate

Mapping of COs with POs

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

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

Mapping of COs with PSOs

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

BloomsTaxonomy			
	CA		**End 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**

Course title: Biostatistics and Bioinformatics

Unit I. Biostatistics–Scope and application. Data collection and Sampling Methods–Merits and demerits, Data presentation methods. Measures of central tendency: Mean median and mode - Concept, formula with problems and solving methods; Measures of dispersion: Mean deviation, Standard deviation, Co-variance, Coefficient of variations – Concept, formula with problems and solving methods – Computer Application programmes for statistics – EXCEL and SPSS package.

Unit II: Correlation–concept and applications–Karl Pearson coefficient of correlation–Formula with problems and solving method. Regression: linear regression – concept and application – Formula with problems and solving method. Hypothesis testing - null and alternative hypothesis – Errors – Type I and Type II; Test of Significance: Student's t_ Test, F test and chi-square test (derivations not required) – Formula, problems with solving methods – Application in Biological Sciences

Unit IIII Probability theory–Basic concept - Probability distributions: Binomial, Poisson and Normal – Problems with solving procedure - Applications, ANOVA – Principle – One-way, Two-way methods – Comparison of means: - LSD and DMRT - Problems with solving methods – Applications in Bioresearch.

Unit IV: Overview on Nucleotide Sequence databases (Genbank, EMBL, DDBJ) and Protein sequence databases (SWISS PROT, PIR, PDB, SCOP, CATH). Structure of proteins - Motifs and Patterns - Secondary Structure and Folding Classes -SpecializedStructures -Tertiary Structure

Unit V: Sequence alignment: local and global alignment, pairwise sequence alignment – FASTA and BLAST, Multiple sequence alignment- CLUSTAL W, Homology Modelling, Phylogeny Tree Analysis – Tree view and Phylip. Introduction to CADD (Computer aided drug designing).

Text Books:

1. Chiranji b Chakraborty. 2010.Bioinformatics: Approaches & Applications, Daya Publishing, New Delhi.
2. Arora, P.N.andMalhan,P.K.2011.Biostatistics, Himalaya Publishing House, NewDelhi,
3. Bryan Bergeron.2006. Bioinformatics Computing, Prantice - Hall of India Pvt. Ltd., NewDelhi
4. Khan, I.D. and Khanum, A. 2004. Fundamentals of Biostatistics, Ukazsz Publications, Hyderabad,India,2004

References:

1. Hooman Rashidi and Lukas K.Buehler.2005. Bioinformatics Basics: Applications in Biological Science and Medicine, Second Edition, CRC Press, Taylor & Francis.
2. Mount,D.W.2006. Bioinformatics: Sequence and Genome Analysis, University of Arizona,Tucson.
3. Stephen A.Krawetz and David D. Womble. 2003. Introduction to Bioinformatics: A Theoretical and Practical Approach, Humana Press.
4. Zar,J.K.2011. Biostatistical Analysis, Fourth Edition, Prantice-Hall International, NewJersey, USA.

WebResources:

http://www.ncbi.nlm.nih.gov/

Course Designers:

1. Dr. K, Sathiyadash

Thiagarajar College (Autonomous):Madurai–625009
(Reaccredited with A++ by NAAC)
Department of Botany
(For those who joined M. Sc., Botany on or after June2023)

Course Code	Course Title	Category	L	T	P	Credit
PBO23ST21	Intellectual Property Rights	Skill Enhancement Course-2	2	-	-	2

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

Preamble

Intent to understand the legal systems governing the knowledge economy.

Course Outcomes

On completion of the course the student will be able to

#	Course Outcome	Knowledge Level	Expected Proficiency	Expected Attainment
CO1	Recall the history and foundation of Intellectual Property.	K1	90%	80%
CO2	Understand the differences of Property and Assets and Various Categories of Intellectual Creativity.	K2	80%	70%
CO3	Apply the methods to protect the Intellectual Property	K3	80%	80%
CO4	Differentiate if the Said Intangible property be protected under law or protected by strategy.	K4	80%	80%
CO5	Create a recommendation document on the methods and procedures of protecting the said IP and search documents to substantiate them	K5	90%	80%

Mapping of COs with POs

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

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

Mapping of COswith PSOs

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

Blooms Taxonomy

	CA		End 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)
Total	**60**	**60**	**150**

Title of the paper: Intellectual Property Rights

UnitI:. INTRODUCTION TO IPR

History and Development of IPR. Theories on concept of property: Tangible *vs* Intangible. Subject matters patentable in India. Non patentable subject matters in India. Patents: Criteria of Patentability, Patentable Inventions - Process and Product. Concept of Copyright. Historical Evolution of Copyright Ownership of copyright, Assignment and license of copyright.

Unit II: OVERVIEW OF THE IPR REGIME AND DESIGN

International treaties signed by India. IPR and Constitution of India. World Intellectual Property Organization (WIPO): Functions of WIPO, Membership, GATT Agreement. Major Conventions on IP: Berne Convention, Paris Convention. TRIPS agreement. Industrial Designs – Subject matter of Design – Exclusion of Designs – Novelty and originality – Rights in Industrial Design

Unit III: TRADE MARK, LEGISLATIONS AND PATENT ACT

History of Indian Patent Act 1970. Overview of IP laws in India. Major IP Laws in India. Patent Amendment Act 2005. WTO-TRIPS – Key effect on Indian Legislation. Organization of Patent System in India. Concept of Trademarks, Different kinds of marks, Criteria for registration, Non Registrable Trademarks, Registration of Trademarks. Infringement: Remedies and Penalties

Unit IV: PRIOR ART SEARCH AND DRAFTING

Overview of Patent Search. Advantages of patent search. Open source and paid databases for Patent Search. International Patent classification system. Types of specifications: Drafting of Provisional specifications. Drafting of complete specifications. Drafting of claims.

Unit V:GI AND PATENT FILING PROCEDURES

Geographical Indications of Goods (Registration and Protection) Infringement – Offences and Penalties Remedies. Plant Variety and Farmers Right Act (PPVFR). Plant variety protection: Access and Benefit Sharing (ABS). Procedure for registration, effect of registration and term of protection. Role of NBA. Filing procedure for Ordinary application. Convention application. PCT National Phase application. Process of Obtaining a Patent. Infringement and Enforcement

Text Books:

1. Kalyan, C.K. 2010. Indian Patent Law and Practice, India, Oxford University Press.
2. Ahuja, V.K. 2017. Law relating to Intellectual Property Rights. India, IN: Lexis Nexis.
3. Arthur Raphael Miller, Micheal Davis H. 2000. Intellectual Property: Patents, Trademarks and .Copyright in a Nutshell, West Group Publishers.
4. Margreth, B. 2009. Intellectual Property, 3nd, New York Aspen publishers.
5. Nithyananda, K.V. 2019. Intellectual Property Rights: Protection and Management. India, IN: Cengage Learning India Private Limited.

References:

1. World Intellectual Property Organization. 2004. WIPO Intellectual property Handbook. Retrieved from https://www.wipo.int/edocs/pubdocs/en/intproperty/489/wipo_pub _489.pdf Journal of Intellectual Property Rights (JIPR): NISCAIR.
2. Anant Padmanabhan. 2012. Intellectual Property Rights: Infringement and Remedies LexisNexis Butterworths Wadhwa.
3. Intellectual Property Law in the Asia Pacific Region. 2009. Kluwer Max Planck Series,
4. Pradeep, S. Mehta (ed.). 2005. Towards Functional Competition Policy for India, Academic Foundation, Related.
5. Ramakrishna B and Anil Kumar, H.S. 2017. Fundamentals of Intellectual Property Rights: For Students, Industrialist and Patent Lawyers, Notion Press, Chennai.

Web Resources:

1. http://cipam.gov.in/
2. https://www.wipo.int/about-ip/en/
3. http://www.ipindia.nic.in/
4. https://www.wipo.int/edocs/pubdocs/en/intproperty/489/wipo_pub_489.pdf.
5. https://swayam.gov.in/nd2_cec20_ge04/preview

Course Designers:

Dr.T.M.Jothimani

Thiagarajar College (Autonomous), Madurai–625009
(Reaccredited with A^{++} by NAAC)
Department of Botany
(For those who joined M. Sc., Botany From June2023-2024)

Course Code	Course Title	Category	L	T	P	Credit
PBO23AE21	Food Microbiology	Ability Enhancement Compulsory Course-2	2	-	-	1

L - Lecture T - Tutorial P - Practical

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

Preamble

To equip the students with analyse the types of foods and its contamination, apply the practicing of food preservation methods to avoid food borne diseases.

Course Outcomes

On completion of the course the student will be able to

#	Course Outcome	Knowledge Level	Expected Proficiency	Expected Attainment
CO1	Categorize the types of various foods from plant and animal sources.	K1	100%	80%
CO2	Analyze the food spoilage and its contaminating agents	K2	100%	90%
CO3	Apply various physical modes of food preservation	K3	100%	100%
CO4	Apply radiation and chemical modes of food preservation and also familiar with food borne diseases	K4	100%	100%
CO5	Aware about food safety-laws and standard organizations.	K5	100%	80%

K1 - Knowledge K2 - Understand K3 – Apply K4- Analyse K5- Evaluate

Mapping of COs with POs

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

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

Mapping of COs with PSOs

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

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

Blooms taxonomy

	CA		End of Semester
	First	Second	
Knowledge	10%	10%	20%
Understand	10%	10%	20%
Apply	10%	10%	20%
Analyze	10%	10%	20%
Evaluate	10%	10%	20%
Total	52	52	104%

Title of the paper: Food Microbiology

Unit I: Food: Types of food-plant based foods- vegetables-fruits-tubers, whole grains and animal-based foods-milk and milk products- sea foods- instant food, junk food, canned foods, dehydrated foods and balanced food.

Unit II: Food spoilage: Definition, food contamination by bacteria, fungi, actinomycetes, viruses, metals-heavy metals-chemicals and plastics.

Unit III: Food preservation by physical methods: Drying, low temperature methods-refrigeration-freezing, high temperature - thermal processing-canning, pasteurization, sterilization, aseptic processing-blanching-dehydration.

Unit IV: Food preservation by radiation-UV-rays, X-rays and gamma rays. Chemical methods by salting-organic and inorganic salts. Food borne diseases in human: Botulism, salmonellosis, Shigellosis, Aspergillosis and Blastomycosis

Unit V: Food safety: Importance of food safety, food safety and quality laws-regulations. Food laws: FSS and FSSAI.

Text Books:

1. Betty C.Hobbs, 1982. Food Microbiology-related to food borne diseases, Published by Gulab Vazirani for Arnold-Heinemann Publishers, New Delhi, India.
2. Fellows, P. Food Processing Technology-Principles and practice, 2nd Edn.2000. Woodhead Publishing Limited Abington Hall, Abington Cambridge CB1 6AH, England.
3. Michael P Doyle; Francisco Diez-Gonzalez; Colin Hill, Food Microbiology : Fundamentals and Frontiers (Edition 5) (Hardcover)
4. Osman Erkmen, T. Faruk Bozoglu, 2016. Edtd. Food Microbiology: Principles into Practice, Print ISBN:9781119237761 |Online ISBN:9781119237860 |DOI:10.1002/9781119237860

References:

1. Shankar Prasad Sha and Kriti Ghatani, 2020. Traditional food, fermented food and alcoholic beverages of North Bengal,. Traditional Indian Fermented Foods and Their Health Promoting Effects In Microbes, Environment and Human Welfare. Editor Sha. T and Tiwari. B, ISBN: 978-1-53617-945-3.
2. Shankar Prasad Sha and Kriti Ghatani, 2020. Food Microbiology, Publisher: Research India Publications, New Delhi. ISBN: ISBN-978-93- 86138-79-8.

Web Resources:

1. https://ebooks.foodtechlearning.xyz/2020/12/pdffood-microbiology-book-by-william-c.html
2. https://ebooks.foodtechlearning.xyz/2020/12/foods-facts-and-principles-by-n.html

Course designer:

Dr.B.Sadhana