ETHIRAJ COLLEGE FOR WOMEN

DEPARTMENT OF PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

REVISED SYLLABUS JUNE 2021

RULES AND REGULATIONS FOR THE PROGRAMME

Department of Plant Biology and Plant Biotechnology is revising syllabus with effect from the academic year 2021-2022.

Every academic year is divided into two semester sessions. Each semester will have a minimum of 90 working days and each day will have 5 working hours. Teaching is organized into a modular pattern of credits courses. Credit is normally related to the number of hours a teacher teaches a particular subject. It is also related to the number of hours a student spends learning a subject or carrying out an activity.

REGULATIONS

I. ELIGIBILITY FOR ADMISSION :

Candidate for admission to the first year of the degree of Plant Biology and Plant Biotechnology courses should be required to have passed B.Sc Botany / Plant Biology and Plant Biotechnology course of study for a period of not less than three academic years, passed the examination of all six semester prescribed.

II. ELIGIBILITY FOR THE AWARD OF DEGREE:

A candidate shall be eligible for the award of degree only if she has undergone the prescribed course of study for a period of not less than two academic years, passed the examination of all the four semester prescribed.

III. COURSE OF STUDY:

The main subjects of study for the Master of Science degree shall consist of the following:

a) Core Subjects

b) Elective subjects

c) Extra disciplinary elective subjects

d) Soft skills

e) Internship

f) Research Project

IV. PASSING MINIMUM:

A candidate shall be declared to have passed in each paper / practical of the main subject of study wherever prescribed, if she secured NOT LESS THAN 50% of marks prescribed for the examination.

V. CLASSIFICATION OF SUCCESSFUL CANDIDATES:

Successful candidate passing the examination and secured the marks (i) 60 percent and above and (ii) 50 percent and above but below 60 percent in the aggregate shall be declared to have passed the examination in the FIRST and SECOND class respectively. All other successful candidates shall be declared to have passed the examination in the THIRD class. Candidate who passes all the examination prescribed for the course in the **FIRST APPEARANCE ITSELF ALONE** are eligible for the ranking.

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)

CHOICE BASED CREDIT SYSTEM

M.Sc., PLANT BIOLOGY AND PLANT BIOTECHNOLOGY (SELF SUPPORTING)

(with effect from the Academic Year 2021 - 2022 and thereafter)

Programme Educational Objectives

PEO1	Display higher order thinking in the knowledge domain and demonstrate professional skills.
PEO2	Contribute to the advancement and application of relevant knowledge by self-directed learning.
PEO3	Extend and integrate knowledge and skills to design and develop novel products and explore innovative solutions to national and international goals of development.
PEO4	Exercise management skills and develop social interactions in a responsive, ethical and constructive way to meet global standards of excellence in all spheres of activity.
PEO5	Strive for social and economic equity based on the need for gender parity and ecological sustainability.

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)

CHOICE BASED CREDIT SYSTEM

M.Sc., PLANT BIOLOGY AND PLANT BIOTECHNOLOGY (SELF SUPPORTING)

(with effect from the Academic Year 2021 - 2022 and thereafter)

Programme Outcomes

PO1 To acquire advanced conceptual knowledge and comprehensive understanding of the fundamental principles in respective discipline.

PO2 To apply knowledge and critically evaluate the concepts and scientific developments to take up any challenge.

PO3 To visualize and work on laboratory multidisciplinary tasks related to current research in the fields of Mathematical, Physical and Life sciences

PO4 To acquire research based knowledge and design methods to conduct investigations of complex problems in research/ Industrial field and achieve employability / self employment.

PO5 To communicate effectively ideas verbally in English, leading to Entrepreneurship ventures such as consultancy and training.

PO6 Employ innovative and environment friendly methods, novel ideas to solve complex and challenging societal and environmental issues.

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)

CHOICE BASED CREDIT SYSTEM

M.Sc., PLANT BIOLOGY AND PLANT BIOTECHNOLOGY (SELF SUPPORTING)

(with effect from the Academic Year 2021 - 2022 and thereafter)

Programme Specific Outcomes

PSO1 Apply the contextual knowledge to assess the Plant diversity, conservation, vegetative and reproductive parts of different plant forms and procure insight on concepts of Cytology and Genetics.

PSO2 Employ innovative ideas and methods based on their practical experience and knowledge on sophisticated instruments to solve complex and challenging issues in Plant Biology, Biotechnology and allied fields.

PSO3 Analyze data using appropriate statistical methods and think critically to design and execute an experiment with confidence.

PSO4 Utilize the scientific skills and communicate effectively through written work, seminar and project work.

PSO5 Stakeholders can attend and clear the competitive exams and take up promising careers in research, government and private sectors.

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS) - CHENNAI-08
CHOICE BASED CREDIT SYSTEM

POST GRADUATE PROGRAMME PROFILE
DEPARTMENT OF PLANT BIOLOGY AND PLANT BIOTECHNOLOGY (Self Supporting)
(with effect from the Academic Year 2021-2022 and thereafter)
COURSE CODES AND CREDITS

TOTAL MINIMUM CREDITS: 91 **TEACHING HOURS: 120**

S.N	CORE/ ELECTIVE	TITLE OF THE PAPER	CODE	L	T	P	H	C	CA	SE	MM
	I SEMESTER										
1	Core 1	Plant diversity – I Algae, Fungi, Lichens and Bryophytes	10SP21/1C/AFB	3	2	0	5	4	40	60	100
2	Core 2	Plant diversity – II Pteridophytes, Gymnosperms and Palaeobotany	10SP21/1C/PGP	3	2	0	5	4	40	60	100
3	Core 3	Microbiology, Immunology and Plant Pathology	10SP21/1C/MIP	3	3	0	6	4	40	60	100
4	Core 4	Practical - I: Covering Core Papers – 1,2, 3	10SP21/2C/PR1	0	0	8	8	-	-	-	-
5	Elective 1	Phytochemistry and Drug Development	10SP21/1E1/PDD	2	2	0	4	3	40	60	100
		Mushroom Technology	10SP21/1E1/MTE								
		Algal Technology	10SP21/1E1/ATE								
6	Soft Skill 1	Personality Enrichment for Women		2	0	0	2	2	-	50	50
	II SEMESTER										
7	Core 5	Plant Anatomy and Embryology of Angiosperms	10SP21/2C/PAE	3	1	0	4	4	40	60	100
8	Core 6	Cell and Molecular Biology	10SP21/2C/CMB	3	1	0	4	4	40	60	100
9	Core 7	Genetics, Plant Breeding and Evolution	10SP21/2C/GPE	3	1	0	4	4	40	60	100
		Practical - I: Covering Core Papers – 1,2, 3	10SP21/2C/PR1	-	-	-	-	4	40	60	100
10	Core 8	Practical - II: Covering Core Papers – 5 ,6,7	10SP21/2C/PR2	0	0	8	8	4	40	60	100
11	Elective 2	Applied Plant Cell and Tissue culture	10SP21/2E2/APT	2	2	0	4	3	40	60	100
		Horticulture and Landscaping	10SP21/2E2/HLS								
		Organic Agriculture	10SP21/2E2/OAG								
12	Extra Disciplinary Elective 1	Entrepreneurial Botany (offered to other Department students)	10SP21/2E/EBO	2	2	0	4	3	40	60	100
13	Soft Skill 2			2	0	0	2	2	-	50	50
14	Internship	During Summer Vacation	10SP21/2I/INT				Min.2 1 days	2			
	III SEMESTER										
15	Core 9	Taxonomy of Angiosperms and Economic Botany	10SP21/3C/TAE	3	2	0	5	4	40	60	100
16	Core 10	Plant Physiology	10SP21/3C/PPH	3	2	0	5	4	40	60	100
17	Core 11	Practical -III: Covering Core Papers – 9 and 10	10SP21/4C/PR3	0	0	8	8	-	-	-	-
18	Elective 3	Nanobiotechnology	10SP21/3E3/NBT	2	1	0	3	3	40	60	100
		Forest Botany	10SP21/3E3/FBO								
		Biopesticide technology	10SP21/3E3/BPT								
19	Elective 4	Biostatistics	10SP21/3E4/BIS	2	1	0	3	3	40	60	100
		Ethnobotany	10SP21/3E4/ETB								
		Wood Technology	10SP21/3E4/WOT								
20	Extra Disciplinary Elective 2	Medicinal Botany and Dietetics (offered to other Department students)	10SP21/3E/MBD	2	2	0	4	3	40	60	100
21	Soft Skill 3	Computing for Biological Research	10SP21/3S/CBR	2	0	0	2	2	-	50	50
	IV SEMESTER										
22	Core 12	Biochemistry and Applied Biotechnology	10SP21/4C/BAB	3	2	0	5	4	40	60	100
23	Core 13	Ecology, Conservation Biology and Intellectual Property Rights	10SP21/4C/ECI	3	2	0	5	4	40	60	100
24	Core 14	Bioinstrumentation and Methodology	10SP21/4C/BME	3	2	0	5	4	40	60	100
		Practical -III: Covering Core Papers – 9 and 10	10SP21/4C/PR3	-	-	-	-	4	40	60	100
25	Core 15	Practical - IV: Covering Core Papers – 12,13,14	10SP21/4C/PR4	0	0	8	8	4	40	60	100
26	Project	Research Project	10SP21/4C/PRO	0	0	5	5	3	40	60	100
27	Soft Skill 4	Introduction to Bioinformatics	10SP21/4S/IBI	2	0	0	2	2	-	50	50

		OPTIONAL EXTRA CREDITS									
I	**Extra Credits (OPTIONAL)**	**Self-Study (Semester III) Plants and Human Welfare**	**10SP21/3S/PHW**	**-**	**-**	**-**	**-**	**2**	**-**	**100**	**100**
		Floriculture	**10SP21/3S/FLC**								

L = Lecture Hours T = Tutorial Hours P=Practical Hours H = Hours per week

C= Credits CA=Continuous Assessment SE=Semester Examinations

MM=Maximum Marks

***No practicals for elective paper**

♦ NPTEL courses must be taken up by the students during the course.

EVALUATION PATTERN FOR CONTINUOUS ASSESSMENT

INTERNAL VALUATION BY COURSE TEACHER/S

THEORY

2 test for 2 hours each (50 marks to be converted to 10)	20 marks
Seminar/Assignment/Quiz /Industrial visit / Field study	10 marks
Participatory learning / Group discussion	10 marks
Total	40 marks

PRACTICALS

Paper Code	Model exam	Class work	Record	Herbarium	Field visit	Total
10SP21/2C/PR1	10	20	5	-	5	40
10SP21/2C/PR2	10	25	5	-	-	40
10SP21/4C/PR3	10	15	5	5	5	40
10SP21/4C/PR4	10	20	5	-	5	40

PROJECTS

Paper Code	Lab work	Presentation	Total
10SP21/4C/PRO	20	20	40

CA QUESTION PAPER PATTERN

Knowledge Level	Section	Word Limit	Marks	Total
K1,K2	A-5×2 marks	50	10	50
K2,K 3	B-4/6×5 marks	250	20	
K4,K 5	C-1/2×20 marks	1500	20	

RUBRICS FOR CONTINUOUS ASSESSMENT (THEORY)

Seminar	Organization/ subject knowledge/ visual aids/ confidence level/ presentation - Communication and Language
Assignment	Contents/originality/ presentation/ schematic representation and diagram/ Bibliography
Industrial visit / Field study	Participation / Attitude/ Conduct
Participatory learning / Group discussion	Answering question/ Clearing doubts/ participation in discussion/ attendance /communication and language

END SEMESTER EVALUATION PATTERN

THEORY PAPERS

SEMESTER I/II/III/IV

DOUBLE VALUATION BY COURSE TEACHER AND EXTERNAL EXAMINER

MAXIMUM MARKS: 100 TO BE CONVERTED TO 60

PASSING MARKS: 50

PRACTICAL PAPERS

SEMESTER I&II/III&IV

DOUBLE VALUATION BY COURSE TEACHER AND EXTERNAL EXAMINER

MAXIMUM MARKS: 100 TO BE CONVERTED TO 60

PASSING MARKS: 50

SOFT SKILLS PAPERS

SEMESTER I/II/III/IV

SINGLE VALUATION BY COURSE TEACHER

MAXIMUM MARKS: 50

PASSING MARKS: 25

PROJECT PAPER

SEMESTER IV

DOUBLE VALUATION BY RESEARCH SUPERVISOR AND EXTERNAL EXAMINER

DISSERTATION: 40

VIVA: 20

MAXIMUM MARKS: 60

PASSING MARKS: 30

INTERNSHIP

YEAR I

SEMESTER II

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)
CHOICE BASED CREDIT SYSTEM
M.Sc., PLANT BIOLOGY AND PLANT BIOTECHNOLOGY (SELF SUPPORTING)
(with effect from the Academic Year 2021 - 2022 and thereafter)

SELF-STUDY (SEMESTER III)
PLANTS AND HUMAN WELFARE

COURSE CODE- 10SP21/3S/PHW
Credits: 2

COURSE OUTLINE:

UNIT-I
The basic needs of human life; plants as the prime source of supply of human needs.

UNIT-II
Cultivation and uses of Single cell protein and Mushroom; Agar Agar, Alginate.

UNIT-III
Chemical Constituents and uses of Spices and condiments – Clove, Cardamom, Cinnamon, Ginger and Garlic.
Beverages – Coffee and Tea. Detection of adulterants.

UNIT-IV
Plants in Cosmetic – Herbal product development – Forms of herbal preparation - preparation of home-made face packs, skin care and hair care.

UNIT-V
Herbal preparation for common ailments (Cold, head ache, diabetes, blood pressure, constipation, heart burn, stomach pain and menstrual disorders)

REFERENCE BOOKS:

1. Ashok Bendre and Ashok Kumar. 1980. Economic botany. Rastogi Publications.
2. B.P.Pandey. Economic Botany. Chand and Co.
3. Christopher and Lovell. Plants and Skin.
4. Dubey.R.C. 1993.A text book of Biotechnology. Chand and Co.
5. H.K.Bhakru .Herbs that heal. 2008. Orient Publication.
6. K.C.Kokate, A.P.Purohit,S.B.Gokhale. Pharmacognosy. Nirali Prakashan.2008.Pune.
7. Lynn keegan. Healing nutrition.
8. Paul.J.Thottam. Siddha medicine-A hand book of traditional remedies. 2000.
9. Sundara Rajan.S. 2001. Introduction to algae. Anmol Publications.
10. Thothathri. Selected poisonous plants from tribal areas of India.
11. Vashista.B.R. 1987.Text book of algae. Chand and Co.

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)
CHOICE BASED CREDIT SYSTEM
M.Sc., PLANT BIOLOGY AND PLANT BIOTECHNOLOGY (SELF SUPPORTING)
(with effect from the Academic Year 2021 - 2022 and thereafter)

SELF-STUDY (SEMESTER III)
FLORICULTURE

COURSE CODE- 10SP21/3S/FLC
Credits: 2

COURSE OUTLINE:

UNIT- I

Introduction and Scope of Floriculture Status of Floriculture in India.

UNIT-II

Types of pots and containers. Pot mixtures and potting media for different ornamentals. A brief account of hydroponics. Propagation- natural and artificial (cutting, layering, grafting).

UNIT-III

Cultivation and production of flowers- climatic requirements and distribution in India-Rose, Jasmine, Chrysanthemum.

UNIT-IV

Cut flowers- preservation, prolonging vase life.

Flower arrangement – Dry and fresh arrangements, massing, Ikebana, Bouquets.

UNIT-V

Marketing of flowers-types of markets- traditional and modern, transport – air, road and rail packaging. Flower products – Jasmine products and rose products**.**

REFERENCE BOOKS:

1. Andrews,F.S., R.G.Halfacre. 1977. Fundamentals of horticulture. Tata- Mcgraw Hill
2. Bhattacharjee.S.K. 2006. Vistats in Floriculture. Pointer Publishers.
3. Elizabeth Gundrey. 1985. Arranging flowers and plants. Marshall covendish Ltd.,
4. Gurcharan Singh Randhawa, Amitabha Mukhopadhyay. 1986. Floriculture in India..Allied Publishers.Ltd.Bombay.
5. John Clayton. 1979. Flower arrangement. Peerage Books.
6. Kumar N. 2016 Introduction to Horticulture. Oxford & IBH Publishing Company.
7. Manibhushan Rao. 1991. Text book of Horticulture. Macmillian India.
8. S.Kolavalli, L.K.Atheeq. Xanvier Jacob. 1991. Floriculture Industry in India. Oxford and IBM.
9. S.Prasad and U.Kumar. 2000. Commercial Floriculture. Agrobios.
10. Violet Stevenson. 1984. Plants and flowers in the Home. Treasures Press.

NPTEL/SWAYAM Courses

S.No.	Title of the Course	Duration	Offered by	Course Type
1.	Ecology and Environment	8 Weeks	IIT Madras	Core
2.	Environmental Biotechnology	12 Weeks	IIT,Karagpur	Core
3.	Organic Farming for Sustainable Agriculture	8 Weeks	IIT,Karagpur	Core

COURSE PROFILE

I YEAR - FIRST SEMESTER

TOTAL CREDITS - 17

S.N	CORE/ ELECTIVE	TITLE OF THE PAPER	CODE	L	T	P	H	C	CA	SE	MM
1	Core 1	Plant diversity – I Algae, Fungi, Lichens and Bryophytes	10SP21/1C/AFB	3	2	0	5	4	40	60	100
2	Core 2	Plant diversity – II Pteridophytes, Gymnosperms and Palaeobotany	10SP21/1C/PGP	3	2	0	5	4	40	60	100
3	Core 3	Microbiology, Immunology and Plant Pathology	10SP21/1C/MIP	3	3	0	6	4	40	60	100
4	Core 4	Practical - I: Covering Core Papers – 1,2, 3	10SP21/2C/PR1	0	0	8	8	-	-	-	-
5	Elective 1	Phytochemistry and Drug Development	10SP21/1E1/PDD	2	2	0	4	3	40	60	100
		Mushroom Technology	10SP21/1E1/MTE								
		Algal Technology	10SP21/1E1/ATE								
6	Soft Skill 1	Personality Enrichment for Women		2	0	0	2	2	-	50	50

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M.Sc., PLANT BIOLOGY AND PLANT BIOTECHNOLOGY (SELF SUPPORTING)
(with effect from the Academic Year 2021 - 2022 and thereafter)

SEMESTER I

CORE PAPER 1

PLANT DIVERSITY – I ALGAE, FUNGI, LICHENS AND BRYOPHYTES

COURSE CODE - 10SP21/1C/AFB

Teaching hours: 5/ Week **Credits: 4**

75/ Semester **L-T- P**

3 -2- 0

COURSE OBJECTIVES:

To enable the students to

1. Understand the diversity among Algae, morphology, structure, lifecycle and economic importance.
2. Impart knowledge on classification, structure, lifecycles and economic importance of Fungi
3. Learn the morphology, structure, reproduction, life cycles of fungi.
4. Acquire knowledge on the structure, reproduction and economic importance of Lichens.
5. Study the morphology, structure, lifecycle and economic importance of Bryophytes.

COURSE OUTLINE:

UNIT - I **(20 Hrs)**

Algae: History of Algology, Classification of algae by Silva (1982). General characteristic features of major classes: Chlorophyceae, Xanthophyceae, Chrysophyceae, Bacillariophyceae, Cryptophyceae, Dinophyceae, Chloromonadineae, Euglenophyceae, Phaeophyceae, Rhodophyceae, and Cyanophyceae. Structure, reproduction and life histories of the following genera: *Anabaena, Scytonema, Ulva, Codium, Cyclotella, Padina, Gelidium.*

UNIT - II **(15 Hrs)**

Fungi: History of Mycology, Classification of Fungi Alexopoulos and Mims (1979). General characteristic features of the classes: Plamsodiophoromycetes, Oomycetes, Zygomycetes, Ascomycetes, Basidiomycetes and Deuteromycetes. Heterothallism in fungi, sexuality in

fungi, Parasexuality, sex hormones in fungi. Cultivation of mushrooms – *Pleurotus*, Mycorrhizal Fungi, Economic importance of fungi.

UNIT –III: **(15 Hrs)**

Structure, reproduction and life histories of the following genera:

Plamsodiophoromycetes	: *Plasmodiophora*
Oomycetes	: *Phytophthora*
Zygomycetes	: *Pilobolus*
Ascomycetes	: *Taphrina*
Basidiomycetes	: *Puccinia*
Deuteromycetes	: *Fusarium, Alternaria, Colletotrichum*

UNIT - IV **(10 Hrs)**

Lichens: Classification - Structure of thallus, nutrition, asexual reproduction, sexual reproduction, structure of apothecium, lichens as pollution indicator, economic importance.

UNIT - V **(15 Hrs)**

Bryophytes: Classification of Bryophytes by Watson (1971). General characteristic features of Bryophytes: Hepaticopsida, Anthocerotopsida and Bryopsida. Range of gametophytes and sporophytes in bryophytes. Ecological and economic importance of bryophytes. Structure, reproduction and life histories of the following genera: *Reboulia, Anthoceros, Porella, Funaria.*

RECOMMENDED TEXTBOOKS

1. Kumar. H. D. and H. N. Singh. A text book of Algae. Affliated Esat West Press. Pvt. Ltd. New Delhi (1979)C.J. Alexopoulos, Introductory Mycology (First Edition)
2. C.J. Alexopoulos, C.W. Mims,M. Blackwell. Introductory Mycology (Fourth Edition) Wiley India Pvt. Ltd (2007).
3. Gangulee and Khar. College Botany The New Central Book Agency Calcutta, 6th edition (2011)
4. Fritsch, F. E.1967. The Structure and Reproduction of Algae, Vol.I I. University Press Cambridge
5. Fritsch, F. E.1967. The Structure and Reproduction of Algae, Vol Il. I. University Press Cambridge
6. Dubey & D K Maheshwari, A Textbook of Microbiology, 3rd edition,2013.

REFERENCE BOOKS

1. Chapman,V. J. 1962. The Algae. Macmillan and Co. Ltd. New York.
2. Smith, G. M.1955. Crytogamic Botany Vol. IMc Graw – Hill Co.New York
3. Smith, S and Reed, D. J.1997. Mycorrhizal Symbiosis Academic Press.
4. Stein, J. R. 1980. Hand Book of Phycological Methods. University Press. Cambridge
5. Elizabeth Moore and Landecker Fundamentals of Fungi. Benjamin-Cummings Publishing Company (1996).
6. Vashista, Sinha B.R., Singh, V.P., 2013, Botany for Degree students, Algae 9th revised edition, S. Chand & Company Ltd., New Delhi.

JOURNALS

1. American Journal of Botany (AJB)
2. Indian journal of experimental biology

E-LEARNING RESOURCE

1. https://www.livescience.com/amp/54979-what-are-algae.html#aoh=15669283508959&amp_ct=1566928356695&referrer=https%3A%2F%2Fwww.google.com&amp_tf=From%20%251%24s
2. https://ucmp.berkeley.edu/fungi/fungi.html
3. https://www.anbg.gov.au/lichen/what-is-lichen.html
4. https://www.toppr.com/guides/biology/plant-kingdom/bryophytes/
5. https://science.jrank.org/pages/714/Bacteria.html

COURSE OUTCOMES

CO No.	CO Statement	Knowledge Level
CO 1	Discuss the classification, structure, reproduction, life cycles and economic importance of Algae	K2, K4
CO 2	Outline the classification, structure, reproduction, life cycles and economic importance of Fungi	K3, K4
CO 3	Compile the structure, reproduction, life cycles of fungi	K2, K3
CO 4	Explain the structure, reproduction and economic importance of Lichens	K2, K3
CO 5	Analyse the classification, structure, reproduction, life cycles and economic importance of Bryophytes.	K3, K4

MAPPING-COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	**3**	**2**	**2**	**3**	**3**
CO 2	**3**	**2**	**2**	**3**	**3**
CO 3	**3**	**2**	**2**	**3**	**3**
CO 4	**3**	**2**	**2**	**3**	**3**
CO 5	**3**	**2**	**2**	**3**	**3**
Average	**3**	**2**	**2**	**3**	**3**

TEACHING METHODOLOGY:
Lecture (Chalk and Talk-OHP-LCD),
E Content, Videos/ Animation,
Quiz-Seminar,
Peer Learning,
Field Visits.

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)
CHENNAI- 600 008.
(For candidates admitted during the academic year 2021-2022)
M.Sc DEGREE EXAMINATION
I M.Sc PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

CORE PAPER 1
PLANT DIVERSITY – I ALGAE, FUNGI, LICHENS AND BRYOPHYTES
COURSE CODE - 10SP21/1C/AFB

QUESTION PAPER PATTERN

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K1,K2	A-10×2 marks	50	20	100	Question No. is compulsory
K2,K3	B-5/8×8 marks	500	40		
K4,K5	C-2/3×20 marks	1500	40		

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SEMESTER I

CORE PAPER 2

PLANT DIVERSITY-II

PTERIDOPHYTES, GYMNOSPERMS AND PALAEOBOTANY

COURSE CODE-10SP21/1C/PGP

Teaching hours: 5/ Week **Credits: 4**

75/ Semester **L-T- P**

3 -2- 0

COURSE OBJECTIVES:

To enable the students to

1. Study the lower vascular plants and their characteristics
2. Learn the salient features of fossil and living forms of Pteridophytes and Gymnosperms
3. Understand the diversity, structural organization and reproduction of Pteridophytes and Gymnosperms
4. Make the students aware of the economic value of Pteridophytes and Gymnosperms
5. Summarize the importance of fossils

COURSE OUTLINE:

UNIT – I **(15 Hrs)**

Pteridophytes: General features, origin and classification (Reimer, 1954) - General characters of major groups-Psilophytopsida, Psilotopsida, Lycopsida, Sphenopsida, Pteropsida. Range of morphology, structure, reproduction and evolution of gametophytes and sporophytes of fossil Pteridophytes - *Calamites, Sphenophyllum* and *Calamostachys*

UNIT – II **(15 Hrs)**

Morphology, anatomy and reproduction of living Pteridophytes – *Isoetes, Angiopteris, Osmunda, Pteris, Polypodium* and *Salvinia,* - Heterospory and origin of seed habit - Origin and evolution of stele and soral evolution - Economic importance of Pteridophytes.

UNIT – III **(15 Hrs)**

Gymnosperms: General characters, origin and classification (Sporne, 1965) of gymnosperms – General characters of major groups - Cycadopsida, Coniferopsida, Gnetopsida - Salient features, morphology, anatomy and evolutionary trends of fossil gymnosperms – *Lyginopteris, Medullosa,* and *Pentoxylon.*

UNIT – IV **(15 Hrs)**

General account on the distribution, morphology, anatomy, reproduction and phylogeny of *Araucaria, Podocarpus, Cupressus* and *Ephedra* – Economic importance of gymnosperms, Woods of gymnosperms.

UNIT – V **(15 Hrs)**

Palaeobotany: Concepts of Palaeobotany - Geological time scale – Contributions of Birbal Sahni- Techniques for palaeobotanical study – Fossil types - Impressions, Compressions, incrustation, casts, molds, petrifications, coal balls and compactions – Age determination and methods of study of fossils –Systematic and nomenclature of fossil plants – Palaeoclimates and fossil plants – Role of fossil in oil exploration – Palaeopalynology.

RECOMMENDED TEXT BOOKS

1. Bhatnagar, S.P. and Moitra, A.1996. Gymnosperm New Age International pvt. Ltd., NewDelhi.
2. Pandey B.P., 2006 – A text book of Botany, Pteridophytes and Gymnosperms, Vol.II, S.Chand & Co
3. Parihar N.S. 1996. Biology and Morphology of Pteridophytes. Central Book Depot, Allahabad.
4. Sharma.O.P.2012- Pteridophyta , Tata McGraw-Hill Education private limited
5. Singh.V., Pandey.P.C., and Jain.D.K.2018. A Textbook of Botany. Rastogi Publications
6. Stewart, W.N and Rathwell, G.W.1993. Paleobotany and the evolution of plants, Cambridge University press.
7. Vashista. P.C. 2010, Gymnosperms, S.Chand & Co.
8. Vashista.P.C., 2010 – Botany for Degree students : Pteridophyta. S.Chand & Co.

REFERENCE BOOKS

1. Sporne, K.R. 1970. The morphology of Pteridophytes (The structure of Ferns and AlliedPlants), Hutchinson University, London.
2. Pandey, B.P. 1998. A Text Book of Botany Vol. II. Chand, New Delhi.
3. Stuart, W.N. 1998. Paleobotany and Evolution of Plants, New York Publications.

4. Johri, R.M., Lata, S. and Tyagi, K. 2005. A textbook of Gymnosperms, Dominant Publishers& Distributor, New Delhi.
5. Johri, R.M., Lata, S. and Tyagi, K. 2012. A textbook of Pteridophyta..
6. Vashishta, P.C., Sinha, A.K. and Anilkumar. 2010. Pteridophytes (Revised Edition), S.Chand Publishing, New Delhi.
7. Vastishta, P.C., Sinha, A.K. and Anikumar 2010. Gymnosperms (Revised Edition), ChandPublishing, New Delhi.
8. Inderdeep Kaur and Prem, L.U. 2019. Textbook of Gymnosperms. ASTRAL Publisher.ISBN: 9789351249832, 9351249832
9. Rashid, A. 2013. An introduction to Pteridophyta – Diversity, Development andDifferentiation (2nd Edition), Vikas Publications, New Delhi.
10. Pandey, P.B. 2014. College Botany: 2: Pteridophyta, Gymnosperms and Palaeobotany andAngiopsperms. Chand Publishing, New Delhi.
11. Byng, J.E. 2015. The Gymnosperms handbook: A practical guide to extant families andgenera to the world. Plant Gateway Ltd.

JOURNALS

1. Journal of Plant Research
2. Phytotaxa

E-LEARNING RESOURCES

1. http://www.biologydiscussion.com/articles/pteridophytes-features-economic-importance- and- classification/5698
2. http://www.academia.edu-stelar system
3. https://www.askiitians.com/biology/plant-kingdom/pteridophytes.html
4. https://www.plantscience4u.com/2014/05/economic-importance-of-gymnosperms.html
5. https://www.newworldencyclopedia.org/entry/Geologic_time_scale

COURSE OUTCOMES

CO No.	CO Statement	Knowledge Level
CO 1	Write the general characters of Pteridophytes, the structural organization and reproduction of various fossil Pteridophytes	K3, K4
CO 2	Explain the structure and reproduction of various living Pteridophytes	K3,K4
CO 3	List the general characters of Gymnosperms and the salient features of various fossil Gymnosperms	K3, K4
CO 4	Summarize the lifecycle patterns of different Gymnosperms	K3,K4
CO 5	Explain the applied aspects of Paleobotany	K4, K5

MAPPING-COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	**3**	**3**	**1**	**3**	**3**
CO 2	**3**	**3**	**1**	**3**	**3**
CO 3	**3**	**3**	**1**	**3**	**3**
CO 4	**3**	**3**	**1**	**3**	**3**
CO 5	**3**	**3**	**1**	**3**	**3**
Average	**3**	**3**	**1**	**3**	**3**

TEACHING METHODOLOGY:

Lecture (Chalk and Talk-OHP-LCD),

E Content, Videos/ Animation,

Quiz-Seminar,

Peer Learning,

Field Visits.

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)
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CORE PAPER 2

PLANT DIVERSITY-II PTERIDOPHYTES, GYMNOSPERMS AND PALAEOBOTANY

COURSE CODE-10SP21/1C/PGP

QUESTION PAPER PATTERN

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K1,K2	A-10×2 marks	50	20	100	Question No. is compulsory
K2,K3	B-5/8×8 marks	500	40		
K4,K5	C-2/3×20 marks	1500	40		

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)
CHOICE BASED CREDIT SYSTEM
M.Sc., PLANT BIOLOGY AND PLANT BIOTECHNOLOGY (SELF SUPPORTING)
(with effect from the Academic Year 2021 - 2022 and thereafter)

SEMESTER I

CORE PAPER 3

MICROBIOLOGY, IMMUNOLOGY AND PLANT PATHOLOGY

COURSE CODE-10SP21/1C/MIP

Teaching hours: 6 / Week **Credits: 4**
90/Semester **L-T-P**
3 -3- 0

COURSE OBJECTIVES:
To enable the students to

1. Study the basic information and general features of bacteria, viruses and mycoplasma.
2. Know the economic importance of microbes in food/food products and agriculture
3. Understand the fundamentals of immunology.
4. Understand the principles of plant pathology and defense mechanisms
5. Study the details of plant pathogens, plant diseases and their impact on crop plants andcontrol measures.

COURSE OUTLINE:

UNIT – I **(15 Hrs)**

Bacteriology - General characteristics of Bacteria - Classification (Bergey's) Ultra structure of Bacterial cell- Gram positive & Gram negative, Staining methods-Gram's staining.

Virology - General characters, classification, structure, Multiplication. Viruses of Prokaryotes, Eukaryotes-Plant Viruses, Viroids and prions.

Mycoplasma - Structure and Classification

UNIT – II **(20 Hrs)**

Food Microbiology: The role of microorganisms in foods - Spoilage of fruits, vegetables, meats, poultry, eggs, bakery products, dairy products and canned foods – Food borne infections and intoxications – Mycotoxins - Food preservation.

Industrial Microbiology: Introduction to industrial microbiology - Microbes in industrial processes - Their source, types of fermentation andbioreactors - Design of a fermenter - Microbiology of fermented milk products (Cheese, Yoghurt), beverages, wine and vinegar. Production of organic acids (Acetic acid & Citric acid), Industrial enzymes (Amylase) and Alcohol (Ethanol). Indicator organisms and biosensors.

Agricultural Microbiology: Microbial inoculants in agriculture: Biofertilizers, Biocontrol agents, Bioherbicides and Biopesticides. Microbial degradation of chemical pesticides.

UNIT – III **(15 Hrs)**

Immunology: Cells of the Immune System - Innate and Adaptive immunity – Antigens - Antigenicity and immunogenicity - B and T cell epitopes - Immunoglobulin: Structure, Function and Immunoglobulin classes - Monoclonal and polyclonal antibodies and its Significance, Antigen-Antibody reactions: Immunodiffusion, ELISA. Immune response during viral (Corona) infections – vaccines.

UNIT – IV **(20 Hrs)**

Plant Pathology: History, scope and significance of Plant Pathology – Principles of plant infection – inoculum potential – infection and dissemination of pathogens. Causal agents of plantdiseases - biotic causes (fungi, bacteria virus, mycoplasma, nematodes, parasitic algae, angiospermic parasites - Abiotic causes (Physiological, deficiency of nutrients & minerals and pollution). Koch's postulates - Symptoms of plant diseases. Host – parasite interactions (Physiology of parasitism): Pathogenesis & Disease development, Role of enzymes and toxins indisease development.

Defense mechanisms: Host defense (Structural and Biochemical defenses). Process of infection – Mechanical, physiological and enzymatic action - Penetration and entry of pathogens into host tissues - Spread and transmission of plant diseases – wind, water, seed & vector borne. Genetics of plant disease: Disease resistance – Geneics of virulence and resistance, Gene-for-gene concept, Techniques in plant breeding for disease resistance. Genetics of host – parasite interaction – mutation, heterokaryosis, parasexual recombination.

UNIT – V **(20 Hrs)**

Plant Disease Management: Principles and methods of plant disease management: Cultural, physical, biological and chemical. Disease resistance and molecular approaches for plant disease management. Integrated pest management. Concept of biological control - definitions, importance, principles of plant disease management with biocontrol agents - history of biological control - merits and demerits of biological control. Antagonism – competition, antibiosis – parasitism – induced systemic resistance.

Techniquesin Plant Pathology: Detection of pathogens in host tissues – ELISA – Methods for incorporation of resistant genes – Electroporation – *Agrobacterium* mediated transformation.

Important diseases of crop plants in India (Blast, sheath blight and bacterial blight of rice, anthracnose of cereals, late blight of potato, leaf rust of coffee, smut of sugarcane, yellow vein mosaic in okra, cucumber mosaic).

RECOMMENDED TEXT BOOKS

1. Dubey & D K Maheshwari, A Textbook of Microbiology, 3rd edition, 2013.
2. Wulf Cruger and Anneliese Crueger, Biotechnology: A Textbook of Industrial Microbiology, 2nd edition,Panima Publishing Corporation, 2004.
3. Casida Jr, L.E., Industrial Microbiology, New Age International (P) Ltd, 2007.
4. Kuby R.A. Goldsby et al., 2002. Osborne Immunology (Ed: 6) Freeman & Co., New York.
5. Stanbury P.F. et al. 3rd edition. 2016. Principles of Fermentation Technology, Butterworth-Heinemann, UK.
6. K. Sukesh, P K Sivakumar & M.M. Joe, An Introduction to Industrial Microbiology, 2010.
7. Tizard, Ian R. Immunology and introduction, Fourth Ed, Saunders College publishing, New Delhi, 2010 Coico R, Sunshine G. Immunology: A short course, Sixth Edition, Wiley-Blackwell publishers, Canada 2009.
8. Pathak, Khatri and Pathak. 1996. Fundamentals of Plant Pathology. AgroBios, Jodhpur.
9. Pandey, B.P. 1982. Plant Pathology – Pathogen and Plant disease. S.Chand & Company Pvt. Ltd, New Delhi.
10. Rangaswami G and A. Mahadevan Diseases of Crop plants in India. IV Edition Practice Hall 1999.
11. Bilgrami K.S. and Dube H.C., A Text Book of Modern Pathology Vikas publishing house pvt., Ltd., 1976.
12. Mehrotra R.S. Plant Pathology Tata-Mc Graw Hill Publish, co., Ltd., 1980.

REFERENCE BOOKS

1. Agrios, A.G. 2007. Plant Pathology, Elsevier. ISBN: 9780120445653.
2. Singh, R.S. 2018. Introduction to Principles of Plant Pathology, 4th Edition.
3. Mehrotra, R.S. and Aggarwal, A. 2017. Plant Pathology. McGraw Hill Publisher.
4. Dube, H.C. 2010. A text Book of Fungi, Bacteria and Viruses, 3rd Edition, Agrobios India,ISBN: 8188826383.
5. Ingraham, J.L. and Ingraham, C. A. 2004 Introduction to Microbiology: A Microbiology: ACase History Approach. Thomson Asia Pvt. Ltd., Singapore.
6. Jeffery, C., Pommerville. 2014. Alcamos Fundalmedals of Microbiology. 10th Edition. Johnsand Bartlett Learning.
7. Pelczar, M. J. 2007. Microbiology. 35th Edition, Tata-McGraw Hill Publications, New York,ISBN: 0074623260.
8. Ravi Chandra, N.G. 2013. Fundamentals of Plant Pathology, Phi Learning.
9. Willie, J. and Sherwood, L. 2016. Prescott's Microbiology McGraw-Hill Education; 10thEdition, ISBN: 978-1259281594.
10. Chaube, H.S. and Singh, R. 2015. Introductory Plant Pathology CBS Publishers, ISBN: 978-8123926704.

11. Vaman Rao, C. 2006. Immunology. 2nd Edition. Narosa Publisher.
12. Kenneth, M. 2017. Janeway's Immunobiology. 9th Edition. Garland Publisher.
13. Vijaya, R.P. 2015. Immunology, SBW Publisher.

JOURNALS

1. Indian journal of experimental biology
2. Journal of Plant Pathology & Microbiology
3. Asian journal of plant pathology
4. Journal of Food and Bioprocess Technology
5. Journal of Bioprocessing & Biotechniques
6. Journal of Immunology

E-LEARNING RESOURCES

1. https://science.jrank.org/pages/714/Bacteria.html
2. https://www.sciencedirect.com/topics/biochemistry-genetics-and-molecular-biology/host-pathogen-interaction
3. https://www.researchgate.net/publication/308642520_Molecular_Plant_Pathology
4. http://www.hillagric.ac.in/edu/coa/ppath/lect/plpath111/Lect.%201%20%20Introduction-Pl%20Path%20111.pdf
5. http://www.hillagric.ac.in/edu/coa/ppath/lect/plpath233/PlPath233-I-DISEASES-OF-FIELD-CROPS-AND-THEIR-MANAGEMENT.pdf
6. https://books.google.co.in/books?id=yYOoBQAAQBAJ&printsec=frontcover&dq=fermentation+technology&hl=en&sa=X&ved=0ahUKEwiki8jD4p_kAhVLP48KHR1ZC0gQ6AEIVjAH#v=onepage&q=fermentation%20technology&f=false
7. https://bioprocessing.weebly.com/bioprocess-technology.html
8. https://www.sciencedirect.com/topics/social-sciences/food-technology
9. https://www.sciencedirect.com/book/9780122740206/immunology

COURSE OUTCOMES

CO No.	CO Statement	Knowledge Level
CO 1	Write the structure and classification of bacteria, viruses and mycoplasma	K3, K4
CO 2	Analyse the role microbes in the field of Food, Industry and Agriculture	K4
CO 3	Build a Knowledge on Basics of Immunology and its importance	K3, K4
CO 4	Explain Principles and Genetics of Plant infections	K4, K5
CO 5	Determine certain control measures including integrated pest management	K4,K5

MAPPING-COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	**3**	**3**	**1**	**3**	**3**
CO 2	**1**	**3**	**1**	**3**	**3**
CO 3	**3**	**3**	**1**	**3**	**3**
CO 4	**3**	**3**	**1**	**3**	**3**
CO 5	**2**	**3**	**1**	**3**	**3**
Average	**2.4**	**3**	**1**	**3**	**3**

TEACHING METHODOLOGY:

Lecture (Chalk and Talk-OHP-LCD)
E Content,
Videos/ Animation,
Quiz-Seminar,
Peer Learning,
Field Visits.

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS) CHENNAI-600 008.

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M. Sc DEGREE EXAMINATION

I M. Sc PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

CORE 3

MICROBIOLOGY, IMMUNOLOGY AND PLANT PATHOLOGY

COURSE CODE-10SP21/1C/MIP

QUESTION PAPER PATTERN

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K1,K2	A-10×2 marks	50	20	100	Question No. is compulsory
K2,K3	B-5/8×8 marks	500	40		
K4,K5	C-2/3×20 marks	1500	40		

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)
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SEMESTER I
CORE PAPER 4
PRACTICAL-I: COVERING CORE PAPERS 1, 2 and 3

COURSE CODE-10SP21/2C/PR1

Teaching hours: 8/ Week **Credits: 4**
120/ Semester **L-T- P**
0- 0 - 8

COURSE OBJECTIVES:
To enable the student to

1. Study different forms of Algae, Fungi and Bryophytes
2. Understand the vegetative and reproductive structures of Pteridophytes and Gymnosperms both living and fossil forms
3. Study of Microbes from soil, water and air
4. Study the fundamentals of Immunology
5. Understand the details of Plant pathogens and Plant diseases

COURSE OUTLINE:

Algae

External Morphology and internal anatomy of the vegetative and reproductive structures of the genera given in the theory.

Fungi

Study of morphological and reproductive structures of the genera mentioned in theory.

Preparation of PDA medium, isolation and identification of fungi from soil and air.

Haemocytometer.

Lichens

Study of morphological and reproductive structures of the genera *Usnea*

Bryophytes

Morphological and anatomical study of representative members of the genera given in the theory

Pteridophytes

Study of vegetative, anatomy and reproductive structure of *Isoetes, Angiopteris, Osmunda, Pteris, Polypodium* and *Salvinia*

Gymnosperms

Study of morphology, anatomy and reproductive structure of *Araucaria, Podocarpus, Cupressus* and *Ephedra*

Palaeobotany

Specimens of fossil plants.

Microbiology

1. Serial dilution.
2. Preparation of NA medium, isolation and identification of bacteria from soil and air.
3. Gram's staining of bacteria found in curd.

Immunology

1. Antigen-Antibody reactions
2. Immunodiffusion
3. ELISA

Plant Pathology

Study of the following diseases: Rice blight, anthracnose of cereals, late blight of potato, leaf rust of coffee, smut of sugarcane, Yellow mosaic in okra, cucumber mosaic. Study of effect of pathogens on seed germination and vigour index by paper towel method.

Bonafide record of practical work done should be submitted for the practical examination.

COURSE OUTCOMES

CO No.	CO Statement
CO 1	Describe the characteristic features of Algae, Fungi, Lichens and Bryophytes
CO 2	Discuss the structural organization of various living and fossil forms of Pteridophytes and Gymnosperms
CO 3	Examine on eco-friendly microbes and their uses.
CO 4	Understand the Fundamentals of immunology
CO 5	Discuss about plant diseases and their impact on various crop plants

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SEMESTER I

ELECTIVE PAPER 1

PHYTOCHEMISTRY AND DRUG DEVELOPMENT

COURSE CODE-10SP21/1E1/PDD

Teaching hours: 4/ Week **Credits: 3**

60/ Semester **L-T- P**

2- 2- 0

COURSE OBJECTIVES:

To enable the students to

1. Study the history and scope of plant derived drugs.
2. Acquire knowledge on the characteristics and importance of major phytochemicals.
3. Know the extraction, purification and characterization of phytochemicals.
4. Learn the process for development of plant derived drugs
5. Impart knowledge on cultivation and processing of medicinal plant

COURSE OUTLINE:

UNIT – I **(15 Hrs)**

Plant drugs: Introduction, history, scope. Classification and pharmacological activities of plant drugs. Secondary metabolites - A brief account of acetate malonate, acetate mevalonate and shikimic acid pathways. Categories of phytochemicals – Phenols, alkaloids, flavonoids, terpenoids, steroids, glycosides, carbohydrates and vitamins.

UNIT – II **(10 Hrs)**

Important plant products: Carbohydrates (starch and gums). Glycosides (*Digitalis* and *Dioscorea*). Alkaloids (*Rauvolfia* and *Catharanthus).* Phenolic compounds produced by plants (*Senna* and *Capsicum*). Betacyanins, Steroidal compounds (types, biological activities and pharmaceutical importance). Volatile oils (Clove and *Mentha).* Resins (types and uses). Antibiotics and vitamins. Botanical pesticides.

UNIT – III **(10 Hrs)**

Extraction methods of phytochemicals: Aqueous and organic solvent extraction, extraction with super critical gases – steam distillation - minor extraction methods - extraction of

essential oil - soxhlet extractor - purification and concentration of miscella. Qualitative phytochemical screening - detection of alkaloids, carbohydrates, saponins, proteins and amino acids, phenolic compounds and tannins.

UNIT – IV **(10 Hrs)**

Methods of separation of phytochemicals: Chromatography - paper chromatography, TLC, column chromatography. Qualitative and quantitative estimation of phytochemicals - Gas chromatography, liquid chromatography, high-performance liquid chromatography, high-performance thin-layer chromatography, optimum performance laminar chromatography. Methods of identification - physical characteristics, Spectral analyses – UV, VIS, IR, NMR and Mass spectra, CHN analysis, X-ray crystallography.

UNIT – V **(15 Hrs)**

Crude Drugs – Scope & importance, Classification (taxonomical, morphological chemical, pharmacological). Drug evaluation - Cultivation, collection and processing of crude drugs. Medicinal and aromatic plants - Cultivation, utilization of medicinal and aromatic plants in India. Role of plant tissue culture in enhancing secondary metabolites – Elicitation – Biotransformation. Factors affecting secondary metabolites production. Application of phytochemicals in industry and healthcare.

RECOMMENDED TEXT BOOKS

1. Kumar, N. 2018. A Textbook of Pharmacognosy. Aitbs Publishers, India.
2. C. K. Kokate, A. P. Purohit & S. B. Gokhale (1996), Pharmacognosy, Nirali Prakashan, 4th Ed.
3. Chichister, U. K. Cultivation & Processing of Medicinal Plants, J. Wiley &Sons. Trease & Evans.
4. K.C.Kokate, A.P.Purohit,S.B.Gokhale. Pharmacognosy. Nirali Prakashan.2008.Pune.

REFERENCE BOOKS

1. Gokhale, S.B., Kokate, C.K. and Gokhale, A. 2016. Pharmacognosy of Traditional Drugs.Nirali Prakashan, 1st Edition. ISBN: 9351642062.
2. Gringauz 2012. Introduction to Medicinal Chemistry: How Drugs Act & Why? Wiley IndiaPvt Ltd. ISBN: 8126528567.
3. Hornok, L. 1992. Cultivation and Processing of Medicinal Plants. Wiley-Blackwell. ISBN:0471923834.
4. Joshi, S.G. 2018. Medicinal Plants. Oxford & IBH Publishing C., Pvt., Ltd., New Delhi.ISBN:9788120414143.
5. Premendra Singh 2013. Medicinal Plants: Conservation, Cultivation and Utilization. DayaPublishing House - A division of - Astral International (P) Ltd.
6. Qadry, J.S. 2014. A textbook of Pharmacognosy Theory and Practicals. CBS Publishers &Distributors, 17th Edition. ISBN: 8123925328.

7. Zhang C.L. 2012. Cultivation Techniques of Medicinal Plants. China AgriculturalUniversity. ISBN: 7811177773.
8. Harborne, A.J. 2008. Phytochemical methods. A guide to modern techniques of plantanalysis. Chapman and Hall Publisher.

JOURNALS

1. Phytotherapy
2. Journal of Medicinal Plants Studies
3. Journal of pharmacognosy and phytochemistry
4. ACS –Natural Product Chemistry

E LEARNING RESOURCES:

1. http://www.yourarticlelibrary.com/pharmacognosy/crude-drugs-cultivation-collection-processing-and-storage/49405
2. harmatutor.org/pharmacognosy/cultivation-methods.html
3. https://www.nmpb.nic.in/sites/default/files/publications/Good_Field_Collection_Practicies_GFCPs_Booklet-Part-I.pdf
4. https://academic.oup.com/chromsci/article/55/3/232/2547730
5. https://pdfs.semanticscholar.org/4dba/b6f76e0ac0bf2e592624f1f73867e2cc40e6.pdf

COURSE OUTCOMES

CO No.	CO Statement	Knowledge Level
CO 1	Describe the history and scope of plant derived drugs	K2, K3
CO 2	Write the characteristics and importance of major Phytochemicals	K3
CO 3	Summarize the extraction, purification and characterization of phytochemicals	K3, K4
CO 4	Categorize various methods of separation of phytochemicals	K4, K5
CO 5	Explain the process for development of plant derived drugs	K4, K5

Mapping of CO with PSO

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	**2**	**3**	**3**	**3**	**3**
CO 2	**2**	**3**	**3**	**3**	**3**
CO 3	**2**	**3**	**3**	**3**	**3**
CO 4	**2**	**3**	**3**	**3**	**3**
CO 5	**2**	**3**	**3**	**3**	**3**
Average	**2**	**3**	**3**	**3**	**3**

TEACHING METHODOLOGY:
Lecture (Chalk and Talk-OHP-LCD),
E Content, Videos/ Animation,
Quiz-Seminar,
Peer Learning.

Note: No Practical for this paper.

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M. Sc DEGREE EXAMINATION

I M. Sc PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

ELECTIVE PAPER 1

PHYTOCHEMISTRY AND DRUG DEVELOPMENT

COURSE CODE -10SP21/1E1/PDD

QUESTION PAPER PATTERN

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K1,K2	A-10×2 marks	50	20	100	Question No. is compulsory
K2,K3	B-5/8×8 marks	500	40		
K4,K5	C-2/3×20 marks	1500	40		

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)
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(with effect from the Academic Year 2021 - 2022 and thereafter)
SEMESTER I

ELECTIVE PAPER 1

MUSHROOM TECHNOLOGY

COURSE CODE-10SP21/1E1/MTE

Teaching hours: 4/ Week **Credits: 3**

60/ Semester **L-T- P**

2- 2- 0

COURSE OBJECTIVE:

To enable the student to

1. Teach how to identify mushrooms
2. Study the cultivation technique of mushrooms
3. Know the uses of mushroom and their economic importance
4. Study how to establish mushroom cultivation as business enterprise

COURSE OUTLINE:

UNIT - I **(10 Hrs)**

Introduction - history and scope of mushroom cultivation. Mushroom morphology, vegetative characters and life cycle. Nutritional profile of mushrooms - medicinal value of mushrooms. Types of edible mushrooms available in India. Mushroom collection - tools required. Pure culture techniques- pure culture maintenance – long and short term storage of pure culture - mother spawn production.

UNIT - II **(15 Hrs)**

Morphological and Microscopical identification of mushrooms. Spore printing - keys for identification of edible mushrooms - Button mushroom (*Agaricus bisporus*), Oyster mushroom (*Pleurotus sajorcaju*), paddy straw mushroom (*Volvariella volvcea*), morels (*Morchella spp*.) milky mushroom (*Calocybe indica*) and Truffles (*Tuber elanosporum*). Structure and keys for identification of poisonous mushrooms – *Amanita muscaria, A. phalloides*, *Galerina marginata*, and *Chlorophyllum molybdites*. Key for identifying hallucinogenic mushroom (*Psilocybe sp*.) Medicinal Mushroom – *Cordyceps*, *Ganoderma lucidum* and *Lentinus edodes*.

UNIT - III **(15 Hrs)**

Structure and construction of mushroom house - layout of traditional and greenhouse method - Methods of mushroom cultivation - maintenance of sanitation in mushroom plants. Substrates: types, processing, sterilization, preparation for cultivation. Principles of composting, machinery required for compost making, materials for compost preparation. Methods of composting, casing mixture, quality parameters of casing soil, different types of casing mixtures, bed, polythene bag preparation. Cultivation of oyster and paddy straw mushroom, harvesting and utilization of spent.

UNIT - IV **(10 Hrs)**

Post-harvest management – Harvest - preservation of mushrooms, storage methods, quality assurance of mushrooms. Bacterial diseases of mushrooms, pests and nematodes infestation on edible mushrooms and mushroom beds. Principles and methods of pest management - chemical control. Integrated pest management. Influence of abiotic factors affecting mushroom production.

UNIT - V **(10 Hrs)**

Developing small scale industry, special training for developing small scale industry - Government schemes - large scale industry requirement - cost benefit ratio - marketing in India and abroad, export value. Mushroom Research Centres – International National and Regional levels. Production of various mushroom based foods for marketing - pickles, jams, chips, soup, cutlet, vegetable curry, samosa and omelet.

RECOMMENDED TEXT BOOKS

1. Marimuthu, T., Krishnamoorthy, A.S., Sivaprakasam, K. and Jayarajan. R. 1991. Oyster Mushrooms, Department of Plant Pathology, Tamil Nadu Agricultural University, Coimbatore.
2. Tiwari., SC. And Pandey, K. 2018. Mushroom cultivation. Mittal publisher, New Delhi.
3. Verma, 2013. Mushroom: Edible and medicinal: Cultivation conservation, strain improvement with their marketing. Daya Publishing House.

REFERENCE BOOKS

1. Diego, C.Z. and Pando-Gimenez, A. 2017. Edible and medicinal mushrooms: Technology and Application. Wiley-Blackwell Publishers.

2. Pathak, V.N. 2011. Mushroom Production and Processing Technology. 1st Edition. Agrobios (India). ISBN-10: 8177540068.
3. Philips, G., Miles and Chang, S.T. 2004. Mushrooms: Cultivation, nutritional value, medicinal effect and environmental effect. 2nd Edition. CRC Press.
4. Tripathi, D.P. 2005. Mushroom Cultivation, Oxford & IBH Publishing Co. Pvt.Ltd., New Delhi.

COURSE OUTCOMES

CO No.	CO Statement	Knowledge Level
CO 1	Knowledge on identification of different varieties of edible mushroom	K2, K3
CO 2	Understand the difference between edible and poisonous mushroom	K3
CO 3	Knowledge on cultivation techniques of edible and medicinal mushrooms	K3, K4
CO 4	Understand the harvest and post-harvest techniques of mushroom crops	K4, K5
CO 5	Knowledge on the production and marketing strategies for mushrooms	K4, K5

Mapping of CO with PSO

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	2	1	2	3	3
CO 2	2	2	1	3	3
CO 3	2	2	3	3	3
CO 4	2	1	2	3	3
CO 5	2	2	2	3	3
Average	2	1	2	3	3

TEACHING METHODOLOGY:

Lecture (Chalk and Talk-OHP-LCD),
E Content, Videos/ Animation,
Quiz-Seminar,
Peer Learning.

Note: No Practical for this paper.

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS) CHENNAI-600 008.

(For candidates admitted during the academic year 2021-2022)

M. Sc DEGREE EXAMINATION

I M. Sc PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

ELECTIVE 1

MUSHROOM TECHNOLOGY

COURSE CODE-10SP21/1E1/MTE

QUESTION PAPER PATTERN

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K1,K2	A-10×2 marks	50	20	100	Question No. is compulsory
K2,K3	B-5/8×8 marks	500	40		
K4,K5	C-2/3×20 marks	1500	40		

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)
CHOICE BASED CREDIT SYSTEM
M.Sc., PLANT BIOLOGY AND PLANT BIOTECHNOLOGY (SELF SUPPORTING)
(with effect from the Academic Year 2021 - 2022 and thereafter)
SEMESTER I

ELECTIVE 1

ALGAL TECHNOLOGY

COURSE CODE-10SP21/1E1/ATE

Teaching hours: 4/ Week **Credits: 3**

60/ Semester **L-T- P**

2- 2- 0

COURSE OBJECTIVE

To enable the student to

1. Realize the economic importance of algae.
2. Study the multiple technique on algae cultivation.
3. Know about the seaweed liquid fertilizers.
4. Study about the genetics of algae.

COURSE OUTLINE:

UNIT - I **(10 Hrs)**

Scope of algal technology – Commercial potential and utility of algae. Algae as sources for food, feed, pigments, fine chemicals, fuel, biofertilizers and hormones.

UNIT - II **(15 Hrs)**

Industrial application of algal - fuel, algal lipids - transesterification to ester fuel - substitutes for petroleum derived fuel. Production of fine chemicals. Algae as food for fish, poultry and animals. Mass cultivation of micro-algae as source of protein and as feed.

UNIT - III **(15 Hrs)**

Therapeutic uses. remedial compounds, antioxidant, anti-thromombiotic, anticoagulants, wound healing, skin diseases, anti-ulcerogenic, antifungal, antibiotics, antitumor and antiviral compounds. Production of pigments and their utilization. Positive and negative roles of algae in agriculture and aquaculture. Role of algae in closed systems - symbiotic algae, parasitic algae, phycopathology.

UNIT - IV **(10 Hrs)**

Immobilization of algae: natural compounds of immobilization methods of immobilization-alginate beads-extraction of compounds. Recombinant DNA technology in algae, cloning of algal genomics and genetic engineering with reference to algae. Transformation systems in algae. Isolation of protoplasts, regeneration of fusion of macro algae.

UNIT - V **(10 Hrs)**

Role of algae in environmental health - Sewage treatment, treating industrial effluent, heavy metal removal, algae as indicators in assessing water quality and pollution; Saprobic index; Monitoring, assessment, restoration and management of coastal and marine ecosystem environment.

RECOMMENDED TEXT BOOKS

1. Sharma, O.P, 2011. Algae. McGraw Hill Education (India) Private Limited. ISBN: 0070681945
2. Suganya, T. and Renganathan, S. 2015. Biodiesel production using algal technology. Academic Press. ISBN: 0128009713.

REFERENCE BOOKS

1. Bajpai, Rakesh K., Prokop, Ales, Zappi, Mark E. 2014. Algal Biorefineries Volume 1: Cultivation of Cells and Products. Springer. ISBN: 9400774931.
2. Faizal, B. and Yusuf, C. 2016. Algal biotechnology: Products and processes. Springer. ISBN: 3319123335.

COURSE OUTCOMES

CO No.	CO Statement	Knowledge Level
CO 1	Realization on economic importance of algae.	K2, K3
CO 2	Knowledge on the genetics of algae.	K3
CO 3	Knowledge on algal cultivations	K3, K4
CO 4	Understand the preparation seaweed liquid fertilizers and their applications in agriculture and horticulture.	K4, K5
CO 5	Realization of the commercial potential of algal products.	K4, K5

Mapping of CO with PSO

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	2	2	2	3	3
CO 2	1	1	1	3	3
CO 3	2	1	3	3	3
CO 4	2	1	2	3	3
CO 5	1	2	2	3	3
Average	2	1	2	3	3

TEACHING METHODOLOGY:

Lecture (Chalk and Talk-OHP-LCD),
E Content, Videos/ Animation,
Quiz-Seminar,
Peer Learning.

Note: No Practical for this paper.

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS) CHENNAI-600 008.

(For candidates admitted during the academic year 2021-2022)

M. Sc DEGREE EXAMINATION

I M. Sc PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

ELECTIVE PAPER 1

ALGAL TECHNOLOGY

COURSE CODE-10SP21/1E1/ATE

QUESTION PAPER PATTERN

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K1,K2	A-10×2 marks	50	20	100	Question No. is compulsory
K2,K3	B-5/8×8 marks	500	40		
K4,K5	C-2/3×20 marks	1500	40		

COURSE PROFILE

I YEAR - SECOND SEMESTER

TOTAL CREDITS – 30

S.N	CORE/ ELECTIVE	TITLE OF THE PAPER	CODE	L	T	P	H	C	CA	SE	MM
7	Core 5	Plant Anatomy and Embryology of Angiosperms	10SP21/2C/PAE	3	1	0	4	4	40	60	100
8	Core 6	Cell and Molecular Biology	10SP21/2C/CMB	3	1	0	4	4	40	60	100
9	Core 7	Genetics, Plant Breeding and Evolution	10SP21/2C/GPE	3	1	0	4	4	40	60	100
		Practical - I: Covering Core Papers – 1,2, 3	10SP21/2C/PR1	-	-	-	-	4	40	60	100
10	Core 8	Practical - II: Covering Core Papers – 5 ,6,7	10SP21/2C/PR2	0	0	8	8	4	40	60	100
11	Elective 2	Applied Plant Cell and Tissue culture	10SP21/2E2/APT	2	2	0	4	3	40	60	100
		Horticulture and Landscaping	10SP21/2E2/HLS								
		Organic Agriculture	10SP21/2E2/OAG								
12	Extra Disciplinary Elective 1	Entrepreneurial Botany (offered to other Department students)	10SP21/2E/EBO	2	2	0	4	3	40	60	100
13	Soft Skills 2			2	0	0	2	2	-	50	50
14	Internship	During Summer Vacation	10SP21/2I/INT				Min. 21 days	2			

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SEMESTER II

CORE PAPER 5

PLANT ANATOMY AND EMBRYOLOGY OF ANGIOSPERMS

COURSE CODE-10SP21/2C/ PAE

Teaching hours: 4 / Week **Credits: 4**
60/Semester **L-T- P**
3- 1- 0

COURSE OBJECTIVES:
To enable the students to

1. Understand the tissues and its types in plant systems.
2. Enable the students to get knowledge on secondary growth in plants and its abnormalities.
3. Introduce the learners about the embryology of angiosperms.
4. Impart knowledge on morphogenesis and its applications.
5. Understand the developmental process of tissue form Spermatogenesis, Oogenesis to Embryo formation

COURSE OUTLINE:

UNIT – I **(10 Hrs)**

Plant Anatomy: Meristems – characters, classification and theories – Apical cell theory, shoot apical meristem (SAM), root organization – root apical meristem (RAM) - Vascular Cambium –Types, divisions, arrangement and seasonal activity, Factors affecting cambial activity. Origin, Structure, development and ontogeny of xylem and phloem. Reaction wood – structure and properties. Heart wood and sap wood-strength, ability, grains, texture and defects. Anomalous secondary growth in Dicots – *Achyranthes, Bougainvillea*, *Bignonia* and Monocots - Palm.

UNIT – II **(15 Hrs)**

Leaf ontogeny – initiation, apical, intercalary, marginal and adaxial growth, plate meristem and development of vascular tissues .Transfer cells – Structure, development and functions. Classical concept of flower; Floral anatomy and its role in classification. Plant galls; Types, structure and development. Role of polarity in cell differentiation and symmetry. Role of sucrose in Vascular tissue differentiation.

UNIT – III **(10 Hrs)**

Embryology of Angiosperms: Development of microspores and megaspores – types and factors involved. Development of micro gametophyte – pollen wall development - vegetative and generative cells; pollen viability test. Development of megagametophyte – structure and types of ovule. Development of monosporic, biosporic and tetrasporic types of embryo sac and their cellular organization. Endosperm – Origin, types, structure, development. Haustorial endosperms.

UNIT – IV **(15 Hrs)**

Pollen-Pistil interaction and fertilization, types of stigma and style events on stigmatic surface, pollen tube growth, guidance and entry into ovule and embryo sac. Double fertilization – significance. Incompatibility – interspecific – homomorphic and heteromorphic, Causes and methods to overcome incompatibility. Classification of embryo development in Dicots and Monocots. Development of fruit wall and differentiation.

UNIT – V **(10 Hrs)**

Polyembrony – causes – Apomixis, Apospory. Their role in crop improvement programmes and seed development. Biochemical and physical factors in fruit development. Parthenocarpy. Prospects and significance of embryo and endosperm culture.

RECOMMENDED TEXT BOOKS

1. Agarwal, S.B. 1990 Embryology of Angiosperms - a fundamental approach. Sahitya, Bhawan, Agra.
2. Sharma. OP. 2012. Plant Taxonomy 2nd Edition, Mcgraw Hill, ISBN: 9780070141599
3. Pandey B. P. 2006. Taxonomy of Angiosperms, Chand publisher, ISBN: 9788121909327.
4. Pandey S. N. A Textbook of Botany: Angiosperms - Taxonomy, Anatomy, Embryology and Economic Botany Angiosperms. Chand publisher, ISBN: 9788121904049.
5. Pandey, A.K., 1997. Introduction to Embryology. CBS Publishers and Distributors New Delhi
6. Pandey, B. P. 2001, Plant Anatomy. S. Chand and Co. Ltd., New Delhi.
7. Pandey, S.N. and Chadha, A. 2000. Embryology. Vikas Publishing House Pvt. Ltd., New Delhi
8. Singh, V., Pande, P. C. and Jain, D. K. 1987. Anatomy of Seed Plants. Rastogi Publications, Meerut.
9. Pandey, P.B. 2010. College Botany: 3: Plant Anatomy, Reproduction in Flowering Plants, BioChemistry, Plant Physiology, Biotechnology, Ecology, Economic Botany, Cell Biology, and Genetics. Chand Publishing, New Delhi.

REFERENCE BOOKS

1. Easu, K. 2006. Plant Anatomy, Meristems, Cells, and Tissues of the Plant Body: Their Structure, Function, and Development. John Wiley & Sons Inc., New York.
2. Fahn, A. 1990 Plant Anatomy, Pergamon press, Oxford, New York.
3. Fosket, D.E. 1994. Plant Growth and Development – a molecular approach. Academic Press.
4. Maheshwari, P. 2015. An Introduction to the Embryology of Angiosperms, Scholar Select Publishers.
5. Paula J. and Rudall, 2007. Anatomy of Flowering Plants: An Introduction to Structure and Development (3rd Edition), Cambridge University Press.

JOURNALS

1. Journal of Morphology and Anatomy
2. Journal Plant Genetics and Breeding

E-LEARNING RESOURCES

1. https://www.sciencedirect.com/topics/biochemistry-genetics-and-molecular-biology/embryogenesis
2. https://www.researchgate.net/publication/318394791_Plant_Anatomy_and_Embryology/link/59675b44458515e9af9e9f6a/download
3. https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/plant-anatomy
4. https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/palynology/pdf
5. https://www.researchgate.net/journal/0034-6667_Review_of_Palaeobotany_and_Palynology

COURSE OUTCOMES

CO.No.	CO Statement	Knowledge Level
CO 1	Outline the types of tissues in plant kingdoms.	K3
CO 2	Compare the anatomical structures and plant galls	K3, K4
CO 3	Explain the development of male and female gametophytes	K3
CO 4	Explain the pollen and compile the types of endosperms	K3,K4
CO 5	Explain morphogenesis, polyembryony and its uses.	K4

MAPPING OF CO WITH PSO

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	2	2	3	3
CO 2	3	2	2	3	3
CO 3	3	1	2	3	3
CO 4	3	1	1	3	3
CO 5	2	2	3	3	3
Average	2.8	1.6	2.0	3	3

TEACHING METHODOLOGY:

Lecture (Chalk and Talk-OHP-LCD),
E Content, Videos/ Animation,
Quiz-Seminar,
Peer Learning.

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M. Sc DEGREE EXAMINATION
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CORE PAPER 5

PLANT ANATOMY AND EMBRYOLOGY OF ANGIOSPERMS

COURSE CODE-10SP21/2C/ PAE

QUESTION PAPER PATTERN

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K1,K2	A-10×2 marks	50	20	100	Question No. is compulsory
K2,K3	B-5/8×8 marks	500	40		
K4,K5	C-2/3×20 marks	1500	40		

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)
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(with effect from the Academic Year 2021 - 2022 and thereafter)
SEMESTER II

CORE PAPER 6

CELL AND MOLECULAR BIOLOGY

COURSE CODE-10SP21/2C/CMB

Teaching hours: 5 / Week **Credits: 4**
75/ Semester **L-T- P**
3- 2- 0

COURSE OBJECTIVES:
To enable the students to

1. Expose to plant cell organelles and their functions.
2. Learn about cell cycle and nucleic acids.
3. Gain knowledge on synthesis and processing of protein.
4. Knowledge on general principles of gene organization and expression.
5. Understand the role or receptors and ligands in cell signalling.

COURSE OUTLINE:

UNIT – I **(15 Hrs)**

Cell theory; Cell structure, organization of prokaryotic and eukaryotic cells. Plant cell structure and function -Cell wall, nucleus, mitochondria, Golgi bodies, lysosomes, endoplasmic reticulum, peroxisomes, plastids, vacuoles, Ontogeny of mitochondria, chloroplast, ER and Golgi complex. Molecular basis for cell-wall mediated signaling mechanisms and cell-to-cell interaction in a parasitic plant and its hosts, Endocytosis and exocytosis.

UNIT – II **(15 Hrs)**

Cell growth and division - Phases of cell cycle, cell cycle control and regulation systems; extracellular and intracellular signals. Programmed Cell death. Mitosis and Meiosis. Classification of Nucleic acids, physical and chemical structure, Types of DNA and RNA, siRNA, PNA, RNAi, Mitochondrial and chloroplast DNA. DNA replication models, Enzymes of DNA replication, Methylation of DNA, termination of replication, DNA binding protein, Histones. DNA repair mechanisms: photo activation, excision repair recombination repair; SOS and adaptive responses and their regulation. Ultrastructure of Chromosomes, Chromosomal Aberrations – addition, deletion, insertion and translocation.

UNIT – III **(15 Hrs)**

RNA synthesis and processing - transcription factors and machinery, formation of initiation complex, transcription activator and repressor, types of RNA polymerases, capping, elongation and termination, RNA processing, RNA editing, Splicing and polyadenylation, RNA transport. Protein synthesis and processing - Ribosome, formation of initiation complex, initiation factors and their regulation, elongation and elongation factors, termination, genetic code, aminoacylation of tRNA, tRNA – identity. Aminoacyl tRNA synthetase and translational proof-reading, translational inhibitors, post-translational modification of proteins. Nuclear Receptors, Promotors and selective markers, Membranes and Membrane Transport.

UNIT – IV **(15Hrs)**

Control of gene expression at transcription and translation level (Regulating the expression of phages, viruses, prokaryotic and eukaryotic gene, role of chromatin in gene expression and gene silencing). Recombination - Homologous, Non-homologues and site specific recombination. Bacterial and plant two component systems, light signaling in plants, bacterial chemo taxis and Quorum sensing. Molecular Chaperons-Heat Shock proteins. Oncogenes and anti-oncogenes. Oxidative reactions, antioxidants and their mechanisms. Gene mapping methods- linkage maps, tetrads analysis, mapping with molecular markers, mapping by somatic cell hybrids. Types of mutations and mutagens.

UNIT – V **(15 Hrs)**

Development of cell signaling, hormones & their receptors, cell surface receptor, types of ligands, signaling through G-protein coupled receptors, G-Protein - structure and function, signal transduction pathways, second messengers-hydrophilic and hydrophobic, - regulations of signaling pathways. Cell to cell communication - role of different types of cell adhesion molecules, intercellular communication: structure and macromolecular trafficking of plasmodesmata. Outline signaling pathway induction during abiotic and biotic stress in plants.

RECOMMENDED TEXT BOOKS

1. Kumar, H.D. 2000. Molecular Biology. Vikas Publishing House Pvt. Ltd. New Delhi.
2. Verma, P.S. and Aggarwal, V.K. 2010. Molecular Biology, Chand Publishing, New Delhi.
3. Verma P.S. and Agarwal V.K. 2007.Cell biology, Genetics, molecular biology and evolution, S. Chand Publishing, New Delhi.

REFERENCE BOOKS

1. Ajoy Paul, 2009. Text book of Cell and molecular biology, Books and Allied (p) Ltd. Kolkata.
2. Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, Peter Walter (2002). Molecular biology of the cell (IV Edition). Garland Science, Taylor and Francis group, New York.
3. Cooper, G.M. and Hausman, R.E. 2013. The Cell: A Molecular Approach. 6th Edition. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.
4. Smith, A, Coupland, G., Dolan, L., Harberd, N., Jones, J., Marting, C., Sablowski, R. and Amey, A. 2010. Plant Biology. Garland Science, Taylor and Francis Group.
5. Karp, G. 2018. Cell and Molecular Biology: Concepts and Experiments. 6th Edition. John Wiley & Sons. Inc.
6. Lewin, 2017. Gene XII. Jones and Barlett Pub. ISBN. O 7637 5222 3
7. Lodish, et al. 2016. Molecular and Cell Biology. W.H. Freeman & Co. New York.
8. Buchanan, B., Gruissem, W. and Jones, R. 2000. Biochemistry & Molecular Biology of Plants by American Society of Plant Physiology, Rockville, MD.

JOURNALS

1. Plant Cell Biotechnology and Molecular Biology
2. Journal of Plant Biotechnology

E-LEARNING RESOURCE

1. https://www.researchgate.net/publication/329323298_DNA_Replication
2. http://www.bx.psu.edu/~ross/workmg/Replication1Ch5.pdf
3. http://biology.kenyon.edu/courses/biol63/watson_06.pdf
4. https://www.csun.edu/~cmalone/pdf360/Ch20-1%20euk%20gene%20reg.pdf
5. https://www.ccrc.uga.edu/~rcarlson/bcmb3100/Chap40.pdf

COURSE OUTCOMES

CO No.	CO Statement	Knowledge Level
CO 1	Outline the structural organization and function of cell organelles	K2, K4
CO 2	Expain about cell cycle and nucleic acids	K4
CO 3	Discuss about transcription and translation	K4
CO 4	Analyse general concepts in genetics, linkage and crossing over, extra chromosomal inheritance and polygenic inheritance	K2, K4
CO 5	Discuss about cell signaling mechanism, hormones and receptors	K3, K4

Mapping of CO with PSO

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	**3**	**1**	**1**	**3**	**3**
CO 2	**3**	**1**	**1**	**3**	**3**
CO 3	**3**	**1**	**1**	**3**	**3**
CO 4	**3**	**2**	**1**	**3**	**3**
CO 5	**3**	**3**	**1**	**3**	**3**
Average	**3**	**1.6**	**1**	**3**	**3**

TEACHING METHODOLOGY:
Lecture (Chalk and Talk-OHP-LCD)
E Content, Videos-
Problem Solving-Group Discussion-
Quiz-Seminar-
Peer Learning.

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CORE PAPER 6

CELL AND MOLECULAR BIOLOGY

COURSE CODE-10SP21/4C/ CMB

QUESTION PAPER PATTERN

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K1,K2	A-10×2 marks	50	20	100	Question No. is compulsory
K2,K3	B-5/8×8 marks	500	40		
K4,K5	C-2/3×20 marks	1500	40		

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)
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SEMESTER II

CORE PAPER 7

GENETICS, PLANT BREEDING AND EVOLUTION

COURSE CODE -10SP21/2C/GPE

Teaching hours: 4/ Week **Credits: 4**

60/ Semester **L-T- P**

3- 1- 0

COURSE OBJECTIVES

To enable the students to

1. Understand the fundamental principles of Genetics.
2. Impart knowledge about the structure, function and changes in the genetic materials.
3. Expose to the modern concepts and mechanisms.
4. Learn about the principles of Plant Breeding and the application of molecular techniques in crop improvement.
5. Study about the principles and mechanisms of evolution.

UNIT – I (15 Hrs)

Genetics: Mendals Law of inheritance. Gene interactions and modified dihybrid ratios. Quantitative inheritance. Sex determination in plants and theories of sex determination. Sex linked characters - primary, secondary and permanent. Non-disjunction of sex chromosomes in Drosophila. Sex influenced and sex limited characters. Chromosome theory of inheritance. Multiple alleles and pseudoalleles. Extrachromosomal inheritance. Uniparental inheritance in Chlamydomonas. Cytoplasmic male sterility in plants. Population genetics - gene frequencies, mutation, selection, migration, genetic drift.

UNIT – II (15 Hrs)

Gene concept – Factor concept of Mendel, One gene - One enzyme hypothesis. Benzer's concepts of cistron, muton and recon. Types and description of gene family (housekeeping genes, transposons, overlapping genes, pseudogenes, gene cluster). Gene mutation- Molecular basis of mutation, physical and chemical mutagens and their mode of action. Detection of mutation by CLB and Muller methods – Biochemical mutants in bacteria and *Neurospora*.

UNIT – III **(10 Hrs)**

Bateson's concept of coupling and repulsion. Morgan's concept of linkage, linear arrangement of genes, linkage groups, complete and partial linkage, linkage maps, three point test crosses, interference coefficient of coincidence and negative interference. Recombination in fungi (tetrad analysis in *Neurospora*) Molecular mechanism of recombination. Molecular markers and construction of linkage maps. Correlation of genetic and physical maps. QTL mapping.

UNIT – IV **(10 Hrs)**

Plant Breeding: Centers of origin of cultivated plants. Domestication syndrome in cultivated plants. Plant breeding methods in self-fertilized, cross fertilized and vegetative propagated plants. Breeding plants for improving yield, quality and resistance to insect pests and diseases. Plant breeding work in India with special reference to Rice, Cotton and Sugarcane. Role of polyploidy in plant improvement. Heterosis breeding with examples. Application of induced mutations in crop improvement. Application of Tissue culture techniques in plant breeding. Role of molecular markers in plant breeding- RAPD, RFLP, VNTR, SSR and ISSR. Germplasm maintenance of rice and sugarcane. Role of IBPGR, Italy and NBPGR, New Delhi in germplasm conservation.

UNIT - V **(10 Hrs)**

Evolution: Darwin concept of variation, adaptation, struggle, fitness and natural selection. The evolutionary synthesis. Origin of basic biological molecules, Abiotic synthesis of organic monomers and polymers, Concept of Oparin and Haldane, Experiment of Miller. The first cell. Origin of prokaryotic and eukaryotic cells. Evolution of unicellular eukaryotes. Concepts of neutral evolution, molecular divergence and molecular clocks – Micro and macro evolution. Concept of Wallace and his contributions.

RECOMMENDED TEXT BOOKS

1. Allard, R.W. 2010. Principles of Plant Breeding (2nd Edition). John Wiley and Sons, Inc.
2. Chahal, G.S. and Gosal, S.S. 2002. Principles and procedures of Plant Breeding. Narosa Publishing House.
3. Chaudhry R.K. A text Book of Plant Breeding.
4. Gardner, E.J. 2019. Principles of Genetics, 8th Edition, Johan Wiley, New York.
5. Gupta, P.K. 2007. Genetics. Rastogi Publication, Meerut, India.
6. Rangaswami.R.A. A Text book of Agricultural Statistics., 1995.

7. Satyesh Chandra Roy, Kalyan Kumar De, Cell Biology, New Central Book Agency Pvt. Ltd. 2014.
8. Sharma, J.R. 1994. Principles and practices of Plant Breeding. Tata McGraw-Hill Publishers.
9. Shukla, R.S. and Chandel P.S. Cytogenetics, Evolution and Plant Breeding, 2004.
10. Singh, B.D. 2015. Plant Breeding: Principles and Methods. Kalyani Publications.
11. Snustad, D.P. and Simmons, M.J. 2003. Principles of Genetics. John Hailey & Sons Inc., USA.
12. Verma P.S.A and V.K. Agarwal. Cell Biology, Genetics, Molecular Biology, Evolution and Ecology. S.Chand & Co. Pvt. Ltd., 2014.

REFERENCE BOOKS

1. Benjamin A. Pierce, 2008. Genetics: A conceptual approach (4th Edition). W H Freeman and Company Ltd.
2. Brian, K.H. and Benedict, H. 2014. Evolution (5th Edition). Jones & Bartlett Publishers.
3. Daniel L. Hartl, 2017. Genetics: Analysis of genes and genomes (8th Edition). Jones and Bartlett Publishers.
4. Darlington, C.D.: Recent Advances in Cytology, Blarkstains Sons & Co.
5. David R. Hyde, 2010. Genetics and molecular biology (1st Edition). Tata-McGraw Hill.
6. DeRobertis, E.D.P. and De Robertis, E.M.F. 2001. Cell and Molecular Biology, Lippineott Williams & Wilkins, Bombay.
7. Hartl, D.L & Jones E. W. 2000. Genetic analysis of Genes and Genomes, Jones and Bartlett Pub, Boston.
8. Levin B. 2015. Genes XI
9. Maxtoshi Nei and Sudhir Kumar, 2000. Molecular Evolution and phylogenetics. Oxford University Press.
10. Roderic, D., Page, M. and Holmes, E.C. 1998. Molecular Evolution: A phylogenetic approach. Blackwell Science Ltd.
11. Sharma, A.K. and Sharma, A. 1980. Chromosome Techniques. Theory and Practice, Butterworth.
12. Sinnott, E.W. Dunn, L.E. and Dobzhansky, T. 1973. Principles of Genetics.
13. Stansfield, W.D. 1969. Theory and problems of Genetics.
14. William S Klug and Michael R Cummings, 2018. Concepts of Genetics (12th Edition). Pearson Education Pvt. Ltd., Singapore.
15. Winter,P.C., Hickey,G.I. and Fletcher, H.L., Genetics,Viva Books 2002

JOURNALS

1. Journal of Genetics
2. Journal of Plant Breeding

E-LEARNING RESOURCES

1. http://www.cellsignal.com/contents/science/cst-pathways/science-pathways
2. https://www.researchgate.net/publication/10799605_Cell_Division
3. https://mcb.berkeley.edu/courses/mcb110spring/nogales/mcb110_s2008_4signaling.pdf
4. https://www.researchgate.net/publication/289980213_Lecture_notes_Principles_of_Genetics
5. https://www.researchgate.net/publication/263162927_Plant_Breeding

COURSE OUTCOMES

CO No.	CO Statement	Knowledge Level
CO 1	Gain knowledge on the fundamental principles of Genetics	K2, K4
CO 2	Develop knowledge on the structure, function and changes in the genetic materials	K2,K3
CO 3	Analyse general concepts in genetics, linkage and crossing over	K4
CO 4	Evaluate plant breeding techniques and apply for crop improvement	K2,K3,K4
CO 5	Understanding the principles and mechanism of evolution.	K1,K2, K4

Mapping of CO with PSO

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	**3**	**2**	**3**	**2**	**3**
CO 2	**3**	**3**	**3**	**3**	**3**
CO 3	**3**	**2**	**3**	**3**	**3**
CO 4	**2**	**3**	**3**	**3**	**3**
CO 5	**2**	**1**	**0**	**2**	**1**
Average	**2.6**	**2.2**	**2.4**	**2.6**	**2.6**

TEACHING METHODOLOGY:

Lecture (Chalk and Talk-OHP-LCD)

E Content, Videos-

Problem Solving-Group Discussion-

Quiz-Seminar-

Peer Learning.

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)

CHENNAI- 600 008.

(For candidates admitted during the academic year 2021-2022)

M. Sc DEGREE EXAMINATION

II M. Sc PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

CORE PAPER 7

GENETICS, PLANT BREEDING AND EVOLUTION

COURSE CODE - 10SP21/2C/GPE

QUESTION PAPER PATTERN

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K1,K2	A-10×2 marks	50	20	100	Question No. is compulsory
K2,K3	B-5/8×8 marks	500	40		
K4,K5	C-2/3×20 marks	1500	40		

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)
CHOICE BASED CREDIT SYSTEM
M.Sc., PLANT BIOLOGY AND PLANT BIOTECHNOLOGY (SELF SUPPORTING)
(with effect from the Academic Year 2021 - 2022 and thereafter)
SEMESTER II

CORE PAPER 8

PRACTICAL - II: COVERING CORE PAPERS 5, 6 and 7

COURSE CODE-10SP21/2C/PR2

Teaching hours: 8/ Week
120/ Semester

Credits: 4
L-T- P
0-0- 8

COURSE OBJECTIVES:

To enable the students to

1. Understand the tissues and its types in plant systems.
2. Gain knowledge on secondary growth in plants and its abnormalities.
3. Learn about the embryology of angiosperms.
4. Study the cell organelles of the plant cell.
5. Understand the different stages of cell division.

Plant Anatomy and Embryology of Angiosperms

1. Anomalous secondary thickening in stems in *Antigonon, Achyranthes, Nyctanthes, Aristolochia* and *Bougainvillea.*
2. Preparation of 5 permanent slides using double staining technique.
3. Observation of pollen types and pollen germination
4. Section of anther (observation of different stages)..
5. Endosperm and embryo mounting.

Cell and Molecular Biology

1. Squash preparation of onion root tips to study mitosis.
2. Smear preparation of maize or onion flower buds to study meiosis.
3. Nucleic acid isolation.
4. Study of induced aberrations in onion root tips employing chemicals and plant extracts.
5. Calculation of aberration percentage of chemical treated onion root tip cells.
6. Induction of polyploidy using colchicines.
7. Study of sub cellular organelles from electron micrographs.

Genetics, Plant Breeding and Evolution

1. Problem solving on dihybrid phenotypic, genotypic and test cross ratios.
2. Incomplete dominance in plants.
3. Interactions of factors and modified dihybrid ratios.
4. Multiple alleles in plants, blood group inheritance in human.
5. Sex linked inheritance in *Drosophila* and plants.
6. Chromosome mapping from three point test cross data. Calculation of variation pattern in fruits/leaves/ seeds - standard deviation standard error – Based on the data given.
7. Chi square test.
8. Students "t" Test.
9. Calculate gene and genotypic frequency by Hardy- Weinberg equation.
10. Techniques in plant hybridization.

Bonafide record of practical work done should be submitted for the practical examination.

COURSE OUTCOMES

CO No.	CO Statement
CO 1	Discuss the anatomical relations among angiosperms
CO 2	Compare the cell organelles and their functions of a plant cell
CO 3	Analyze the chromosomal aberrations induced by chemicals
CO 4	Apply the statistical methods for various plant population studies
CO 5	Utilize the nucleic acid isolation technique for advanced molecular studies

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)
CHOICE BASED CREDIT SYSTEM
M.Sc., PLANT BIOLOGY AND PLANT BIOTECHNOLOGY (SELF SUPPORTING)
(with effect from the Academic Year 2021 - 2022 and thereafter)
SEMESTER II

ELECTIVE PAPER 2

APPLIED PLANT CELL AND TISSUE CULTURE

COURSECODE-10SP21/2E2/APT

Teaching hours: 4 / Week **Credits: 3**

60/ Semester **L-T- P**

2- 2- 0

COURSE OBJECTIVES:

To enable the students to

1. Understand the basic concepts of *in vitro* plant regeneration techniques.
2. Knowledge on different methods of micropropagation.
3. Exposure on isolation of protoplast, their culturing and hybridization techniques.
4. Knowledge on cell culture and hairy root culture for secondary metabolites production.
5. Understand the basic concepts of cryopreservation for germplasm storage and various types of bioreactors for upstream and downstream processing.

COURSE OUTLINE:

UNIT – I **(15 Hrs)**

Basic plant tissue culture: Totipotency and concepts of plant tissue culture – Laboratory organization – Design of different laboratories and management - Aseptic techniques – Plant culture media – Inorganic nutrients – Macronutrients – Micronutrients - Carbon and energy sources – Organic supplements – Growth regulators – Solidifying agent – MS medium and B5 medium – Explant preparation - Methods of sterilization – Transfer and incubation of culture – Transplantation area.

UNIT – II **(10 Hrs)**

In-vitro culture techniques - Micropropagation – Stages of micropropagation - Multiplication by axillary and apical shoots – Multiplication by adventitious shoots – Multiplication through callus culture – Organogenesis and somatic embryogenesis – Multiplication and Rooting - Hardening -Factors effecting micropropagation – Technical problems in micropropagation – Practical applications of micropropagation - Somaclonal & gametoclonal variation – synthetic seed technology - Shoot tip/Meristem culture for virus free plants.

UNIT – III **(10 Hrs)**

Cell and protoplast cultures and haploid production: Haploid Production and Somatic hybridization – Applications - Anther culture and pollen culture – Induction of haploids from un-pollinated ovaries and ovules – Role of haploids in Plant breeding - Protoplast culture: Protoplast isolation, purification – regeneration – culturing. Protoplast fusion techniques – somatic hybridization and cybridization - Applications of protoplast culture and hybridization.

UNIT – IV **(10 Hrs)**

Metabolic engineering: Application of cell culture systems in metabolic engineering - advantages of cell, tissue and organ culture as a source of secondary metabolites - Hairy root culture - Screening of high yielding cell lines - Procedures for extraction of high value industrial products – Alkaloids and food additives in *in vitro* system.

UNIT – V **(15 Hrs)**

Cryopreservation and bioreactors: Germplasm storage and conservation – Methods of *in vitro* conservation – Cryopreservation and steps involved in cryopreservation of plant materials - Types of bioreactors (Photo-bioreactors, Stirred tank and airlift) and their uses - Industrial scaling – Upstream and downstream processing - Manipulation in production profile by biotic and abiotic elicitation – Biotransformation – Food vaccines, bioplastics, plantibodies, plantigens - Applications of tissue culture in agriculture, Horticulture and forestry.

RECOMMENDED TEXT BOOKS

1. Bhojwani, S.S. and Razdan, M.K. 1996. Plant tissue culture theory and practice, Revised Edition. Elsevier, Amsterdam.
2. Bhojwani, S.S. and Dantu, P.K. 2013. Plant Tissue culture: An introductory text, Springer Science & Business Media, ISBN. 8132210263, 9788132210269

REFERENCE BOOKS

1. Razdan, M.K. 2003. Introduction to plant tissue culture. Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.
2. Dubey, R.C. 2006. A Textbook of Biotechnology, Chand & Company Ltd., New Delhi.
3. Loyola-Vargas, V.M. Ochoa-Alejo, N. 2016. Somatic embryogenesis: Fundamental aspects and applications, Springer international publishing, Switzerland.

COURSE OUTCOMES

CO.No.	CO Statement	Knowledge Level
CO 1	Understand the basic concepts of in vitro plant regeneration techniques	K4
CO 2	Knowledge on different methods of micropropagation	K4,K5
CO 3	Exposure on isolation of protoplast, their culturing and hybridization techniques	K4, K5
CO 4	Knowledge on cell culture and hairy root culture for secondary metabolites production	K4,K5
CO 5	Understand the basic concepts of cryopreservation for germplasm storage and various types of bioreactors for upstream and downstream processing.	K4, K5

MAPPING OF CO WITH PSO

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	**2**	**2**	**3**	**3**	**3**
CO 2	**1**	**2**	**1**	**3**	**3**
CO 3	**1**	**3**	**3**	**3**	**3**
CO 4	**1**	**3**	**2**	**3**	**3**
CO 5	**2**	**2**	**2**	**3**	**3**
Average	**1**	**2.4**	**2.2**	**3**	**3**

TEACHING METHODOLOGY:

Lecture (Chalk and Talk-OHP-LCD),

E Content, Videos/ Animation,

Quiz-Seminar,

Peer Learning.

Note: No Practical for this paper

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)

CHENNAI-600 008.

(For candidates admitted during the academic year 2021-2022)

M. Sc DEGREE EXAMINATION

II M. Sc PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

ELECTIVE PAPER 2

APPLIED PLANT CELL AND TISSUE CULTURE (ELECTIVE)

COURSECODE-10SP21/2E2/APT

QUESTION PAPER PATTERN

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K1,K2	A-10×2 marks	50	20	100	Question No. is compulsory
K2,K3	B-5/8×8 marks	500	40		
K4,K5	C-2/3×20 marks	1500	40		

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)
CHOICE BASED CREDIT SYSTEM
M.Sc., PLANT BIOLOGY AND PLANT BIOTECHNOLOGY (SELF SUPPORTING)
(with effect from the Academic Year 2021 - 2022 and thereafter)
SEMESTER II

ELECTIVE PAPER 2

HORTICULTURE AND LANDSCAPING

COURSECODE-10SP21/2E2/HLS

Teaching hours: 4 / Week **Credits: 3**

60/ Semester **L-T- P**

2- 2- 0

COURSE OBJECTIVES:

To enable the student to

1. Understand the basic concepts of horticulture.
2. Learn the various methods of plant propagation.
3. Know the art of fruit crop and vegetable crop cultivation.
4. Understand the art of floriculture and landscape gardening.

COURSE OUTLINE:

UNIT – I **(10 Hrs)**

Basics of Horticulture: Importance and scope of Horticulture - Divisions of Horticulture – Climate, soil and nutritional needs – Manures and fertilizers – Organic manures – Inorganic fertilizers – Biofertilizers – Methods of applications of manures and fertilizers - Water irrigation – Surface irrigation – Sub irrigation – Special irrigation methods – Plant protection and pest control for horticulture crops.

UNIT – II **(15 Hrs)**

Plant propagation: Natural method: Propagation through seeds and specialized vegetative structures – vegetative methods: Cutting: types (root, stem, leaf cuttings), advantages and disadvantages - Layering: types (simple, compound, tip, trench, mound, air-layering) advantages and disadvantages - Grafting: types (inarching, side, splice, whip/tongue, veneer, cleft, bark, epicotyl, top-working) advantages and disadvantages - Budding: Types (T-budding, shield, patch, and ring budding) advantages and disadvantages - Stock – scion relationships – Micropropagation.

UNIT – III **(10 Hrs)**

Fruit crops: Training and pruning methods for fruit plants – Induction of flowering, flower thinning - fruit setting and fruit development – Seedlessness in horticultural fruits – Importance of plant growth regulators in fruit crops – Cultivation and harvesting methods of important fruit crops; Mango, Sapota, Pomegranate, Grapes and Guava.

UNIT – IV **(10 Hrs)**

Flower and vegetable crops: Floriculture – Cultivation of commercial flower crops – Rose, Jasmine, Chrysanthemum, Crossandra, Anthurium and Gerberas – Cut flowers – Vase life period – Packages for export of cut flowers - Flower decoration – Dry and wet decoration - Classification of vegetables – Cultivation of important vegetables - Tomato, Potato, Onion, Cabbage and Snake guard – Layout for a model kitchen garden.

UNIT – V **(15 Hrs)**

Landscape designing: Principles and methods of landscape designing – Types of garden – Garden components – Shrubs and shrubberies, ornamental hedges, edges, flower beds, orders and carpet beds – Climbers and creepers – Foliage plants - Succulents and cacti – Ornamental palms – Orchids - Topiary and trophy - Rockeries and arches – Lawn making and maintenance – Water garden - Layout for college garden - Indoor gardening – Hanging baskets - Bonsai plants – Training and pruning - Terrace garden - Cultivation of tree species – Eucalyptus and teak.

RECOMMENDED TEXT BOOKS

1. Kumar, N. 2017. Introduction to Horticulture, Midtech Publisher.
2. Manibushan Rao, K. 1991. Textbook of Horticulture. Macmillan Publishing Co., NewYork.
3. Rao, K.M. 2000. Text book of Horticulture. Macmillan India Ltd, New Delhi.
4. Singh, J. 2018. Fundamentals of Horticulture. Kalyani Publishers.

REFERENCE BOOKS

1. Edmond, J.B. 1977. Fundamentals of Horticulture. Tata McGraw Hill Publishers Co. Ltd., New Delhi.
2. George, A. 2002. Horticulture Principles and Practices. 2nd Edition. Pearson Education, Delhi.
3. Bohra, M.P.S. and Arora, 2017. Introduction to Horticulture, 2nd Edition.

COURSE OUTCOMES

CO No.	CO Statement	Knowledge Level
CO 1	Understand the basic concepts of horticulture	K2, K3
CO 2	Understand the importance and divisions of horticulture.	K3
CO 3	Acquire knowledge on plant propagation and fruit crop cultivation.	K3, K4
CO 4	Learn about vegetable cultivation and kitchen gardening.	K4, K5
CO 5	Get to know about landscaping and components of gardens.	K4, K5

Mapping of CO with PSO

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	2	2	2	3	3
CO 2	2	1	3	3	3
CO 3	1	2	1	3	3
CO 4	1	2	2	3	3
CO 5	2	2	1	3	3
Average	2	1.6	2	3	3

TEACHING METHODOLOGY:
Lecture (Chalk and Talk-OHP-LCD),
E Content, Videos/ Animation,
Quiz-Seminar,
Peer Learning.

Note: No Practical for this paper.

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS) CHENNAI-600 008.

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M. Sc DEGREE EXAMINATION

II M. Sc PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

ELECTIVE PAPER 2
HORTICULTURE AND LANDSCAPING
COURSECODE-10SP21/2E2/HLS
QUESTION PAPER PATTERN

Knowledge Level	Section	Word Limit	Marks		Total	Special Instruction any
K1,K2	A-10×2 marks	50	20		100	Question N compulso
K2,K3	B-5/8×8 marks	500	40			
K4,K5	C-2/3×20 marks	1500	40			

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)
CHOICE BASED CREDIT SYSTEM
M.Sc., PLANT BIOLOGY AND PLANT BIOTECHNOLOGY (SELF SUPPORTING)
(with effect from the Academic Year 2021 - 2022 and thereafter)
SEMESTER II

ELECTIVE PAPER 2

ORGANIC AGRICULTURE

COURSECODE-10SP21/2E2/OAG

Teaching hours: 4 / Week **Credits: 3**

60/ Semester **L-T- P**

2- 2- 0

COURSE OBJECTIVES:

To enable the student to

1. Study various aspects of organic farming.
2. Understand the relevance of organic farming, its advantages and short comings against conventional high input agriculture.
3. Know the importance of organic farming in the present scenario and its impact on environment and soil health.

UNIT – I **(15 Hrs)**

Importance of organic farming: Organic farming: Definition – Scope – principles and concepts – history of organic farming – Indian and global scenario – biodiversity: importance and measure to preserve biodiversity – pre requisites for Organic farming. Green revolution – definition – impacts, Natural resources and its management.

UNIT – II **(10 Hrs)**

Organic sources: Organic sources of nutrients – on farm and off farm sources – organic waste recycling – methods compost – compost making – In-situ and ex-situ manuring – Soil and crop management – inter cropping, crop rotation, green manures, cover crops, mulching – bio fertilizers.

UNIT – III **(10 Hrs)**

Indigenous practices of organic farming: Indigenous – role of livestock – cow in organic farming – Panchagavya – Dasagavya – Amirthakaraisal – preparation – properties – general effects on crops.

UNIT – IV **(10 Hrs)**

Organic certification: Organic certification – NPOP guidelines – Certification agencies in India – crop production standards – Quality considerations – labeling and accreditation process – marketing and export opportunities – APEDA.

UNIT – V **(15 Hrs)**

Bio-intensive nutrient management: application of Effective microorganism (EM) technology – phosphate rich organic manure (PROM). Weed management in organic farming – organic crop protection methods. Organic rice production – economic evaluation – benefits – organic enterprises.

RECOMMENDED TEXT BOOKS

1. Palaniappan, S.P. and Annadurai, K. 2018. Organic Farming: Theory and Practice. Scientific Publishers.
2. Veeresh, G.K. 2010. Organic Farming, Cambridge University Press, India.

REFERENCE BOOKS

1. Arunkumar Sharma, 2008. A Handbook of organic Farming. Agrobios Publishers.
2. Dahama, A.K. 2009. Organic Farming for Sustainable Agriculture, Agrobios Publishers.

COURSE OUTCOMES

CO No.	CO Statement	Knowledge Level
CO 1	Knowledge on various aspects of organic farming.	K2, K3
CO 2	Understand the relevance of organic farming, its advantages and short comings against conventional high input agriculture.	K3
CO 3	Awareness on the importance of organic farming in the present scenario and its impact on environment and soil health.	K3, K4
CO 4	Learn about organic certifications	K4, K5
CO 5	Knowledge on the nutrient management	K4, K5

Mapping of CO with PSO

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	1	1	3	3	3
CO 2	1	2	2	3	3
CO 3	2	2	2	3	3
CO 4	1	2	1	3	3
CO 5	2	2	1	3	3
Average	1.4	1.8	2	3	3

TEACHING METHODOLOGY:
Lecture (Chalk and Talk-OHP-LCD),
E Content, Videos/ Animation,
Quiz-Seminar,
Peer Learning.

Note: No Practical for this paper.

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M. Sc DEGREE EXAMINATION

II M. Sc PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

ELECTIVE PAPER 2
ORGANIC AGRICULTURE

COURSECODE-10SP21/2E2/OAG

QUESTION PAPER PATTERN

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K1,K2	A-10×2 marks	50	20	100	Question No. is compulsory
K2,K3	B-5/8×8 marks	500	40		
K4,K5	C-2/3×20 marks	1500	40		

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)
CHOICE BASED CREDIT SYSTEM
M.Sc., PLANT BIOLOGY AND PLANT BIOTECHNOLOGY (SELF SUPPORTING)
(with effect from the Academic Year 2021 - 2022 and thereafter)
SEMESTER II

EXTRA DISICIPLINARY-I

ENTREPRENEURIAL BOTANY

(Offered to other Department students)

COURSE CODE-10SP21/2E/EBO

Teaching hours: 4/ Week **Credits: 3**

60/ Semester **L-T- P**

2- 2- 0

COURSE OBJECTIVES:

To enable the students to

1. Understand the mushroom cultivation and marketing.
2. Study the importance and scope of Gardening.
3. Learn vegetable carving, floral arrangement, Bonsai technique, Topiary, Floriculture and marketing.
4. Impart knowledge on food preservation, food spoilage, vermicomposting, organic farming.
5. Educate them about the entrepreneurial potential, entrepreneurship-funding agencies and importance of entrepreneurship development programme.

COURSE OUTLINE:

UNIT - I **(10Hrs)**

Introduction and scope of mushroom cultivation-biology and cultivation of paddy straw and oyster mushroom –nutritional values and uses-diseases-post harvest technology-Marketing packing, storage and recipes.

UNIT - II **(10Hrs)**

History and importance of gardening: garden tools – different types of gardens-rockery, water garden-lawn formation and maintenance. Landscape layout gardening. Nursery structure and maintenance.

UNIT – III **(15Hrs)**

Vegetable carving and floral arrangement. Importance of green house. Bonsai technique and topiary. Floriculture- rose and jasmine and cut flowers-cultivation and marketing- bouquet making.

UNIT - IV **(15Hrs)**

Food spoilage-causes-preservation of fruits and vegetables- principles-different method of preservatives-canning of fruits and vegetables-mango and carrot, drying of fruits - Banana and dates, preparation of juices – methods of canning , packing technology.

UNIT – V **(10Hrs)**

Vermicomposting and organic farming, methods of organic farming, vermicomposting-methods-preparations. Entrepreneurship-funding Agencies for promoting green industries-Entrepreneurship development programme (EDP) need and importance.

RECOMMENDED TEXT BOOKS

1. Manibhushan Rao, K 1991 Text book of Horticulture.MacMillan India Private Limited New Delhi.
2. Prasad S and Kumar 1999 Principles of Horticulture. Agrobotanica.Bikander India.
3. B.C. Suman, V. Sharma, B. Suman, V.P. Sharma Mushroom Cultivation in India. 2007. Daya pub house.Delhi.
4. Gurcharan Singh Randhawa, Amitabha Mukhopadhyay. Floriculture in India.1986.Allied Publishers.Ltd.Bombay.
5. Bhupendra Singh Khatkar .Food Science and Technology 2007. Daya pub house.Delhi.
6. Kumar N (2016) Introduction To Horticulture 7Ed. Oxford & IBH Publishing Company Pvt. Limited,

REFERENCE BOOKS

1. Brig,Harmander Singh 1991. Mushroom- The art of cultivitaion. Sterling Pubnlishers.
2. Mathew IP and Karikari 1994 Horticulture; Principles and practice MacMillan Press Limitted New Delhi
3. Marshall Woodrow.G 1999 Gardening in India, Biotech Books New Delhi.
4. Mary Violet Christy A.(2014) Vermitechnology ,MJP Publisher.
5. R.P.Srivastava, Sanjeev Kumar (2013) Fruit and Vegetable Preservation: Principles and Practices (3rd Edition)

JOURNALS:

1. International Journal of Horticulture & Agriculture
2. Indian Horticulture Journal

E-LEARNING RESOURCES:

1. https://farmer.gov.in>chap9pdf
2. nhb.gov.in>pdf>Cultivation
3. https://edis.ifas.ufl.edu/pdffiles/MG/MG08600.pdf
4. https://edblog.hkedcity.net/te_tl_e/wp-content/blogs/1685/uploads/FST/Food%20Booklet%2010%20eng.pdf
5. http://www.hillagric.ac.in/edu/coa/agronomy/lect/agron-3610/TeachingManual-Organic-Farming-3610-2016.pdf

COURSE OUTCOME

CO.No.	CO Statement	Knowledge Level
CO 1	Demonstrate mushroom cultivation and marketing	K3
CO 2	Discuss the techniques of gardening & tools	K3, K5
CO 3	Explain vegetable carving, floral arrangement, Bonsai technique, Topiary, Floriculture and marketing	K3, K5
CO 4	Analyse food preservation, food spoilage and packing technology	K4, K5
CO 5	Outline vermicomposting, organic farming, entrepreneurship-funding agencies and importance of entrepreneurship development programme.	K4, K5

Mapping of CO with PSO

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	**3**	**2**	**2**	**3**	**3**
CO 2	**3**	**2**	**2**	**3**	**3**
CO 3	**3**	**2**	**2**	**3**	**3**
CO 4	**3**	**2**	**2**	**3**	**3**
CO 5	**3**	**2**	**2**	**3**	**3**
Average	**3**	**2**	**2**	**3**	**3**

TEACHING METHODOLOGY:
Lecture (Chalk and Talk-OHP-LCD),
E Content, Videos/ Animation,
Quiz-Seminar,
Peer Learning,
Field Visits.

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS) CHENNAI-600 008.
(For candidates admitted during the academic year 2021-2022)
M. Sc DEGREE EXAMINATION
I M. Sc PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

EXTRA DISICIPLINARY-I

ENTREPRENEURIAL BOTANY (offered to other Department students)

COURSE CODE-10SP21/2E/EBO

QUESTION PAPER PATTERN

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K3	B-5/8×8 marks	500	40	100	Question No. is compulsory
K4,K5	C-3/5×20 marks	1500	60		

COURSE PROFILE

II YEAR - THIRD SEMESTER

TOTAL CREDITS - 19

S.N	CORE/ ELECTIVE	TITLE OF THE PAPER	CODE	L	T	P	H	C	CA	SE	MM
15	Core 9	Taxonomy of Angiosperms and Economic Botany	10SP21/3C/TAE	3	2	0	5	4	40	60	100
16	Core 10	Plant Physiology	10SP21/3C/PPH	3	2	0	5	4	40	60	100
17	Core 11	Practical -III: Covering Core Papers – 9 and 10	10SP21/4C/PR3	0	0	8	8	-	-	-	-
18	Elective 3	Nanobiotechnology	10SP21/3E3/NBT	2	1	0	3	3	40	60	100
		Forest Botany	10SP21/3E3/FBO								
		Biopesticide technology	10SP21/3E3/BPT								
19	Elective 4	Biostatistics	10SP21/3E4/BIS	2	1	0	3	3	40	60	100
		Ethnobotany	10SP21/3E4/ETB								
		Wood Technology	10SP21/3E4/WOT								
20	Extra Disciplinary Elective 2	Medicinal Botany and Dietetics (offered to other Department students)	10SP21/3E/MBD	2	2	0	4	3	40	60	100
21	Soft Skill 3	Computing for Biological Research	10SP21/3S/CBR	2	0	0	2	2	-	50	50

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)
CHOICE BASED CREDIT SYSTEM
M.Sc., PLANT BIOLOGY AND PLANT BIOTECHNOLOGY (SELF SUPPORTING)
(with effect from the Academic Year 2021 - 2022 and thereafter)

SEMESTER III

CORE PAPER 9

TAXONOMY AND ECONOMIC BOTANY OF ANGIOSPERMS

COURSE CODE-10SP21/3C/TAE

Teaching hours: 5 / Week **Credits: 4**

75/ Semester **L-T- P**

3- 2- 0

COURSE OBJECTIVES:

To enable the students to

1. Expose to modern trends in classification.
2. Acquire scientific knowledge of plant resources.
3. Describe and compare the distinguishing features of angiosperm families.
4. Develop skills to handle plant identification and floristic work.
5. Impart the application of botanical knowledge to the well-being of mankind.

COURSE OUTLINE:

UNIT – I **(15Hrs)**

Taxonomy and systematics, objectives of plant systematics, hierarchy. Systems of classification – Artificial (Linnaeus), Natural (Bentham & Hooker), Phylogenetic (Takhtajan), Modern (APG). Molecular taxonomy, Botanical Gardens & Herbaria.

UNIT – II **(15Hrs)**

Modern trends in Taxonomy - numerical taxonomy - chemotaxonomy - Biosystematics. Botanical Survey of India- its organization and role. ICBN- Importance and principles of binomial nomenclature - Valid and effective publication. Citation, rejection and retention of names, Typification, Limitation to priority. Monographs, Flora, Manual. Types of Taxonomic keys and its uses.

UNIT- III **(15Hrs)**

Families of Angiosperms: Study of the following Polypetalae families in detail with special reference to their salient features & economic significances:

1. Ranunculaceae
2. Magnoliaceae
3. Menispermaceae
4. Brassicaceae
5. Portulacaceae
6. Sterculiaceae
7. Tiliaceae.
8. Meliaceae
9. Rhamnaceae
10. Vitaceae
11. Sapindaceae
12. Anacardiaceae
13. Moringaceae
14. Rosaceae
15. Combretaceae

UNIT – IV **(15 Hrs)**

Study of the following Gamopetalae families in detail with special reference to their salient features and economic significances:

16. Turneraceae
17. Passifloraceae
18. Aizoaceae
19. Apiaceae
20. Oleaceae
21. Boraginaceae
22. Solanaceae
23. Bignoniaceae
24. Verbenaceae

Study of the following Monochlamydeae families in detail with special reference to their salient features & economic significances:

25. Nyctaginaceae
26. Casuarinaceae

Study of the following Monocodelydons families in detail with special reference to their salient features and economic significances:

27. Commelinaceae
28. Amaryllidaceae
29. Arecaceae
30. Cyperaceae

UNIT - V: Economic Botany (15Hrs)

Origin, evolution, botany, cultivation and uses of (i) food, (Finger Millet, Tapioca, Black gram), forage and fodder crops (Sorgham, Napier's grass), (ii) Fibre crops (Hemp, Jute), (iii) Medicinal and aromatic plants (*Acorus calamus, Aloe vera, Coleus, Withania somnifera* and *Phyllanthus amaraus* (iv) vegetable oil yielding plants (Sesame, Coconut, Palm). timber (Teak and Red Sanders) and non-wood forest products (NWFPs) such as *Bambusa rattens,* raw materials for paper making, tannins, dyes, resins and gum (Asafoetida and Gum Arabic) Essential oils (Lemon grass, Eucalyptus and Menthol) and fruits. Plants used as avenue trees for shade, pollution control and aesthetics. Energy plantation - cultivation and uses of *Casuarina* and *Eucalyptus.*

RECOMMENDED TEXT BOOKS

1. Pandely.B.P., 1997 – Taxonomy of Angiosperms. S.Chand & Co.
2. Pandey.B.P. (1987) – Economic Botany. S.Chand & Co.
3. Verma. V (1984) – Economic Botany. S.Chand & Co.
4. Gokhale.S.B (1992) – Pharmacognosy. S.Chand & Co.
5. Ansari.S.H. (1993) – Pharamacognosy S.Chand & Co.
6. Sivarajan. S.(1993) - Introduction to Principles of Taxonomy. Oxford. IBH New Delhi.

REFERENCE BOOKS

1. Lawrence.G.H.M, 1985 – An Introduction to Plant Taxonomy, Central Book Depot, Allahabad.
2. Porter.C.L., 1982 – Taxonomy of Flowering Plants, Eurasia Publications House, New Delhi.
3. Rendle.A.B., 1980 – The Classification of Flowering Plants (Vol. I & II), Vikas Students Education.
4. Hill.A.W. (1981) – Economic Botany, McGraw Hill Pub.
5. Willis.T.E(1994) – Text Book of Pharmacognosy. Tata McGraw Hill Publishers.

JOURNALS:

1. Botanical Journal of Linnean Society
2. Annals of Botany

E - LEARNING RESOURCES:

1. https://www.brainkart.com/article/Angiosperm-phylogeny-group-(APG)-classification_32976/
2. http://bio.slu.edu/mayden/systematics/bsc420520lect2.html
3. http://edis.ifas.ufl.edu/topic_plant_families
4. http://www.bsienvis.nic.in/Database/Angiosperms_of_India_26171.aspx
5. http://edis.ifas.ufl.edu/topic_plant_families

COURSE OUTCOMES:

CO.No.	CO Statement	Knowledge Level
CO 1	Discuss different systems of classification of flowering plants including recent APG system	K4
CO 2	Analyze the general principles and modern trends in taxonomy of angiosperms	K4
CO 3	Write the technical description of the prescribed families followed by phylogenetic consideration.	K3
CO 4	Analyse family characteristics with illustrations depicting flowering twigs, floral structures and floral diagrams	K3, K4
CO 5	Apply the knowledge on plant products in Industries	K3

MAPPING-COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	**3**	**3**	**1**	**3**	**3**
CO 2	**3**	**3**	**1**	**3**	**3**
CO 3	**3**	**3**	**1**	**3**	**3**
CO 4	**3**	**3**	**1**	**3**	**3**
CO 5	**3**	**3**	**1**	**3**	**3**
Average	**3**	**3**	**1**	**3**	**3**

TEACHING METHODOLOGY:

Lecture (Chalk and Talk-OHP-LCD),
E Content, Videos/ Animation,
Quiz-Seminar,
Peer Learning,
Field Visits.

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS) CHENNAI-600 008.

(For candidates admitted during the academic year 2021-2022)

M. Sc DEGREE EXAMINATION

II M. Sc PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

CORE PAPER 9

TAXONOMY AND ECONOMIC BOTANY OF ANGIOSPERMS

COURSE CODE - 10SP21/3C/TAE

QUESTION PAPER PATTERN

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K1,K2	A-10×2 marks	50	20	100	Question No. is compulsory
K2,K3	B-5/8×8 marks	500	40		
K4,K5	C-2/3×20 marks	1500	40		

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(with effect from the Academic Year 2021 - 2022 and thereafter)
SEMESTER III

CORE PAPER 10

PLANT PHYSIOLOGY

COURSE CODE-10SP21/3C/PPH

Teaching hours: 5 / Week **Credits: 4**

75/ Semester **L-T- P**

3- 2- 0

COURSE OBJECTIVES:

To enable the students to

1. Integrate plant physiological knowledge to understand functioning of plants.
2. Understand the biophysical and biochemical processes of plants.
3. Study the metabolism of plants during plant growth and development. .
4. Impart knowledge on phytohormones and their role in plant functioning
5. Know the adaptive mechanisms of plants in adverse environmental conditions.

COURSE OUTLINE:

UNIT – I (15 Hrs)

Water and Plant Relations: Physical and chemical properties of water – Imbibition, Diffusion, Osmosis, Components of water potential - Plasmolysis - water absorption by roots – Apoplast and Symplast concept - water transport through the xylem – SPAC concept – Transpiration and evapotranspiration- stomatal structure and function – mechanism of stomatal opening and closing – mineral nutrition – essential nutrients – macro and micro nutrients – deficiencies and plant disorders – absorption of solutes – translocation of solutes – pathways and mechanisms – phloem loading and unloading - translocation of photosynthates – source- sink relationship – partitioning of assimilates and harvest index.

UNIT – II (15 Hrs)

Photosynthesis: The physical nature of light – the absorption and fate of light energy – absorption and action spectra- photoreceptors- Ultrastructure and biochemical compartmentation of Chloroplast; Photosynthetic Electron Transport and

Photophosphorylation (cyclic and non-cyclic): Photosystems and reaction centres - Light Harvesting complexes - Photosystem I & II and Oxidation of Water; Carbon metabolism: C3, C4 and CAM pathways and their distinguishing features - photorespiration and its significance. Biochemistry and Molecular Biology of RUBISCO.

UNIT – III **(15 Hrs)**

Respiration: An overview of plant respiration – Glycolysis – TCA cycle– Electron Transport – oxidative phosphorylation and ATP synthesis – Chemiosmotic Theory - Pentose Phosphate Pathway– Respiration and its significance in crop improvement. Cyanide resistant respiration; Nitrogen fixation (Biological - symbiotic and non-symbiotic), Physiology and Biochemistry of nitrogen fixation. Nitrogen metabolism – Nitrogen ammonium assimilation; amino acid biosynthesis.

UNIT – IV **(15 Hrs)**

Growth and development – Phases of plant growth – growth types- Growth substances - Auxins, Gibberellins, Cytokinins, Abscisic acid, Ethylene, Brassinosteroids – physiological effect and mechanism of action in agricultural and horticultural crops – Photoperiodism – classification of plants and mechanism of flowering – Photoreceptors and their actions on plant mechanisms. Vernalization - mechanism and its practical application, biological rhythms and movements.

UNIT – V **(15 Hrs)**

Plant senescence –types and mechanism of senescence- Abscission: morphological and biochemical changes – significance. Fruit ripening- biochemical, physiological changes and control of fruit ripening. Seed dormancy and causes and Seed germination and their biochemical changes.

Plant response to environmental stress: Biotic (pathogen and insects) and Abiotic stress (Water, temperature, light and salinity) – adaptive mechanism to various stresses (avoidance, escape, tolerance) – stress responsive proteins – anti-oxidative mechanism.

RECOMMENDED TEXT BOOKS

1. Datta. S. C. 1989.Plant Physiology. Central Book Depot. Allahabad.
2. Gontia. 2016. A textbook of Plant Physiology. Satish Serial publishing House, New Delhi.
3. Hall. D. V. K. K. Rao. Photosynthesis. Arnold London

4. Jain, V.K. 2017. Fundamentals of Plant Physiology. S.Chand & Company Ltd., New Delhi.
5. Moore, T.C. 1989. Biochemistry and Physiology of Plant Hormones (2nd Edition). Springer-Verlag, New York, USA.
6. Noggle, R.G and Fritz, G.J. 2010. Introductory Plant Physiology, PHI Learning Pvt Ltd, New Delhi.
7. Salisbury, F.B and Cleon Ross, 2007. Plant Physiology, Wadsworth Publishing Company, Belimont.
8. Shinha. R.K. 2007. Modern Plant Physiology. Ane Books India, New Delhi.
9. Verma, SK. 2006. A Textbook of Plant Physiology, S.K.Chand & Co., New Delhi

REFERENCE BOOKS

1. Bidwell. R. G. S. 1979. Plant Physiology. Macmillan Publisher, Delhi.
2. Devlin, R.M. 1996. Plant Physiology, PWS publisher, Boston.
3. Gauch. H. G.1972 Inorganic Plant Nutrition. Hutchinson & Dowd. New York.
4. Govindji. 1982. Photosynthesis. AP. New York.
5. Heldt, H.W. 2005. Plant Biochemistry, 3rd Edition. Elsevier Academic Press
6. Jacob. W. P. 1979. Plant Hormones and Plant Development. Cambridge University Press. Cambrigde.
7. Khan. A. A. 1982. The Physiology and Biochemistry of Seed development, Dormancy and Germination. Elesiver. Amsterdam.
8. Lea, P. J. and R. C. Leegood. 1993. Plant Biochemistry and Molecular Biology, John Wiley & Sons. New York.
9. Leopold, A.C, 1994. Plant Growth and Development, McGraw Hill, New York.
10. Lincoln Taiz et al., 2014. Plant Physiology and Development. Sinauver Associates Inc. Publishers, Sunderland, Massachusetts.
11. Michealis. I. And J. C. Torry. 1956. Plant in Action W. H. Freeman
12. Panda, S.K, 2005. Advances in Stress Physiology of Plants. Scientific Publishers India, Jodhpur.
13. Park S. Nobel. 2005. Physicochemical and Environmental Plant Physiology. Elsevier Academic Press, New York.
14. Ting. I. P. 1982.Plant Physiology. Addison Wesley Pb. Philippines
15. William G. Hopkins, 1999. Introduction to Plant Physiology, John Wiley and sons, INC, New York.

JOURNALS:

1. Indian Journal of Physiology and Pharmacology
2. International Journal of Physiology

E- LEARNING RESOURCES:

1. http://www.biologydiscussion.com/plant-physiology-2/water-relation/mechanism-of-absorption-of
2. https://www.khanacademy.org/science/biology/photosynthesis-in-plants/photorespiration--c3-c

3. http://hsc.csu.edu.au/agriculture/production/3359/plant_hormones.htm
4. https://www.advancednutrientsonline.com/
5. https://www.researchgate.net/publication/228042145_plant stress plant physiology

COURSE OUTCOMES:

CO.No.	CO Statement	Knowledge Level
CO 1	Compare the process of plant and water relation	K4
CO 2	Explain the process of photosynthesis	K4
CO 3	Analyse the mechanism of respiration and Nitrogen fixation in plants	K3,K4
CO 4	Discuss the function and mechanism of action of various plant hormones	K3, K4
CO 5	Evaluate stress physiology of plants	K5

MAPPING-COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	**1**	**3**	**3**	**3**	**3**
CO 2	**1**	**3**	**3**	**3**	**3**
CO 3	**1**	**3**	**3**	**3**	**3**
CO 4	**1**	**3**	**3**	**3**	**3**
CO 5	**1**	**3**	**2**	**3**	**3**
Average	**1**	**3**	**2.8**	**3**	**3**

TEACHING METHODOLOGY:

Lecture (Chalk and Talk-OHP-LCD),
E Content, Videos/ Animation,
Quiz-Seminar,
Peer Learning.

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M. Sc DEGREE EXAMINATION

II M. Sc PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

CORE PAPER 10

PLANT PHYSIOLOGY

COURSE CODE - COURSE CODE-10SP21/3C/PPH

QUESTION PAPER PATTERN

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K1,K2	A-10×2 marks	50	20	100	Question No. is compulsory
K2,K3	B-5/8×8 marks	500	40		
K4,K5	C-2/3×20 marks	1500	40		

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SEMESTER III

CORE PAPER 11

PRACTICAL – III COVERING CORE PAPERS 9 AND 10

COURSE CODE-10SP21/4C/PR3

Teaching hours: 8/ Week **Credits: 4**

120/ Semester **L-T- P**

0-0- 8

COURSE OBJECTIVES:

To enable the students to

1. Classify angiosperm taxa.
2. Gain knowledge on the economic importance of plants and their products
3. Study the plant pigments.
4. Understand the mechanism of photosynthesis.
5. Find out the effect of plant growth hormones.

Taxonomy of Angiosperm and Economic Botany

1. Identification of binomial nomenclature for the available species from the local flora using Gamble's flora.
2. Detailed study of the plant families mentioned in the theory with two representative species from the local area.
3. Solving the taxonomical problems.
4. Each student has to submit 25 herbarium specimens of local flora.
5. Field study to familiarize the angiosperm plants (3 days) and submission of field report.

Plant Physiology

1. Determination of osmotic potential by plasmolytic method.
2. Determination of water potential using gravimetric method.
3. Determination of water potential using dye method (Chardakov's method).
4. Determination of effect of Chemicals on membrane permeability (Colorimetricaly)
5. Determination of effect of Temperature on membrane permeability (Colorimetricaly)
6. Separation of chloroplast pigments of C_3 and C_4 plants using paper chromatographic technique.
7. Extraction and separation of photosynthetic pigments of C_3 and C_4 plants by thin layer chromatographic (TLC) method.

8. Extraction and separation of photosynthetic pigments of C_3 and C_4 plants by Column chromatographic method.
9. Effect of varying intensities of light on the rate of photosynthesis of an aquatic plant by using Wi1mott's Bubble Counter.
10. Effect of Monochromatic light on apparent photosynthesis.
11. Effect of CO_2 concentration on apparent photosynthesis.
12. Estimation of Chlorophyll a, Chlorophyll b and Total chlorophyll by Arnon's method.
13. Estimation of Carotenoids by using colorimeter.
14. Determination of absorption spectra of Chlorophyll a and Chlorophyll b by using colorimeter.
15. Experiment to study the rate of Hill activity of isolated chloroplast by dye-reduction.
16. Rice coleoptile growth test for Indole Acetic Acid.
17. Effect of Auxin on root initiation.
18. Experiments to show the heribicidal action of Auxin (2-4,0D).
19. Effect of synthetic Cytokinin on the destruction of chlorophyll.
20. Determination of Relative Water Content.
21. Estimation of total Phenols.

Bonafide record of practical work done should be submitted for the practical examination.

COURSE OUTCOME

CO No.	CO Statement
CO 1	Identify angiosperm taxa
CO 2	Assess economic value of plant products
CO 3	Compare the importance of pigments in various plants
CO 4	Predict the physiological mechanisms of plants
CO 5	Demonstrate the importance of plant growth hormones

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SEMESTER III
ELECTIVE PAPER 3
NANOBIOTECHNOLOGY

COURSE CODE-10SP21/3E3/NBT

Teaching hours: 3 / Week **Credits: 3**

45/ Semester **L-T- P**

2- 1- 0

COURSE OBJECTIVES:

To enable the student to

1. Teach the basics of Nanoscience and Nanobiotechnology.
2. Understand the biological techniques for various Nanotechnological applications.
3. Acquire knowledge about biological Nanoparticles.
4. Know the importance of Green nanotechnology and its applications.
5. Impart knowledge on Nanobiotechnological applications.

COURSE OUTLINE:

UNIT – I **(10 Hrs)**

Background of Nanoscience, influence of nano over micro/macro, size effects and crystals, large surface to volume ration, surface effects on the properties. Nanoparticles, quantum dots, nanotubes and nanowires, Fundamentals of Bionanoparticles: Production, Size, Surface area, Suspension and Settling, Magnetic and Optical Properties, Biological Transport. Biological nanoparticles production - plants and microbial.

UNIT - II **(10 Hrs)**

Techniques to analyse bio Nano materials- Electron Microscopy- Scanning Electron Microscopy (SEM)-Transmission Electron microscopy (TEM), Scanning probe microscopy-STEM Atomic Force Microscopy (AFM) - Confocal Microscopy - Scanning Near Field Microscopy, Nanoindendation. UV-Vis Spectroscopy- Energy Dispersive X-ray Spectroscopy, Mass Spectroscopy, FT-IR Spectroscopy, X-Ray Diffraction (XRD), Photoelectron Spectroscopy, Mossbauer Spectroscopy, Differential Scanning Calorimetry (DSC), Biological sample preparation for Electron Microscopy and other techniques.

UNIT – III **(10 Hrs)**

Nano carriers for drug delivery-polymeric nanoparticle, Micelles, Microemulsions, Lipoproteins as pharmaceutical carriers. Solid and lipid nanoparticle as drug carriers. Nanocapsules - Preparation, Characterization & therapeutic applications. Nano medicine-Biopharmaceuticals. Implantable materials, Devices, Surgical aids, diagnostic tools, Genetic testing, Imaging. Nanotechnology for cancer research & therapy. Magnetic Nanoparticles for Imaging and Therapy, Photodetectors, Nanophotonics. Nanoelectronic Devices.

UNIT – IV **(8 Hrs)**

Nanofertilizers - Nanourea and mixed fertilizers, Nanofertigation - Nanopesticides, Nanoseed Science. Nanotechnology in Food industry – Nanopackaging for enhanced shelf life, Electrochemical sensors for food analysis and contaminant detection. Nanotechnology in Precision (smart) farming.

UNIT - V **(7 Hrs)**

Nanotechnology for waste reduction and improved energy efficiency, nanotechnology based water treatment strategies. Nanoporous polymers and their applications in water purification, Nanotoxicology. Health impact of Nanoparticles, safety and toxicological effects transport of nanomaterials in soil/sediments. Mapping of the environmental fate of nanomaterials.

RECOMMENDED TEXT BOOKS

1. Kumar, C.S. 2007. Nanomaterials for Biosensors, Wiley-VCH.
2. Jennifer Kuzma and Peter VerHage, 2006. Nanotechnology in agriculture and food production, Woodrow Wilson International Center.

REFERENCE BOOKS

1. Juyoung Kim, 2011. Advances in Nanotechnology and the Environment, CRC Press.
2. Cooper, J. and Tass, C. 2004. Biosensors: A Practical Approach, Oxford University Press.
3. Gnauck, P. and Hoffrogge, P. 2005. Instrument E L Principle, Microscopy and Microanalysis Cambridge University Press11: 830- 831.
4. Mirkin, C.A. and Niemeyer, C.M. 2007. Nanobiotechnology – II: More concepts and applications. Wiley-VCH.
5. Claudio Nicolini, 2009. Nanobiotechnology & Nanobiosciences. Pan Stanford Publishing Pte. Ltd.
6. David Goodsell, S. 2004. Bionanotechnology, Lessons from Nature, Wiley-Liss, Inc.,
7. Melgardt M. deVilliers, Pornanong Aramwit, Glen S. Kwon, 2009. Nanotechnology in Drug Delivery, Springer-American Association of Pharmaceutical Scientists Press.

8. Robert A. Freitas Jr. 1999. Nanomedicine, Volume I: Basic Capabilities, Landes Bioscience.
9. David E. Reisner, 2009. Bionanotechnology- Global Prospects, Taylor & Francis Group, LLC,
10. Chang, W.N. (2009). Nanofibers Fabrication, Performance and Applications, Nova Science Publishers Inc.
11. Michael A. Stroscio and Mitra Dutta, 2004. Biological Nanostructures and Applications of Nanostructures in Biology. Electrical, Mechanical, and Optical Properties. Kluwer Academic Publishers, New York, Boston, Dordrecht, London, Moscow, eBook ISBN: 0- 306-48628-8, Print ISBN: 0-306-48627-X.

JOURNALS

1. Journal of Nanobiotechnology
2. Journal of Nanotechnlogy, Nanomedicine and Nanobiotechnology

E-Learning Resources:

1. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6982820/
2. https://www.frontiersin.org/journals/all/sections/nanobiotechnology
3. https://nptel.ac.in/courses/118/107/118107015/
4. https://jnanobiotechnology.biomedcentral.com/articles/10.1186/1477-3155-10-31
5. https://www.nanowerk.com/nanotechnology-and-the-environment.php

COURSE OUTCOMES:

CO.No.	CO Statement	Knowledge Level
CO 1	Discuss about the basics of Nanoscience and Nanobiotechnology.	K3
CO 2	Explain about the techniques involved in Nanobiotechnology	K3
CO 3	Outline about the characterization of Nanoparticles	K4
CO 4	Analyse applications of Nano biotechnology in Food industry and farming	K4,K5
CO 5	Evaluate applications of Nano biotechnology for Health and Environment	K4,K5

TEACHING METHODOLOGY:
Lecture (Chalk and Talk-OHP-LCD),
E Content, Videos/ Animation,
Quiz-Seminar,
Peer Learning.

Note: No Practical for this paper

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M. Sc DEGREE EXAMINATION

II M. Sc PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

ELECTIVE PAPER 3
NANOBIOTECHNOLOGY
COURSE CODE-10SP21/3E3/NBT

QUESTION PAPER PATTERN

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K1,K2	A-10×2 marks	50	20	100	Question No. is compulsory
K2,K3	B-5/8×8 marks	500	40		
K4,K5	C-2/3×20 marks	1500	40		

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SEMESTER III

ELECTIVE PAPER 3

FOREST BOTANY

COURSE CODE-10SP21/3E3/FBO

Teaching hours: 3 / Week **Credits: 3**

45/ Semester **L-T- P**

2- 1- 0

COURSE OBJECTIVES:

To enable the student to

1. Study various aspects of Forest Botany.
2. Understand the importance and different forests and plants species.
3. Know the ecological significance of forests.
4. Study the Indian forests laws and various acts.

COURSE OUTLINE:

UNIT – I **(10 Hrs)**

Introduction and scope of Forest Botany - Merits of combining traditional Botany and Forestry practices. General introduction to forests, natural and manmade. Types of forests tropical, temperate, evergreen, semi evergreen, deciduous, monoculture, multipurpose, social and industrial. Forest and climate - Forest and Biodiversity - Forest and gene conservation - Forest and ecosystem - Forest and civilization. Geographical history of the forest vegetation - natural vs. artificial. Special emphasizes on social forestry, Industrial forestry and Multi-purpose forestry. Preservation of natural forestry - Pollution control.

UNIT – II **(10 Hrs)**

Forest genetics, Forest physiology, forest ecology – strong interrelationships. Macro-dynamic ecosystem reserves, hydrological cycles, balance. Identification of timber plants based on vegetative features. Seedlings, leaves, bark branching pattern architectural models of trees. Major and minor forest products, use and misuse of forests by man, direct and indirect forest wealth, forest policies, forest protection through peoples committee.

UNIT - III **(8 Hrs)**

Silviculture: concept and scope of study, forest in general form, composition, classification of world forests and Indian forests. Classification based on its quality density, tolerance, crown; water cycles of forest. Photosynthetic processes in forest: nitrogen and mineral nutrition in forests.

UNIT - IV **(7 Hrs)**

Seed dynamics in forest: seed production, dissemination, germination, establishment and mortality, growth of trees in general terms – height, diameter, volume, growth of stands – gross increment, net increment, stand reaction to varies types of cuttings.

UNIT – V **(10 Hrs)**

Measurement: definition, direct measurements, direct and indirect estimate, and prediction. Measurement of diameter – rules and methods, measurement of height – different rules, methods, instruments, total height and merchantable length. Measurement of volume – common units, different methods and procedures of volume measurements. Measurement of age: direct estimate, averages, standard error, and sampling, General concept of indirect estimate based on one or more independent variables. Forestry for social and national development. Progress to be achieved in social forestry, industrial forestry and multiple forestry. Forest Laws- Indian Forest Act, 1927; Forest conservation Act. Wild Life Protection Act, 1972.

RECOMMENDED TEXT BOOKS

1. Chaturvedi, A.N. and Khanna, L.S. 2015. Hand Book of Forestry (5th Edition).
2. Parthiban, K.T. 2018. Introduction to Forestry & Agroforestry.

REFERENCE BOOKS

1. Frederick Franklin Moon, 2018. The Book of Forestry. Repro Books.
2. Singh, S.K. 2009. Text Book of Wildlife Management. Aspire Traders.
3. Sagreta, K.P. 2000. Forests and Forestry. National Book Trust India, New Delhi.

COURSE OUTCOMES

CO No.	CO Statement	Knowledge Level
CO 1	Knowledge on various aspects of Forest Botany.	K2, K3
CO 2	Understand the importance and of different forests.	K3
CO 3	Understanding the tree cultivations.	K3, K4
CO 4	Knowledge on ecological significance of forests.	K4, K5
CO 5	Understanding on various Indian forests laws and acts.	K4, K5

Mapping of CO with PSO

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	1	1	3	3	3
CO 2	1	2	3	3	3
CO 3	2	1	3	3	3
CO 4	1	2	2	3	3
CO 5	2	2	2	3	3
Average	1.4	1.6	2.6	3	3

TEACHING METHODOLOGY:
Lecture (Chalk and Talk-OHP-LCD),
E Content, Videos/ Animation,
Quiz-Seminar,
Peer Learning.

Note: No Practical for this paper.

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS) CHENNAI-600 008.

(For candidates admitted during the academic year 2021-2022)

M. Sc DEGREE EXAMINATION

II M. Sc PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

ELECTVE PAPER 3

FOREST BOTANY

COURSE CODE-10SP21/3E3/FBO

QUESTION PAPER PATTERN

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K1,K2	A-10×2 marks	50	20	100	Question No. is compulsory
K2,K3	B-5/8×8 marks	500	40		
K4,K5	C-2/3×20 marks	1500	40		

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)
CHOICE BASED CREDIT SYSTEM
M.Sc., PLANT BIOLOGY AND PLANT BIOTECHNOLOGY (SELF SUPPORTING)
(with effect from the Academic Year 2021 - 2022 and thereafter)

SEMESTER III

ELECTIVE PAPER 3

BIOPESTICIDE TECHNOLOGY

COURSE CODE-10SP21/3E3/BPT

Teaching hours: 3/ Week **Credits: 3**
45/Semester **L-T- P**
2-1- 0

COURSE OBJECTIVES:

To enable the students to

1. Gain knowledge on biopesticides.
2. Know the different types of biopestcides.
3. Study the importance of biopesticides.
4. Evaluate target pest and crops of important biopesticides.
5. Understand the commercialization and efficiacy of biopesticides.

COURSE OUTLINE:

UNIT- I **(7 Hrs)**

Introduction of biopesticides. Advantages for the use of biopesticides.

UNIT- II **(8 Hrs)**

Types of biopesticides: Bioinsecticides, biofungicides, biobactericides, bionematicides and bioherbicides.

UNIT- III **(10 Hrs)**

Important bioinsecticides: *Bacillus thuringiensis*, NPV, entomopathogenic fungi (*Beauveria, Metarhizium, Verticillium, Paecilomyces, Momuraea*). Biofungicides: *Trichoderma, Gliocladium, Coniothyrium*, non-pathogenic *Fusarium, Pseudomonas* spp., *Bacillus* spp. Biobactericides: *Agrobacterium radiobacter, Pseudomonas* spp., *Bacillus* spp. Bionematicides: *Paecilomyces*, *Trichoderma*, Bioherbicides: *Phytophthora, Colletotrichum*.

UNIT- IV **(10 Hrs)**

Target pests and crops of important biopesticides and their mechanisms of action.

UNIT- V **(10 Hrs)**

Mass multiplication and formulation technology of biopesticides. Prospects and problems in commercialization and efficiacy of biopesticides. Commercial products of biopesticides.

RECOMMENDED TEXTBOOKS

1. Dube H.C. (2013). An Introduction To Fungi - Scientific Publishers
2. Mehrotra R.S and Aneja R.S (1998). An introduction to Mycology. New Age Intermediate Press.
3. Mehrotra, B.S. 1976. The Fungi. Oxford and IBH Publishing Co., New Delhi.

REFERENCE BOOKS

1. Ainsworth, G.C. 1971. A Dictionary of the Fungi. Commonwealth Mycological Institute, Kew, Surrey, England.
2. Alexopoulus C.J, Mims C.W. and Blackwell M.I 1996. Introductory Mycology. 4th Edition. John Wiley and Sons Inc.
3. Bessey (1950). Morphology and Taxonomy of fungi. The Blakistan Co.
4. Burnett J.H. (1968). Fundamentals of Mycology. Edwards Arnold Publication, Cambridge, UK. 841p.
5. Carlile, M.J., Watkinson, S.C., and Gooday, G.W. 2001. The Fungi. 2nd Edition. Academic Press, San Diego
6. Charlile, M.J., Watkinson, S.C. and Gooday, G.W. 2005. The Fungi. Elsevier, New Delhi.
7. Gilman, J.C. 1957. A manual of soil fungi. Lowa State College Press, Ames, lowa.
8. Hawksworth, D.L., Kirk, P.M., Sutton, B.C., and Pegler, D.N. 1995. Ainsworth & Bisby's Dictionary of the Fungi. 8th Edition. C.A.B. International.
9. Kendrik, B. 2000. The Fifth Kingdom. 3rd edition. Focus Publishing, Newburyport, MA. 386 p.
10. Moore-Landecker, E. 1996. Fundamentals of the fungi, Prentice Hall international, USA.
11. Subramanian, C.V. 1983. Hyphomycetes: Taxonomy and Biology. Academic Press, London and New York.
12. Talbot, P.H.B. 1971 Principles of Fungal Taxonomy. Macmillan Press, London.
13. Webster, J. 1970. Introduction to Fungi. Cambridge University Press, UK.
14. Webster, J. and Weber, R.2007. Introduction to Fungi. 3rd Edition. Cambridge University Press, UK.

COURSE OUTCOMES

CO No.	CO Statement	Knowledge Level
CO 1	Outline the use of biopesticides.	K4
CO 2	Discuss about the different types of biopesticides	K3, K4
CO 3	Analyze the role of important biopesticides	K3,K4
CO 4	Explain the mechanism of action of biopesticides	K3, K4
CO 5	Formulate the commercial products of biopesticides.	K4, K5

Mapping of CO with PSO

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	2	2	1	3	3
CO 2	1	2	2	3	3
CO 3	2	3	2	3	3
CO 4	3	2	1	3	3
CO 5	1	3	1	3	3
Average	1.8	2.4	1.4	3	3

TEACHING METHODOLOGY:

Lecture (Chalk and Talk-OHP-LCD),
E Content, Videos/ Animation,
Quiz-Seminar,
Peer Learning.

Note: No Practical for this paper.

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)

CHENNAI-600 008.

(For candidates admitted during the academic year 2021-2022)

M. Sc DEGREE EXAMINATION

I M. Sc PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

ELECTIVE PAPER 3
BIOPESTICIDE TECHNOLOGY
COURSE CODE-10SP21/3E3/BPT
QUESTION PAPER PATTERN

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K1,K2	A-10×2 marks	50	20	100	Question No. is compulsory
K2,K3	B-5/8×8 marks	500	40		
K4,K5	C-2/3×20 marks	1500	40		

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)
CHOICE BASED CREDIT SYSTEM
M.Sc., PLANT BIOLOGY AND PLANT BIOTECHNOLOGY (SELF SUPPORTING)
(with effect from the Academic Year 2021 - 2022 and thereafter)
SEMESTER III
ELECTIVE PAPER 4
BIOSTATISTICS

COURSE CODE-10SP21/3E4/BIS

Teaching hours: 3 / Week **Credits: 3**

45/ Semester **L-T- P**

2- 1- 0

COURSE OBJECTIVES:

To enable the students to

1. Impart knowledge about basic principles of biostatistics.
2. Understand fundamental concept of probability.
3. Acquire knowledge test of hypothesis in biostatistics.
4. Know the concept of sampling methods and analysis of biological data.
5. Enlighten about computer applications in biology.

COURSE OUTLINE:

UNIT - I (7Hrs)

Introduction to Biostatistics. Experimental designs: Principles - replication and randomization. Common designs in biological experiments: Completely randomized design, randomized block design and Latin square design. Methods of data collection. Primary and secondary data, qualitative and quantitative data. Frequency distribution table construction. Graphical representation of data.

UNIT – II (8Hrs)

Analysis of quantitative characters and Measures of central tendency of mean, median, mode. Measures of dispersion – types, standard deviation and standard error, variance and coefficient of variation. ANOVA, multiple mean comparison tests (DMRT, Tukey's test).

UNIT - III (10Hrs)

Probability; basic principles - types - Rules of probability - addition and multiplication rules. Patterns of probability distribution; binomial - Poisson and normal - Tests of significance; Chi - square test for goodness of Fit; Null hypothesis, level of Significance - Degrees of Freedom.

UNIT – IV **(10Hrs)**

Student's - distribution; "t" test - Estimation of population parameters based on small sample statistics - Comparison of sample mean with population mean - comparison means of two small sample of equal and unequal sizes. - Correlation - types of correlation - methods of study of correlation - testing the significance of the coefficients of correlation - Regression and types.

UNIT – V **(10Hrs)**

Computer application in Biology - Computer memory and storage devices - Operating systems and application programmes - MS excel and statistical functions - ANOVA. Basic introduction to Multivariate Analysis of Variance (M ANOVA).

RECOMMENDED TEXT BOOKS

1. Gupta, S.P. 2014, Elementary Statistical Methods – Sultan Chand & Sons Pvt. Ltd.
2. Gurumani, N. (2005) Biostatistics, 2nd edn. MJP publications, India.
3. Pillai, R.S.N. and Bagawathi, V. (1989), Statistics. Theory and practice (For B.Com. and B.A. (Eco) classes) S.Chand & Co. Ltd. New Delhi.
4. Mahajan, B.K. (1984). Methods in Biostatistics for Medical students and Research works. Smt. Indu Mahajan, New Delhi.
5. Prasad, 2011. Elements of Biostatistics – S. Rastogi Publications, Meerut.

REFERENCE BOOKS

1. Calvin Dytham, 2017. Choosing and using statistics – A Biologist's Guide, 3rd Edition. Blackwell Publishing Company.
2. Milton, J.s. (1992) Statistical method in Biological and Health Sciences. McGraw Hill Inc., New York.
3. Schefler, W.C. (1968) Statistics for biological sciences, Addision- Wesely Publication Co., London.
4. Snedecor, G.W and Cocham, W.G. (1967) Statistical Methods. Oxford & IBH Publication co., New Delhi.
5. Spiegel, M.R. (1981) Theory and Problems of statistics, Schaum's Outline series McGraw-Hill International Book Co., Singapore.
6. Stansfield, W.D. (1986) Theory and problems of genetics (including 600 problems). Schaum's outline series. McGraw Hill) Book Co. New York.
7. Sobl. R.R. and Rohif, F.J. (1969) Biometry. The principles and Practice and Statistics in Biological Research. W.H. Freman and Co., San Francisco.
8. Zar, J.K. 2003. Biostatistical analysis, Prentice-Hall International, INC, Engleword Chiffs, New Jersey.

JOURNALS

1. Journal in Critical Reviews in Analytical Chemistry
2. AKCE International Journal of Graphs and Combinatorics

E LEARNING RESOURCES:

1. http://www.math.louisville.edu/~pksaho01/teaching/Math662TB-09S.pdf
2. http://www.sjsu.edu/faculty/gerstman/StatPrimer/probability.pdf
3. https://stats.libretexts.org/Bookshelves/Biostatistics/Book Natural_Resources Biometrics(Kiernan)/1%3A_Descriptive_Statistics_and_the_Normal_Distribution /1.2ProbabilityDistribution
4. https://www.statisticshowto.datasciencecentral.com/probability-and-statistics/t-test/
5. https://www.ruf.rice.edu/~bioslabs/tools/stats/ttest.html

COURSE OUTCOMES

CO No.	CO Statement	Knowledge Level
CO 1	Discuss the fundamental concept of biostatistics, sampling techniques, diagrammatic and graphical representation	K3
CO 2	Analyse data using measures of central tendency and measures of dispersion	K4
CO 3	Apply the fundamentals of probability and its distrubtion and statistical hypothesis test	K3,K4
CO 4	Evaluate student 't' test , correlation , regression and testing its significance	K4, K5
CO 5	Use computer application in biology and imbibe computer skills for biological data analysis and graphical representation	K5

Mapping of CO with PSO

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	**1**	**3**	**3**	**3**	**3**
CO 2	**1**	**3**	**3**	**3**	**3**
CO 3	**1**	**3**	**3**	**3**	**3**
CO 4	**1**	**3**	**3**	**3**	**3**
CO 5	**1**	**3**	**3**	**3**	**3**
Average	**1**	**3**	**3**	**3**	**3**

TEACHING METHODOLOGY:

Lecture (Chalk and Talk-OHP-LCD),
E Content, Videos,
Problem Solving-Group Discussion,
Quiz-Seminar,
Peer Learning.

Note: No Practical for this paper

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)
CHENNAI-600 008.
(For candidates admitted during the academic year 2021-2022)
M. Sc DEGREE EXAMINATION

II M Sc PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

ELECTIVE PAPER 4

BIOSTATISTICS

COURSE CODE- 10SP21/3E4/BIS

QUESTION PAPER PATTERN

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K1,K2,	A-10×2 marks	50	20	100	Question No. is compulsory
K2,K3	B-5/8×8 marks	500	40		
K4,K5	C-2/3×20 marks	1500	40		

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)
CHOICE BASED CREDIT SYSTEM
M.Sc., PLANT BIOLOGY AND PLANT BIOTECHNOLOGY (SELF SUPPORTING)
(with effect from the Academic Year 2021 - 2022 and thereafter)
SEMESTER III

ELECTIVE PAPER 4

ETHNOBOTANY

COURSE CODE-10SP21/3E4/ETB

Teaching hours: 3 / Week **Credits: 3**

45/ Semester **L-T- P**

2- 1- 0

COURSE OBJECTIVES:

To enable the student to

1. Study the history and importance ethnic knowledge on the uses of herbal plants.
2. Study the details and life style of tribals of Tamil Nadu.
3. Understand the importance and methods of ethnobotanical surveys.
4. Know the commercial significance of traditional knowledge and benefit sharing mechanisms.

COURSE OUTLINE:

UNIT – I **(10 Hrs)**

History of Ethnobotany - Ethnobotanical studies in the world and in India - Interdisciplinary approaches. Knowledge of following sociological and anthropological terms of culture, values and norms, institutions, culture diffusion and ethnocentrism.

UNIT – II **(8 Hrs)**

Distribution of tribes in India - Basic knowledge of following tribes of Tamil Nadu (Irulas, Kanis, Paliyars, Kurumbers, thodas and Malayalis) - Life style and traditional practices of the above tribes.

UNIT – III **(7 Hrs)**

Ethnobotanical knowledge and communities - Folk Taxonomy - Plants associated with culture and socio-religious activities. Non-Timber Forest Produces (NTFP) and livelihood – Sustainable harvest and value addition.

UNIT - IV **(10Hrs)**

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.

UNIT – V **(10 Hrs)**

Bioprospecting and commercial use of traditional knowledge. Developing research partnerships - Codes of ethics and research guidelines, equitable research relationships. Traditional knowledge (TK) in relation to Intellectual Property Rights and Biopiracy. Equitable Benefit sharing models of the world - Problems in equitable benefit sharing.

RECOMMENDED TEXT BOOKS

1. Gokhale, S.B., Kokate, C.K. and Gokhale, A. 2016. Pharmacognosy of Traditional Drugs. Nirali Prakashan, 1st Edition. ISBN: 9351642062.
2. Kumar, N. 2018. A Textbook of Pharmacognosy. Aitbs Publishers, India, ISBN: 978937473456
3. Prajapati, ND., Purohit, SS., Sharma, AK. And Kumar, T. 2018. A handbook of medicinal plants: A complete sources of book. Agrobios (India).

REFERENCE BOOKS

1. Hornok, L. 1992. Cultivation and Processing of Medicinal Plants. Wiley-Blackwell. ISBN: 0471923834.
2. Joshi, S.G. 2018. Medicinal Plants. Oxford & IBH Publishing C., Pvt., Ltd., New Delhi. ISBN:9788120414143.
3. Premendra Singh 2013. Medicinal Plants: Conservation, Cultivation and Utilization. Daya Publishing House - A division of - Astral International (P) Ltd. ASIN: B00C865V6M.
4. Qadry, J. S. 2018. A textbook of Pharmacognosy: Theory and Practicals. CBS Publishers & Distributors, 17th Edition. ISBN: 8123925328.
5. Zhang C.L. 2012. Cultivation Techniques of Medicinal Plants. China Agricultural University. ISBN: 7811177773.

COURSE OUTCOMES

CO No.	CO Statement	Knowledge Level
CO 1	Knowledge on history and importance ethnic knowledge on the uses of herbal plants.	K4
CO 2	Awareness on the details and life style of tribals of Tamil Nadu.	K3, K4
CO 3	Understand the importance and methods of ethnobotanical surveys.	K3,K4
CO 4	Awareness on the commercial significance of traditional knowledge and benefit sharing mechanisms.	K3, K4
CO 5	Understand the trading knowledge	K4, K5

Mapping of CO with PSO

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	2	2	2	3	3
CO 2	1	2	2	3	3
CO 3	2	3	2	3	3
CO 4	2	2	2	3	3
CO 5	1	3	2	3	3
Average	1.6	2.4	2	3	3

TEACHING METHODOLOGY:
Lecture (Chalk and Talk-OHP-LCD),
E Content, Videos/ Animation,
Quiz-Seminar,
Peer Learning.

Note: No Practical for this paper.

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)

CHENNAI-600 008.

(For candidates admitted during the academic year 2021-2022)

M. Sc DEGREE EXAMINATION

II M. Sc PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

ELECTIVE PAPER 4

ETHNOBOTANY

COURSE CODE-10SP21/3E4/ETB

QUESTION PAPER PATTERN

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K1,K2	A-10×2 marks	50	20	100	Question No. is compulsory
K2,K3	B-5/8×8 marks	500	40		
K4,K5	C-2/3×20 marks	1500	40		

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)
CHOICE BASED CREDIT SYSTEM
M.Sc., PLANT BIOLOGY AND PLANT BIOTECHNOLOGY (SELF SUPPORTING)
(with effect from the Academic Year 2021 - 2022 and thereafter)
SEMESTER III

ELECTIVE PAPER 4

WOOD TECHNOLOGY

COURSE CODE-10SP21/3E4/WOT

Teaching hours: 3 / Week **Credits: 3**

45/ Semester **L-T- P**

2- 1- 0

COURSE OBJECTIVES:

To enable the students to

1. Gain knowledge on wood formation.
2. Understand the properties of wood.
3. Study the mechanical properties and factors affecting wood formation.
4. Learn chemical properties.
5. Explore the uses of wood.

COURSE OUTLINE:

Unit – I **(10 Hrs)**

wood formation – role of hormones, water , internal and external factors - Growth rings- Heart wood and sap wood, juvenile and reaction wood.- Vessels- length, shape, lateral wall pittings, perforations, intervessel pits,tyloses, Tracheids, size and wall characteristics- rays- classification and types

Unit – II **(10 Hrs)**

Density and specific gravity of the wood – significance- Calculation of moisture content and and specific heat of wood- Principles of wood preservation- Preservatives- Process of preservation (pressure and non- pressure methods)- Seasoning of wood.

Unit – III **(7 Hrs)**

Mechanical properties of wood-tensile strength-compression strength- shearing strength-bending strength- stiffness-shock resisting capacity- hardness. Factors affecting mechanical properties of wood.

Unit – IV **(8 Hrs)**

Chemical properties of wood- Cellulose- hemicellulose-, lignin, mineral matter- essential oil, tannins, resins, gums, eco-friendly dyes from bark and wood.

Unit – V **(10 Hrs)**

Wood products- Timber, rail road ties, veneer plywood- furniture, wood fuel- lead pencils- matches, tooth picks- paper pulp-filaments and yarn cellulose- gums, resins, turpentine- resins barks, tannins and dyes.

REFERENCES

1. Bailey, I. W.1954 Contribution to plant Anatomy. Chronica Botanica Waltham Mass
2. Brown, H. P Text Book of Wood Technology Vol –I McGraw Hill Book Co. New York
3. Gamble, J. S. Manual of Indian Timbers London
4. Pearson, R. S. Commercial Timbers of India Govt of India Publications
5. Metcalfe, C. R. 1962. Anatomy of Dicotyledons Vol 2 Claredon Press London

COURSE OUTCOMES:

CO.No.	CO Statement	Knowledge Level
CO 1	Analyse the formation of wood	K4
CO 2	Discuss the properties of wood	K3
CO 3	Explain the mechanical properties and factors affecting wood formation	K3, K4
CO 4	Outline the chemical properties of wood	K3
CO 5	Evaluate the economic importance of wood	K5

Mapping of CO with PSO

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	1	3	3	3	3
CO 2	2	3	3	3	3
CO 3	2	2	3	3	3
CO 4	1	3	3	3	3
CO 5	2	3	3	3	3
Average	1	3	3	3	3

TEACHING METHODOLOGY:

Lecture (Chalk and Talk-OHP-LCD),
E Content, Videos/ Animation,
Quiz-Seminar,
Peer Learning.

Note: No Practical for this paper.

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)

CHENNAI-600 008.

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M. Sc DEGREE EXAMINATION

II M. Sc PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

ELECTIVE PAPER 4

WOOD TECHNOLOGY

COURSE CODE-10SP21/3E4/WOT

QUESTION PAPER PATTERN

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K1,K2	A-10×2 marks	50	20	100	Question No. is compulsory
K3	B-5/8×8 marks	500	40		
K4,K5	C-2/3×20 marks	1500	40		

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)
CHOICE BASED CREDIT SYSTEM
M.Sc., PLANT BIOLOGY AND PLANT BIOTECHNOLOGY (SELF SUPPORTING)
(with effect from the Academic Year 2021 - 2022 and thereafter)
SEMESTER III

EXTRA DISICIPLINARY-II

MEDICINAL BOTANY AND DIETETICS
(offered to other Department students)

COURSE CODE-10SP21/3E/MBD

Teaching hours: 4/ Week **Credits: 3**

60/ Semester **L-T- P**

3- 1- 0

COURSE OBJECTIVES:

To enable the students to

1. Explore the field of medicinal plants
2. Understand the scope and importance of Pharmacognosy.
3. Know the specific plant taxa used in traditional medicine.
4. Understand the therapeutic value of plant products
5. Learn the applications of plant chemical constituents on human health

COURSE OUTLINE:

UNIT – I **(15 Hrs)**

Biological source, geographical distribution, physic chemical analysis of the following medicinal plants: *Vetiveria* (root), *Acorus calamus* (rhizome), *Ocimum* (leaf), *Terminalia chebula* (fruit), *Trigonella* (seed), *Cinnamomum (*bark).

UNIT - II **(10 Hrs)**

Uses of essential oils (Sandal wood, Eucalyptus and Citronella), fatty oil (Sesame, Sunflower and Coconut), vegetable fat (Vanaspathi and Peanut butter).

UNIT - III **(10 Hrs)**

Therapeutic value of Indian plant foods- Rice, Wheat, Green gram, Black gram, Millets, Lemon, Banana, Ginger, Turmeric, Coriander, Garlic, Asafoetida, Cumin and Clove. Allergic responses of plants- Brinjal, Colocasia & Mushrooms.

UNIT - IV **(15 Hrs)**

Plants in the treatment of diseases- anorexia, arthritis, constipation, diarrhea, diabetics, psoriasis, hyper tension, memory loss.

UNIT - V **(10Hrs)**

Anti-oxidants, PUFA, probiotics, prebiotics dietary fibres, omega-III fatty acids. Cosmeceuticals: Introduction, retinoic acid, alpha hydroxyl acid, boswellic acid, vitamins C and E, Coenzyme Q-10 (Ubiquinone) miscellaneous; tetra hydro curcuminoids.

RECOMMENDED TEXT BOOKS

1. Pharmacognosy, C.K Kokate, A.P Purohit& S.B Gokhale (2009), Nirali Prakashan, 4 th Ed.
2. H.K.Bhakru .Herbs that heal. 2008. Orient publication.
3. Dr B.P. Pandey (2014) Economic Botany, Published by S. Chand & Company Ltd,

REFERENCE BOOKS

1. Natural products in medicine: A biosynthetic approach (1997). Wiley.
2. Hornok, L (ed.) (1992). Cultivation and processing of medicinal plants, Chichister, U. K;
   J.Wiley and sons.
3. Trease and Evans, Pharmacognosy – William Charles Evans, 14 th ed. (2002) , Harcourt Brace and Company.
4. Sukh Dev (2006) Prime Ayurvedic Plant Drugs , Anshan publication.

JOURNALS:

1. Medicinal and Aromatic Plants
2. International Journal of Medicinal Plants

E LEARNING RESOURCES:

1. www.gamlaa.com/categories/Medicinal-Plants
2. http://www.ecornell.com/certificates/plant-based-nutrition/certificate-in-plant-based-nutrition/
3. http://carlg.org/englakandeorter.html
4. https://www.urmc.rochester.edu/encyclopedia/content.aspx?contenttypeid=1&contentid=1169
5. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5132387/

COURSE OUTCOMES

CO.No.	CO Statement	Knowledge Level
CO 1	Analyse the physicochemical analysis of medicinal plants	K4,K5
CO 2	Apply the knowledge gained on botanical resources for its varied uses	K3,K4
CO 3	Discuss on the therapeutic value of Indian foods	K4, K5
CO 4	Utilize plants in treatment of various diseases	K4, K5
CO 5	Design a proper food to maintain proper health	K 5

MAPPING-COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	1	1	3	3
CO 2	3	1	1	3	3
CO 3	3	1	1	3	3
CO 4	3	1	1	3	3
CO 5	3	1	1	3	3
Average	3	1	1	3	3

TEACHING METHODOLOGY:

Lecture (Chalk and Talk-OHP-LCD),
E Content, Videos/ Animation,
Quiz-Seminar,
Peer Learning.

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS) CHENNAI-600 008.

(For candidates admitted during the academic year 2021-2022)

M. Sc DEGREE EXAMINATION

II M. Sc PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

EXTRA DISICIPLINARY-II

MEDICINAL BOTANY AND DIETETICS (offered to other Department students)

COURSE CODE-10SP21/3E/MBD

QUESTION PAPER PATTERN

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K3	A-5/8X8 marks	500	40	100	Question No.- is compulsory
K4,K5	B-3/5X20 marks	1500	60		

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)
CHOICE BASED CREDIT SYSTEM
M.Sc., PLANT BIOLOGY AND PLANT BIOTECHNOLOGY (SELF SUPPORTING)
(with effect from the Academic Year 2021 - 2022 and thereafter)
SEMESTER III

SOFT SKILL 3

COMPUTING FOR BIOLOGICAL RESEARCH

COURSE CODE-10SP21/3S/CBR

Teaching hours: 2/ Week **Credits: 2**

30/ Semester **L-T- P**

2- 0- 0

UNIT – I **(6 Hrs)**

Introduction to Word- Editing a document – Finding and Replacing Text – Inserting symbols- Using Thesaurus – Enhancing document – Columns, Tables and other features.

UNIT – II **(6 Hrs)**

Introduction to Work sheet – Editing cell & using Commands and functions - Formatting a work sheet – Printing work sheet.

UNIT – III **(6 Hrs)**

Creating charts – Naming ranges and using statistical, mathematical functions, database in a work sheet – Additional formatting commands and drawing toolbar – Miscellaneous commands and functions.

UNIT – IV **(6 Hrs)**

Overview of power point using the visual aids, presentation for research projects, Computer viruses, Introduction to Internet – Web features.

UNIT-V **(6 Hrs)**

Biological databases- Types of data and databases, Nucleotide sequence database (EMBL, GENBANK, DDBJ) – Protein sequence database (PIR, SWISS-PROT, TrEMBL, PDB, MMDB, SCOP, CATH) – Secondary databases (PROSITE, PRINTS, BLOCKS). Information retrieval from databases – search concepts, tools for searching.

REFERENCE BOOKS

1. PC Software for Windows 98' made simple – R.K. Taxali – Tata McGraw Hill Publishers, 2005.
2. Sundaralingam. R, Kumaresan. V, (2012).Bioinformatics, Saras Publication,
3. Ignacimuthu . S (2013) Basic Bioinformatics Alpha Science International Limited,
4. Computer Literacy BASICS: Microsoft Office 2007 Companion.

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)

CHENNAI-600 008.

(For candidates admitted during the academic year 2021-2022)

M. Sc DEGREE EXAMINATION

I M. Sc PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

SOFT SKILL 3

COMPUTING FOR BIOLOGICAL RESEARCH

COURSE CODE-10SP21/3S/CBR

QUESTION PAPER PATTERN

Knowledge Level	**Section**	**Word Limit**	**Marks**	**Total**	**Special Instructions if any**
K1,K2	A-5/5×2 marks	50	10	50	Question No. is compulsory
K2,K3	B-4/6×5marks	250	20		
K4,K5	C-1/2×20marks	1500	20		

COURSE PROFILE

II YEAR - FOURTH SEMESTER

TOTAL CREDITS - 25

S.N	CORE/ ELECTIVE	TITLE OF THE PAPER	CODE	L	T	P	H	C	CA	SE	MM
22	Core 12	Biochemistry and Applied Biotechnology	10SP21/4C/BAB	3	2	0	5	4	40	60	100
23	Core 13	Ecology, Conservation Biology and Intellectual Property Rights	10SP21/4C/ECI	3	2	0	5	4	40	60	100
24	Core 14	Bioinstrumentation and Methodology	10SP21/4C/BME	3	2	0	5	4	40	60	100
		Practical -III: Covering Core Papers – 9 and 10	10SP21/4C/PR3	-	-	-	-	4	40	60	100
25	Core 15	Practical - IV: Covering Core Papers – 12,13,14	10SP21/4C/PR4	0	0	8	8	4	40	60	100
26	Project	Research Project	10SP21/4C/PRO	0	0	5	5	3	40	60	100
27	Soft Skill 4	Introduction to Bioinformatics	10SP21/4S/IBI	2	0	0	2	2	-	50	50

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)
CHOICE BASED CREDIT SYSTEM
M.Sc., PLANT BIOLOGY AND PLANT BIOTECHNOLOGY (SELF SUPPORTING)
(with effect from the Academic Year 2021 - 2022 and thereafter)

SEMESTER IV

CORE PAPER 12

BIOCHEMISTRY AND APPLIED BIOTECHNOLOGY

COURSE CODE-10SP21/4C/ BAB

Teaching hours: 6 / Week **Credits: 4**
90/ Semester **L-T- P**
3- 3- 0

COURSE OBJECTIVES:
To enable the students to

1. Knowledge on the fundamentals and significance of Plant Biochemistry.
2. Understanding on the structure and properties of plant biomolecules.
3. Impart knowledge on the production of hybrid plants through rDNA technology
4. Understanding on the importance of differential regulation of gene expression plant systems.
5. Explore microbial/plant enzymes and their role

COURSE OUTLINE:

UNIT – I **(20 Hrs)**

Atomic structure: chemical bonds - ionic bond, covalent bond, coordinate covalent bond, hydrogen bond, hydrogen ion concentration (pH), buffers. Thermodynamics principle, First Law of Thermodynamics a) energy (b) Enthalpy (ii) second law of thermodynamics (a) Spontaneity and disorder (b) entropy (c) free energy, redox potential, dissociation and association constant, activation energy, binding energy.

UNIT – II **(20 Hrs)**

Biomolecules: Classification of carbohydrates; Structure and properties of monosaccharides, Oligosaccharides, Polysaccharides – Glycoproteins. Protein and Amino acids: Structure, Classification and properties; Peptides - Structure: Primary, secondary, Ramachandran plot, tertiary and quaternary structures. Classification of Lipids: Structure and properties of fatty acids, phospholipids, glycolipids, lipoproteins, cholesterol - structure and functions.

UNIT – III **(20 Hrs)**

Enzymes- Classification and nomenclature chemical nature of enzymes – factors affecting enzyme action – Michaelis – Menton constant, MM equation, – Lineweaver Burk plot, Enzyme inhibition, co enzymes- mechanism of enzyme action, isoenzymes. Purifications of enzymes.

UNIT – IV **(15 Hrs)**

Basics of Genetic engineering – tools and techniques, restriction endonucleases, vectors – pBR322, Ti plasmid, cosmids. cDNA libraries.

Transgenic plants - pest resistance, herbicidal resistance, Disease resistant, abiotic and biotic stress tolerant, in improving crop yield, food quality- Golden rice, Edible vaccines, Virus and Bacteria based transient gene expression systems. Virus induced gene complementation, Virus induced gene silencing. Cytoplasmic male sterility and fertility restoration, terminator Seed technology, antisense technology for Delayed fruit ripening, Plants as factories for useful products and pharmaceuticals.

UNIT – V **(15 Hrs)**

Fermentation techniques- Types. Industrial Production of enzymes-amylase, protease & lipase and their applications. Immobilization for enzymes production. Antibiotic Penicillin production. Amino acid - Glutamic acid production. Production of Alcohol and Xanthan Gum. Bioreactors for culturing Plant cells and production of Secondary metabolites, Super bug and its role in biodegradation.

RECOMMENDED TEXT BOOKS

1. Gupta, S.N. 2016. Biochemistry Rastogi Publications, Meerut.
2. Satyanarayana, U. and Chakkrapani, U. 2013. Biochemistry. Elsevier India Pvt Ltd & Books Allied Pvt.Ltd, New Delhi.
3. Jain, J.L., Jain, S. and Jain, N. 2016. Fundamentals of Biochemistry. Chand Publishing, New Delhi.

REFERENCE BOOKS

1. Bonner, J. and Warner, W.H. 1961. Plant Biochemistry. Academic Press. Inv. New York.
2. Nelson, D.L. and Cox, M.M. 2017. Lehninger's Principles of Biochemistry, Prentice Hall, International N.J, 7th Edition.
3. Heldt, H-W. 2005. Plant Biochemistry, 3rd Edition. Elsevier Academic Press.
4. Buchanan, B.B., Grissem, W. and Jones, R.L. 2000. Biochemistry and molecular biology of plants. 5th Edition. Wiley-Blackwell.
5. Wulf Cruger and Anneliese Crueger, Biotechnology: A Textbook of Industrial Microbiology, 2nd edition,Panima Publishing Corporation, 2004.

6. A.H. Patel, Industrial Microbiology, 1st edition, MacMillan Publication, 2008.
7. Casida Jr, L.E., Industrial Microbiology,New Age International (P) Ltd, 2007.

JOURNALS

1. The Journal of Biochemistry
2. Indian journal of biochemistry and biophysics

E-LEARNING RESOURCES

1. https://www.angelo.edu/faculty/kboudrea/index_2353/Chapter_07_2SPP.pdf
2. https://www.angelo.edu/faculty/kboudrea/index_2353/Chapter_09_2SPP.pdf
3. https://biochem.wisc.edu/sites/default/files/symposia/steenbock/36th/36th_Steenbock_Abstract_Book_web.pdf
4. http://people.uleth.ca/~steven.mosimann/bchm2000/Bchm2000_L11.pdf
5. https://www.omicsonline.org/scholarly/industrial-microbiology-journals-articles-ppts-list.php

COURSE OUTCOMES

CO.No.	CO Statement	Knowledge Level
CO 1	Discuss the atomic structure, bonding and Thermodynamics	K4
CO 2	Outline the nature , structure and functions of protein	K3, K4
CO 3	Analyse the classification, nature, structure, functions and biosynthesis of fats	K4
CO 4	Explain the nature, structure, functions and applications of enzymes in industry and medicine	K3, K4
CO 5	Evaluate bioenergetics, laws of thermodynamics, ATP and its applications in biological systems	K3, K4

MAPPING CO WITH PSO

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	**3**	**2**	**2**	**3**	**3**
CO 2	**3**	**2**	**2**	**3**	**3**
CO 3	**3**	**2**	**2**	**3**	**3**
CO 4	**3**	**2**	**2**	**3**	**3**
CO 5	**3**	**2**	**2**	**3**	**3**
Average	**3**	**2**	**2**	**3**	**3**

TEACHING METHODOLOGY:

Lecture (Chalk and Talk-OHP-LCD),

E Content, Videos/ Animation,

Quiz-Seminar,

Peer Learning.

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M. Sc DEGREE EXAMINATION
II M. Sc PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

CORE PAPER 12
BIOCHEMISTRY AND APPLIED BIOTECHNOLOGY
COURSE CODE-10SP21/4C/ BAB
QUESTION PAPER PATTERN

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K1,K2	A-10×2 marks	50	20	100	Question No. is compulsory
K2,K3	B-5/8×8 marks	500	40		
K4,K5	C-2/3×20 marks	1500	40		

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)
CHOICE BASED CREDIT SYSTEM
M.Sc., PLANT BIOLOGY AND PLANT BIOTECHNOLOGY (SELF SUPPORTING)
(with effect from the Academic Year 2021 - 2022 and thereafter)

SEMESTER IV

CORE PAPER 13
ECOLOGY, CONSERVATION BIOLOGY AND INTELLECTUAL PROPERTY RIGHTS

COURSE CODE-10SP21/4C/ ECI

Teaching hours: 5 / Week **Credits: 4**
75/ Semester **L-T- P**
COURSE OBJECTIVES: **3- 2- 0**

To enable the students to

1. Understand the structure and functional attributes of different ecosystems.
2. Impart knowledge on global issues concerned with environment
3. Learn Phytogeography and Remote sensing
4. Understand the values and the need for conservation and management of species andecosystems.
5. Study the Indigenous knowledge and intellectual property rights.

COURSE OUTLINE:

UNIT – I **(15 Hrs)**

Aim and scope of Ecology. Autecology-Population ecology-Characteristics of Population. Positive and negative interactions of Species – Synecology - Qualitative and Quantitative characters of community. Niche-types, niche width and overlap; fundamental and realized niche. Methods of studying plant community- community structure and attributes. Plant Succession-Hydrosere, Xerosere. Contemporary Ecological Issues: Climate change, Pollination Crises, Urban Ecology, Human animal conflicts.

UNIT – II **(15 Hrs)**

Concept and dynamics of ecosystem: Types of ecosystem, components, Food chain, Food web and energy flow - Trophic level, ecological pyramids. Energy flow in the ecosystems. Biogeochemical cycles - Hydrological, Carbon, Nitrogen, and Phosphorous cycles. Characteristic features, structure and functions of Forest, Grassland, Pond, Estuary and Manmade (Crop land) ecosystems. Ecological amplitude of a species and adaptation – *r & k* selection, Ecads, ecotypes, ecospecies, Raunkaier's Life Forms.

UNIT – III **(15 Hrs)**

Types of forests and forest conservation – Utilization of energy resources – Non-renewable and renewable. Environmental pollution – Air, water, soil, thermal and radiation. Causes, consequences and control of pollution on global environment, Ozone depletion, Greenhouse effect, Climate change and Global warming. Ecological indicators. Biomagnifications and Eutrophication. Bioremediation - *In situ* and *Ex situ*. Disaster management – Floods, Earthquake, Cyclone, Tsunami and Landslides. Dams and their effects on forest and tribal people.

UNIT – IV **(15 Hrs)**

Endemism – Red data book – IUCN categories. Phytogeography-Continuous and discontinuous distribution of vegetation. Range – Dispersal and migration barriers hypothesis, Continental drift hypothesis, Land – Bridges hypothesis, Age and Area hypothesis. Major Biomes of the World, Bio-geographical zones of India. Introduction to Remote Sensing and GIS- Earth summit- Kyoto protocol- Environmental Laws and Education. Indigenous knowledge, Bio- prospecting, Bio-piracy, Intellectual property rights and its impact on biodiversity; rights of plantbreeders and farmers, GATT, WTO, Biodiversity act of India.

UNIT – V **(15 Hrs)**

Conservation Biology: Introduction–current practices in conservation – Ecosystem approaches - Species based approaches– *In situ* conservation: reserve forests, Biosphere Reserves, National Parks, Sanctuaries and *Ex-situ* conservation: Afforestation, Sthalavrikshas, Sacred Groves, Social Forestry, Agro Forestry, Botanical Gardens, Cryopreservation, Gene Banks, Seed Banks, Pollen Banks, Sperm Banks, DNA Banks, Tissue Culture and Biotechnological strategies. Social movements for conservation–Chipko movement, Narmada Bacho Andolan.

RECOMMENDED TEXT BOOKS

1. Ambasht, R. S. (2008). A text book of plant ecology.15th Edition. Students & Friends and Co., Varanasi, India.
2. Kumar, H. D. (1997). General Ecology. Vikas Publishing House Pvt. Ltd., New Delhi.
3. Odum, F. E. (1971). Fundamentals of Ecology. W.B. Saunders & Co., New Delhi.
4. Shukla R.S and Chandel P.S (2012) A text book of plant ecology. S Chand

5. Sharma, P.D. (2000) : Ecology & Envoronment Rastogi Publications, Meerut, India.
6. Verma P.S and Agarwal V.K (2015) Cell biology, genetics, molecular biology, evolution and ecology S.Chand

REFERENCE BOOKS

1. Gillson, L. 2015. Biodiversity Conservation and Environmental Change, Oxfrd UniversityPress, Oxford.
2. Gurevitch, J., Scheiner, S.M. and Fox, G.A. 2002. The Ecology of Plants. SinauerAssociates Inc., Publishers. Massachusetts.
3. Keddy, P.A. 2017. Plant Ecology: Origins, processes, consequences. 2nd Edition. CambridgeUniversity Press ISBN. 978-1107114234
4. Kumar, H.D. 1999. Biodiversity and sustainable conservation. Oxford and IBM publishingCompany, New Delhi.
5. Meffe, G.K. and Carroll, C.R. 1994. Principles of Conservation Biology. Sinauer Associates,Inc., USA.
6. Melchias, G. 2001, Biodiversity and Conservation. Oxford and IBM Publishing CompanyPvt., Ltd. New Delhi.
7. Sagreta, K.P. 2000. Forests and Forestry. National Book Trust India, New Delhi.
8. Schulze, E., Beck, E. and Muller-Hohenstein, 2011. Plant Ecology, Springer, Berlin-Heidelberg.
9. Odum, E. P. 1975 Ecology. 2nd Edition. Oxford & IBH Publications, New Delhi.
10. Frankel, O.H., Brown, A.H.D. and Burdon, J.J. 1995. The Conservation of Plant Diversity.Cambridge University Press, London.
11. Heywood, V. H. 1995 Global Biodiversity Assessment. UNEP, Cambridge University Press,London.

JOURNAL

1. North Asian International research Journal consortiums
2. International Journal of Science and Research (IJSR)
4. Intern

E LEARNING RESOURCES:

1. https://shodhganga.inflibnet.ac.in/bitstream/10603/8449/6/06_chapter%201.pdf
2. http://pdf.wri.org/environmentalpollution_bw.pdf
3. https://pdfs.semanticscholar.org/8e7b/a9595bab30d7ea87715533353c53f7452811.pdf
4. http://www.fao.org/3/i3157e/i3157e10.pdf
5. https://pdfs.semanticscholar.org/53ff/76eb3ef9291186f235a59b2ad6214f8cf35d.pdf
6. http://www.scielo.br/pdf/ea/v21n59/en_a21v2159.pdf
7. www.press.uchicago.edu/dam/ucp/books/pdf/course_intro/978-0-226-34214-6_course_intro.pdf+&cd=29&hl=en&ct=clnk&gl=in

COURSE OUTCOMES

CO No.	CO Statement	Knowledge Level
CO 1	Write the characteristics of population and methods of studying plant community	K3,K4
CO 2	Discuss the structure and functional attributes of different ecosystems	K2,K3
CO 3	Analyse the causes, effects and control measures of various global issues related to environment	K4,K5
CO 4	Evaluate the importance of Indigenous knowledge and intellectual property rights	K4,K5
CO 5	Explain the values and the need for conservation and management of species and ecosystems.	K2, K3

MAPPING OF CO WITH PSO

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	**3**	**3**	**3**	**3**	**3**
CO 2	**3**	**3**	**3**	**3**	**3**
CO 3	**3**	**2**	**2**	**3**	**3**
CO 4	**3**	**3**	**2**	**3**	**3**
CO 5	**3**	**2**	**1**	**3**	**3**
Average	**3**	**2.6**	**2.2**	**3**	**3**

TEACHING METHODOLOGY:

Lecture (Chalk and Talk-OHP-LCD),
E Content, Videos/ Animation,
Quiz-Seminar,
Peer Learning,
Field Visits.

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS) CHENNAI-600 008.
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M. Sc DEGREE EXAMINATION

I M. Sc PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

CORE PAPER 13
ECOLOGY, CONSERVATION BIOLOGY AND INTELLECTUAL PROPERTY RIGHTS
COURSE CODE-10SP21/4C/ECI
QUESTION PAPER PATTERN

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K1,K2	A-10×2 marks	50	20	100	Question No. is compulsory
K2,K3	B-5/8×8 marks	500	40		
K4,K5	C-2/3×20 marks	1500	40		

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)
CHOICE BASED CREDIT SYSTEM
M.Sc., PLANT BIOLOGY AND PLANT BIOTECHNOLOGY (SELF SUPPORTING)
(with effect from the Academic Year 2021 - 2022 and thereafter)

SEMESTER IV
CORE PAPER 14
BIOINSTRUMENTATION AND METHODOLOGY

COURSE CODE-10SP21/4C/BME

Teaching hours: 5 / Week **Credits: 3**

75 / Semester **L-T- P**

2- 2- 0

COURSE OBJECTIVES:

To enable the students to

1. Understand the principle, techniques and applications of instruments used in biology
2. Acquire knowledge about microscopy and its applications
3. Understand the applications of Spectroscopy
4. Know the importance of nanobiotechnology and its application.
5. Impart knowledge to write research project.

COURSE OUTLINE:

UNIT – I **(15 Hrs)**

Microtomy – Rotary microtome – Fixatives, Dehydration, Paraffin sectioning. Stains, Micrometry. Centrifugation principles of sedimentation. Relative centrifugal force or field (G). Use of centrifuge. Type of rotors: winging bucket rotor, fixed angles, vertical tube, and continuous flow and zonal centrifugation and isopycnic centrifugation. Centrifuge tubes: choice, matching and balancing of tubes.

UNIT – II **(15 Hrs)**

Microscopy – principles and applications of light – dark field – phase contrast – fluorescence – polarization – scanning and transmission electron microscopes and confocal microscope. Micrometry. FISH. Fixation and preparation of plant materials for microtome slides. Staining for light and fluorescence microscopy. Sample prepararion for SEM and TEM.

UNIT – III **(15Hrs)**

Chromatography - principles and applications of Paper Chromatography, Thin Layer Chromatography (TLC), High Performance Thin Layer Chromatography (HPTLC), Column Chromatography, Ion-Exchange Chromatography, Affinity Chromatography, Gas Chromatography (GC), High Performance Liquid Chromatography (HPLC). Agarose gel electrophoresis, Polyacrylamide gel electrophoresis, zymogram, Isoelectric focusing, Immuno Electrophoresis. PCR, RFLP, RAPD, AFLP based DNA fingerprinting.

UNIT – IV **(15 Hrs)**

Spectrophotometer – working principle and applications. Immunological methods and Blotting techniques. Tracer techniques – liquid and solid scintillation counters, autoradiography. UV/Vis, fluorescence spectroscopy. Infrared Spectrophotometry (IR), Atomic Absorption Spectroscopy (AAS), Nuclear Magnetic Resonance (NMR) spectroscopy, Mass spectroscopy, XRD.

UNIT – V **(15 Hrs)**

Writing the research report (Dissertation and Journal) – The components of research report – Title – Authors and address, abstract – summary – synopsis – key words – introduction – review of literature – materials and methods – results – discussion – bibliography.

RECOMMENDED BOOKS

1. Baijpai, P.K. 2006. Biological Instumentation and Methodology, Chand publisher.
2. Gurumani.N. 2006, Research Methodology for Biological Sciences. MJP.
3. Kadam, R.M. and Allapure, R.B. 2016. Kumar, R. Research Methodology in Botany. ISBN : 9789384139285
4. Kumar, M. 2012. Research Methodology and Techniques in Botany. Centrum Press Publisher.
5. Mahesh, A. B. Vedamurthy 2003. Biotechnology-4: Including Recombinant DNA Technology, Environmental Biotechnology and Animal cell culture. New age Int.Pub.
6. Patania.V.B. Spectroscopy.Campus Books.2002.
7. Prakash Singh Bisen, Anjana Sharma. 2012. Introduction to Instrumentation in Life
8. Sinha, P.K. 2012. Research Methodology in Plant Sciences, Abhijeet Publications.
9. Suresh, P. and Narayana, P. 2016. Research Methodology in Plant Science. Scientific Publisher.
10. Veerakumari.L, 2006, Bioinstrumentation. MJP Publishers, Chennai Publishers, Chennai.

REFERENCE BOOKS

1. Hofmann, A. and Clokie, S. 2018. Wilson and Walker's Principles and Techniques of Biochemistry and Molecular Biology. Cambridge University Press.
2. Wilson, K. and Walker, J. 2000. Principles and Techniques of Practical Biochemistry 5th Edition. Cambridge University Press, Cambridge.
3. Recombinant DNA and biotechnology. A guide for teachers. ASM Press Sciences, CRC press.
4. Swargiary, A. 2012. Biological Tools & Techniques, Kalyani Publishers, New Delhi, ISBN: 978-93-272-7560-5.
5. Karp.G. 2002. Cell and Molecular Biology. John Wiley and Sons, New York.

JOURNALS

1. Journal in Critical Reviews in Analytical Chemistry
2. American Journal of Physical Anthropology
3. International Journal of Current Microbiology Applied Sciences http://www.ijcmas.com

E LEARNING RESOURCES

1. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5206469/
2. https://resources.saylor.org/wwwresources/archived/site/wp-content/uploads/2012/07/Chapter1011.pdf
3. cfamm.ucr.edu/documents/fei-em.pdf

COURSE OUTCOMES

CO. No.	CO Statement	Knowledge Level
CO 1	Explain the principles, methodology, types, techniques and application of microtomy, micrometry and centrifuge.	K3
CO 2	Apply technique in microscopy its principle and types. Fixation and staining technique for EM	K3
CO 3	Evaluate principle, applications and types of chromatography, electrophoresis, PCR, RFLP, RAPD, AFLP, DNA finger printing	K3, K4
CO 4	Discuss the principle, applications of spectroscopy and spectrophotometry.	K3, K4
CO 5	Plan to write research report with all the research component	K6

MAPPING-COURSE OUTCOME WITH PROGRAMME SPECIFIC OUTCOME

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	**1**	**3**	**2**	**3**	**3**
CO 2	**1**	**3**	**2**	**3**	**3**
CO 3	**1**	**3**	**2**	**3**	**3**
CO 4	**1**	**3**	**2**	**3**	**3**
CO 5	**1**	**3**	**2**	**3**	**3**
Average	**1**	**3**	**2**	**3**	**3**

TEACHING METHODOLOGY:

Lecture (Chalk and Talk-OHP-LCD),
E Content, Videos/ Animation,
Quiz-Seminar,
Peer Learning.

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)

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M. Sc DEGREE EXAMINATION

II M.Sc PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

CORE PAPER 14

BIOINSTRUMENTATION AND METHODOLOGY

COURSE CODE -10SP21/4C/BME

QUESTION PAPER PATTERN

Knowledge Level	Section	Word Limit	Marks	Total	Special Instructions if any
K1,K2	A-10×2 marks	50	20	100	Question No. is compulsory
K2,K3	B-5/8×8 marks	500	40		
K4,K5	C-2/3×20 marks	1500	40		

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)
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SEMESTER IV

CORE PAPER 15

PRACTICAL -IV: COVERING CORE PAPERS 12, 13 AND 14

COURSE CODE-10SP21/4C/PR4

Teaching hours: 8/ Week **Credits: 4**

120/ Semester **L-T- P**

0-0- 8

COURSE OBJECTIVES:

To enable the students to

1. Estimate the biochemical compound in plants.
2. Understand various enzymatic activities in plants.
3. Interpret the vegetation of an ecosystem.
4. Estimation of various characteristics of soil
5. Perceive knowledge on molecular techniques.

Biochemistry and Applied Biotechnology

1. Basic Biochemistry - Preparation of different types of solutions
2. Principles of Photometry - Colorimeter and Spectrophotometer- principles and Applications.
3. To find complimentary colour for different coloured solutions by using colorimeter.
4. Preparation of standard graph for potassium dichromate (K2 Crp7) by using colorimeter (OR) Verification of Beer- Lambert Law by using colorimeter.
5. Estimation of amino acids by ninhydrin method
6. Extraction and estimation of lipids
7. Assay of the enzyme catalase
8. Assay of the enzyme peroxidase
9. Extraction and separation of known and unknown amino acids by using paperchromatography method

10. Estimation of glucose by anthrone reagent method colorimetricaly
11. Extraction and separation of known and unknown amino-acids by using Paper Chromatographic method.

Ecology, Conservation Biology and Intellectual Property Rights

1. Soil sampling and estimation of soil nutrients including soil texture, soil pH, nitrogen
2. Vegetation analysis in a community
3. Measuring Biodiversity by Simpson's diversity index
4. Determination of water holding capacity.
5. Determination of the minimum size of quadrat by species area curve.
6. Determination of the quantitative characters of a plant community by random quadrat method (abundance, density, dominance, species diversity, frequency).
7. Determination of the quantitative characters by belt transect method
8. Water analysis including pH, conductivity, total Hardness (Carbonate and bicarbonate) and Turbidity.
9. Study of primary productivity (Winkler's method)
10. Measuring the transparency level of an aquatic system using the Secchi disc.
11. Spotting of Phytogeographical regions of India in maps (Soil, Vegetation and Botanical).
12. Study the Ecological interest of Ecosystems / Ecological tools / Photographs / Models / Plants – studied in the theory syllabus (spotters).
13. Visit to Forests.

Bioinstrumentation and Methodology

1. Demonstration of various microscopes – compound, Fluorescence, SEM and TEM
2. Measure the diameter of pollen grains in micrometer with micrometry technique.
3. Demonstration of UV- VIS spectrophotometer and flame photometer.
4. Demonstration of agarose gel electrophoresis with nucleic acid.
5. Demonstration of SDS-PAGE of seed protein.
6. Demonstration of HPLC with plant secondary metabolites.

Bonafide record of practical work done should be submitted for the practical examination.

COURSE OUTCOME

CO No.	CO Statement
CO 1	Analyse the biochemical constituents of plants
CO 2	Evaluate the enzymatic activity of plants
CO 3	Evaluate the impact of various environmental factors on biodiversity and their distribution
CO 4	Understand about the types of ecosystems
CO 5	Understand the working principles and application of various instruments

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)
CHOICE BASED CREDIT SYSTEM
M.Sc., PLANT BIOLOGY AND PLANT BIOTECHNOLOGY (SELF SUPPORTING)
(with effect from the Academic Year 2021 - 2022 and thereafter)
SEMESTER IV

SOFT SKILL 4

BIOINFORMATICS

COURSE CODE-10SP21/4S/BIN

Teaching hours: 2/ Week **Credits: 2**

30/ Semester **L-T- P**

2- 0- 0

UNIT – I **(6 Hrs)**

Introduction to Bioinformatics – Definitions. Proteomics. Genomics. Applications of Bioinformatics. Techniques in Bioinformatics- FASTA, BLAST, Multiple Sequence Analysis - Open Reading Frame.

UNIT – II **(6 Hrs)**

Gene prediction, Predicting secondary structure of RNA. Predicting molecular structure and functional domains of proteins.

UNIT – III **(6 Hrs)**

Methods of phylogenetic analysis – Phenetic and Cladistic method of analysis - Molecular phylogeny. Phylogeny analysis tools - ClustalW2, MEGA, M-COFFEE and PhyML.

UNIT – IV **(6 Hrs)**

Microarray- Protein array, RNA arrays, DNA microarrays- Applications.

UNIT – V **(6 Hrs)**

Structure-based drug designing approaches: - Target Identification and Validation. Introduction to docking methods to generate new structure; Tools and Molecular docking programs: AutoDock.

REFERENCE BOOKS

1. AndrewsR. Leach. Molecular Modeling: Principles and Applications
2. Ignacimuthu, S. Plant Biotechnology, Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi
3. Leonard, Banaszak. Foundation of Structural Biology
4. Rastogi, S. C1993, Mandiratta,Namita, Rastogi, Parag.. Bioinformatics-Concepts, Skill Applications
5. Shanmugavel. P. Principles of Bioinformatics Pointer Publication Jaipur.
6. Sundaralingam. R, Kumaresan. V, (2012).Bioinformatics, Saras Publication,
7. Ignacimuthu . S (2013) Basic Bioinformatics Alpha Science International Limited.

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)

CHENNAI-600 008.

(For candidates admitted during the academic year 2021-2022)

M. Sc DEGREE EXAMINATION

I M. Sc PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

SOFT SKILL 4

COMPUTING FOR BIOLOGICAL RESEARCH

COURSE CODE-10SP21/4S/BIN

QUESTION PAPER PATTERN

Knowledge Level	**Section**	**Word Limit**	**Marks**	**Total**	**Special Instructions if any**
K1,K2	A-5/5×2 marks	50	10	50	Question No. is compulsory
K2,K3	B-4/6×5marks	250	20		
K4,K5	C-1/2×20marks	1500	20		