ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS) Chennai

DEPARTMENT OF PLANT BIOLOGY AND PLANT BIOTECHNOLOGY
B.Sc. (AIDED)

SYLLABUS
(FOR CANDIDATES ADMITTED DURING THE ACADEMIC YEAR 2021 -2022 ONWARDS)

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS) CHENNAI-600 008

DEPARTMENT OF PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

Revised syllabus for UG 2021-2022

Department of Plant biology and Plant Biotechnology is revising syllabi with effect from the academic year 2021 – 2022 with CBCS and Part IV and Part V components as specified by the Government of Tamil Nadu. Part IV and V components will seek to build the capacity of the students and provide inputs for their social service and social analysis capabilities.

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

REGULATIONS

1. Eligibility for Admission

Candidates for admission to the first year of the Bachelor of Science Course in Plant Biology and Plant Biotechnology course shall be required to have passed the Higher Secondary Examinations (Academic or Vocational Stream) conducted by the Government of Tamil Nadu or an examination accepted as equivalent thereof by the Syndicate of the University of Madras.

2. Eligibility for the Award of Degree

A candidate shall be eligible for the award of the Degree only if she has undergone the prescribed course of study in a college affiliated to the University for a period of not less than three academic years, passed the examinations of all the six semesters prescribed.

3. Course of Study

The main subject of study for Bachelor Degree shall consist of the following:

Part I	Foundation courses exclusive for languages.
Part II	English
Part III	Core subjects, Allied subjects and Project/elective with three courses
Part IV	1. 1(a) – Those who have not studied Tamil up to XII std and taken a non-Tamil language under Part – 1 shall take Tamil comprising of two courses (level will be at 6^{th} standard). 1 (b) – Those who have studied Tamil up to XII std and taken a non- Tamil language under Part-1 shall take advanced Tamil comprising of two courses. 1(c) – Others who do not come under a + b can choose non – major elective comprising of two courses offered by the major departments. 2. Soft Skills 3. Environmental Studies 4. Value education
Part V	Extension activities/Sports/NCC

4. Self-Study papers (Semester V) -Extra credits

(Students who have no arrears and who have obtained distinction in all the previous semesters alone are eligible for these papers.)

5. Internship (Summer Vacation after IV Semester)-Optional-Extra credits

Minimum number of days is 14 and must consist of an Internship report with an Internship Certificate.

6. 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 40% of the marks prescribed for the examination.

7. Classification of successful candidates

Part I, II, III & IV

Successful candidates passing the examination & securing i) 60% and above and ii) 50% and above but below 60% 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 passed in THIRD class.

Candidates who pass all the examinations (Part I, II, III and IV) prescribed for the course in the FIRST APPEARANCE ITSELF ALONE are eligible for ranking.

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS) CHENNAI-600 008
DEPARTMENT OF PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

CHOICE BASED CREDIT SYSTEM OUTCOME BASED EDUCATION

B.Sc PLANT BIOLOGY AND PLANT BIOTECHNOLOGY
(OFFERED FROM THE ACADEMIC YEAR 2021-2022)

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

On obtaining the undergraduate degree the students will be able to:

PEO1: Apply and advance the knowledge and skills acquired, to become a creative professional in their chosen field.

PEO2: Engage in self-directed continuous learning, aimed at global competency, which will promote professional and personal growth.

PEO3: Develop management skills and entrepreneurial skills, by harnessing core competencies tempered by values and ethics.

PEO4: Work towards achieving economic and social equity for women through application of relevant knowledge.

PEO5: Contribute to promoting environmental sustainability and social inclusivity.

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CHOICE BASED CREDIT SYSTEM OUTCOME BASED EDUCATION

B.Sc PLANT BIOLOGY AND PLANT BIOTECHNOLOGY
(OFFERED FROM THE ACADEMIC YEAR 2021-2022)

PROGRAMME OUTCOMES (POs)

PO1- To promote and apply scientific knowledge for finding sustainable solution to solve the issues pertaining to the society/Industry

PO2- Identify, Analyse and formulate novel ideas to yield, substantial results in the fields of research utilizing the principles of Physical and Biological Science

PO3- Relate key concepts and scientific principles to various scientific phenomenon and their applications in day-to-day life

.

PO4- Cultivate unparalled comprehension of fundamental concepts relevant to basic sciences leading to an individual progress and career advancement at the National and Global levels

PO5- To communicate effectively their views and ideas orally/ written in English and in other related languages

PO6- Design solutions for complex problems and design system components or processes that meet the specific needs with appropriate consideration for public health and safety, cultural, societal and environmental conditions

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CHOICE BASED CREDIT SYSTEM OUTCOME BASED EDUCATION

B.Sc PLANT BIOLOGY AND PLANT BIOTECHNOLOGY
(OFFERED FROM THE ACADEMIC YEAR 2021-2022)

PROGRAMME SPECIFIC OUTCOME (PSO)

After completion of B.Sc Plant Biology and Plant Biotechnology

1. Students will be able to assess the different groups of plants, their structural organization and functional aspects and communicate effectively to people the diversity in nature.

2. Students can evaluate the need and impact of plants in the environment, effect of environmental toxicants on plants and apply methodologies and techniques for conservation, utilization and sustainable development.

3. Students can critically think and utilize the acquired knowledge and intellectual skills of Botany and Plant Biotechnology to connect interdisciplinary aspects and to broadcast technological\changes in various fields of science.

4. Students apply scientific knowledge and statistical tools for the research outcomes using recent methods and approaches.

5. Students can integrate and apply all plant breeding techniques and molecular biological technologies in the field of agriculture, food industry and pharmacology for the betterment of human health and socio-economic status of the country.

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS) CHENNAI -08

UNDERGRADUATE PROGRAMME PROFILE
DEPARTMENT OF PLANT BIOLOGY AND PLANT BIOTECHNOLOGY
COURSE CODES AND CREDITS
(For Students Joining the Course from 2021 – 2022 Onwards)

TOTAL MINIMUM CREDITS: 140 **TOTAL TEACHING HOURS: 180**

PART	CORE/ ALLIED/ ELECTIVE	TITLE OF THE PAPER	CODE	L	T	P	H	C	CA	SE	MM
		I SEMESTER									
I	**Language**	**Tamil/Hindi/French/Sanskrit**					5hr/Week	3	**40**	**60**	**100**
II	**English**	**Communicative English**					5hr/Week	3	**40**	**60**	**100**
III	**Core 1**	Plant Diversity 1-(Algae, Fungi and Lichen)	PB21/1C/AFL	4	3	0	7hr/Week	5	**40**	**60**	**100**
III	**Core 2**	Core Practical I	PB21/2C/PR1	0	0	2	2h/Week	-	**-**	**-**	**-**
III	**Allied 1**	Allied Botany Paper 1	PB21/1A/AB1	3	1	0	4h/Week	3	**40**	**60**	**100**
		Allied Practical	PB21/A/ABP	0	0	2	2h/Week	-	**-**	**-**	**-**
IV	**EVS**	**Environmental Studies**	UG21/1/EVS	2	0	0	2h/Week	2	**-**	**50**	**50**
IV	**Soft Skill**	**English Department-Professional English for Arts/Commerce/Physical Sciences/Life Sciences**					2h/Week	3	**-**	**50**	**50**
		II SEMESTER									
I	**Language**	**Tamil/Hindi/French/Sanskrit**					5hr/Week	3	**40**	**60**	**100**
II	**English**	**Communicative English**					5hr/Week	3	**40**	**60**	**100**
III	**Core 3**	Basics in Microbiology and Plant Pathology	PB21/2C/BMP	4	3	0	7hr/Week	5	**40**	**60**	**100**
III	**Core 4**	Core Practical I (Core1&3 theory)	PB21/2C/PR1	0	0	2	2h/Week	4	**40**	**60**	**100**
III	**Allied 2**	Allied Botany Paper 2	PB21/2A/AB2	3	1	0	4h/Week	3	**40**	**60**	**100**
		Allied Botany Practical (Covering Allied 1 and 2)	PB21/A/ABP	0	0	2	2h/Week	2	**40**	**60**	**100**
IV	**Val. Ed**	Value Education	UG21/2/VED	2	0	0	2h/Week	2	**-**	**50**	**50**
IV	**Soft Skill**	**English Department-Professional English for Arts/Commerce/Physical Sciences/Life Sciences**					2h/week	3	**-**	**50**	**50**

III SEMESTER											
I	**Language**	**Tamil/Hindi/French/Sanskrit**					5hr/Week	3	**40**	**60**	**100**
II	**English**	**Communicative English**					5hr/Week	3	**40**	**60**	**100**
III	**Core 5**	Bryophytes and Pteridophytes	PB21/3C/BPT	4	3	0	7h/Week	5	**40**	**60**	**100**
III	**Core 6**	Core Practical II	PB21/4C/PR2	0	0	2	2h/week	-	**-**	**-**	**-**
III	**Allied 3**	Allied Phytochemistry Paper 1	PB21/3A/APC	3	1	0	4h/week	3	**40**	**60**	**100**
		Allied Phytochemistry Practical	PB21/A/PYP	0	0	2	2h/Week	-	**-**	**-**	**-**
IV	**NME(1c)**	Nursery and Landscaping	PB21/3N/NLS	2	0	0	2h/Week	2	**-**	**50**	**50**
IV	**Soft Skill**	**English Department-Professional English for Arts/Commerce/Physical Sciences/Life Sciences**					2h/Week	3	**-**	**50**	**50**
IV SEMESTER											
I	**Language**	**Tamil/Hindi/French/Sanskrit**					5hr/Week	3	**40**	**60**	**100**
II	**English**	**Communicative English**					5hr/Week	3	**40**	**60**	**100**
III	**Core 7**	Gymnosperms, Paleobotany and Evolution	PB21/4C/GPE	4	3	0	7h/Week	5	**40**	**60**	**100**
III	**Core 8**	Core Practical II (Covering core 5 and 7 theory)	PB21/4C/PR2	0	0	2	2h/week	4	**40**	**60**	**100**
III	**Allied 4**	Allied Phytochemistry Paper 2	PB21/4A/APC	3	1	0	4h/week	3	**40**	**60**	**100**
		Allied Phytochemistry Practical (covering Allied 3 and 4)	PB21/A/PYP	0	0	2	2h/Week	2	**40**	**60**	**100**
IV	**NME(1c)**	Mushroom Cultivation	PB21/4N/MRC	2	0	0	2h/Week	2	**-**	**50**	**50**
IV	**Soft Skill**	**English Department-Professional English for Arts/Commerce/Physical Sciences/Life Sciences**					2h/week	3	**-**	**50**	**50**
V SEMESTER											
III	**Core 9**	Plant Morphology, Taxonomy and Economic Botany	PB21/5C/MTE	4	2	0	6h/Week	5	**40**	**60**	**100**
III	**Core 10**	Plant Anatomy and Embryology	PB21/5C/AAE	4	2	0	6h/Week	5	**40**	**60**	**100**
III	**Core 11**	Cell Biology, Genetics and Plant Breeding	PB21/5C/CGP	4	2	0	6h/Week	5	**40**	**60**	**100**
	Core 12	Core Practical III (Covering 9,10,11)	PB21/6C/PR3	0	0	7	7h/Week	-	**40**	**60**	**100**
III	**Elective I**	Bioinstrumentation and Biostatistics	PB21/5E/BIS	4	1	0	5h/Week	5	**40**	**60**	**100**
III	**Elective II**	Entrepreneurship in Mushroom Cultivation	PB21/5E/EMC	4	1	0	5h/Week	5	**40**	**60**	**100**

		VI SEMESTER									
III	**Core 13**	Plant Ecology, Biodiversity and Phytogeography	PB21/6C/EBP	3	1	0	4h/Week	4	**40**	**60**	**100**
III	**Core 14**	Molecular Biology and Plant Biotechnology	PB21/6C/MPB	3	1	0	4h/Week	4	**40**	**60**	**100**
III	**Core 15**	Plant Physiology and Plant Biochemistry	PB21/6C/PPB	3	1	0	4h/Week	4	**40**	**60**	**100**
		Core Practical III (Covering 9,10,11)	PB21/6C/PR3	0	0	7	7h/Week	4	**40**	**60**	**100**
III	**Core 16**	Core Practical IV (covering 13,14,15)	PB21/6C/PR4	0	0	7	7h/Week	4	**40**	**60**	**100**
III	**Elective III**	Horticulture	PB21/6E/HOR	4	1	0	5h/Week	5	**40**	**60**	**100**
III	**Elective IV**	Herbal Science	PB21/6E/HBS	4	1	0	5h/Week	5	**40**	**60**	**100**
III	**Elective V**	Environmental Biotechnology	PB21/6E/EBT	4	1	0	5h/Week	5	**40**	**60**	**100**
III	**Elective VI**	Aquatic Botany	PB21/6E/ABY	4	1	0	5h/Week	5	**40**	**60**	**100**
III	**Elective VII**	Computer Application and Bioinformatics	PB21/6E/CAB	4	1	0	5h/Week	5	**40**	**60**	**100**
V		**Extension Activity (Sports/NCC/NSS/ CSS/ YRC/RRC/Retract /Yoga)**		**-**	**-**	**-**	**Min60 hours**	**1**	**-**	**-**	**-**
		OPTIONAL EXTRA CREDITS									
IV	**Extra Credits**	**Self-Study (Semester V)**									
		Home Gardening	PB21/5S/HOG					**2**	**-**	**100**	**100**
		Forensic Botany	PB21/5S/FOB					**2**	**-**	**100**	**100**
		Internship (Summer Vacation after IVSemester)		**-**	**-**	**-**	**Min.14 days**	**1**	**-**	**-**	**-**

L = Lecture Hours
T = Tutorial Hours
P = Practical Hours
H = Hours per week
C = Credits
CA = Continuous Assessment
SE = Semester Examinations
MM = Maximum Marks

EVALUATION PATTERN FOR CONTINUOUS ASSESSMENT

Internal Valuation by Course Teacher/s

Part I, II, III-Theory papers

S.No.	Component	Time	Max.Marks	CA Marks
1.	TEST I	2 HRS	50 MARKS (to be converted)	10
2.	TEST II	2 HRS	50 MARKS (to be converted)	10
3.	ASSIGNMENT/SEMINAR/FIELD VISIT			10
4.	PARTICIPATORY LEARNING			10
	TOTAL			40

RUBRICS FOR CONTINIOUS ASSESSMENT

Assignment	Content/originality/Presentation/Schematic Representation and Diagram/Bibliography
Seminar	Organisation/Subject Knowledge/Visual Aids/Confidence level/presentation-Communication and Language
Field Visit	Participation/Preparation/Attitude/Leadership
Participation	Answering Questions/Clearing Doubts/Participating in Group Discussions/Regular Attendance
Case Study	Finding the Problem/Analysis/Solution/Justification
Problem Solving	Understanding Concepts/Formula and Variable Identification/Logical Sequence/Answer
Group Discussion	Preparation/Situation Analysis/Relationship Management/Information Exchange/Delivery Skills
Flipped/Blended Learning	Preparation/Information Exchange/ Group interaction/Clearing doubts

PART III- PRACTICAL PAPERS

Pattern for Continuous Assessment (Practicals)

Paper Code	Model Exam	Class work	Record	Herbarium	Field Visit	Total
PB21/2C/PR1	10	25	5	-	-	40
PB21/4C/PR2	10	25	5	-	-	40
PB21/6C/PR3	10	20	5	5	-	40
PB21/6C/PR4	10	20	5	-	5	40
PB21/A/ABP	10	25	5	-	-	40
PB21/A/PYP	10	25	5	-	-	40

PART IV NME Papers

Sem	Code	Course Title	Internal evaluation only
III	PB21/3N/NLS	Nursery and Landscaping	10/12x5=50 marks/ 2hrs
IV	PB21/4N/MRC	Mushroom Cultivation	10/12x5=50 marks/ 2hrs

CA QUESTION PAPER PATTERN-UG (THEORY)

Knowledge Level	**Section**	**Word Limit**	**Marks**	**Total**
K 1	A-5X2 marks	50	10	50
K1. K 2	B-4/6x5 marks	200	20	
K2, K 3	C-1/2x20 marks	1200	20	

END SEMESTER EVALUATION PATTERN

THEORY PAPERS (PART I, II and III) **SEMESTER I/II/III/IV/V/VI**

Double Valuation by course teacher and external examiner

Maximum Marks : 100 to be converted to 60
Passing Marks: 40

PRACTICAL PAPERS (PART III)
Semester II/IV/VI

Double Valuation by course teacher and external examiner

Maximum Marks: 100 to be converted to 60
Passing marks: 40

SEMESTER I COURSE PROFILE-PROGRAMME OF STUDY

I B.Sc PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

SEMESTER	COURSE CODE	TITLE OF THE PAPER	INST Hr / Week	CREDIT	MARKS			LTP
					CIA	EXT.	TOTAL	
I		Part -I - Language – Paper I	5	3	40	60	100	-
		Part - II - English – Paper I	5	3	40	60	100	-
Core 1	PB21/1C/AFL	Part - III - Core Main – Plant Diversity 1 – Algae, Fungi And Lichen	7	5	40	60	100	4 3 0
Core 2		Plant Diversity I - Practical	2	-	-	-	-	0 0 2
ALLIED 1	PB21/1A/AB1	Part -III – Allied Botany Paper – 1	4	3	40	60	100	3 1 0
		Allied Botany Practical	2	-	-	-	-	0 0 2
	UG21/1/EVS	Part – IV- Environmental Studies	2	2	-	-	50	2 0 0
		Part - IV - Soft Skill	2	3	-	-	50	2 0 0
		Total credits	30	**19**				

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

I B. Sc. PLANT BIOLOGY AND PLANT BIOTECHNOLOGY
SEMESTER – I

Title of the Paper: CORE 1- PLANT DIVERSITY -1 (ALGAE, FUNGI AND LICHEN)
Teaching Hours- 7 Hrs/Week (105 Hrs/semester) Course code: PB21/1C/AFL
Credits: 5 LTP: 4 3 0

Course objectives:
To enable students to

- Study the general characters of algae and its importance
- Impart knowledge to understand the different algal groups
- Know the taxonomic position, occurrence and economic importance of fungi
- Differentiate and identify the different lifecycle patterns of fungi
- Provide and understand about the diversity of Lichens and its significance

ALGAE

UNIT – I (20 Hrs)

Introduction, general characteristics, major classes, range of thallus structure, life cycle patterns and economic importance- food and feed; Agar-agar, Alginic acid and Carrageenan; Diatomite, medicine, agriculture - Biofertilizer, Bioremediation and biofuel. Classification of algae - Fritsch (1945) system.

UNIT- II (25 Hrs)

Range of structure, reproduction and life histories of the following genera: *Oscillatoria, Nostoc, Spirulina, Chlorella, Ulva, Chara, Navicula, Sargassum* and *Gracilaria*

FUNGI

UNIT – III (20 Hrs)

Occurrence, characteristics, thallus organization, nutrition and reproduction in fungi. Classification by Alexopolus and Economic importance of Fungi: Medicine, food (mushroom), biopesticides, biofertilizers and industrial - alcohol, acids, dairy products and enzymes. Harmful effects of Fungi.

UNIT – IV (25 Hrs)

Structure, reproduction and life history of the following genera.:
Rhizopus, Albugo, Aspergillus, Peziza, Agaricus.

LICHENS

UNIT – V (15 Hrs)

Thallus organization-types-Crustose, Foliose and fruticose-reproduction with reference to *Usnea*. Economic and ecological importance of Lichens.

Recommended books:

1. Vasishta. B. R. Botany for degree students- Algae. S. Chand & Co., 2014.
2. Pandey, B.P. College Botany, Vol I, S. Chand and Co., 2017.
3. Vasishta. B. R. Botany for degree students- Fungi, S. Chand & Co., 2011.
4. Sharma, O.P. A text book of fungi. Tata-McGraw hill Publications Ltd, 1989.
5. Vashista and Sinha A.K. botany for degree students-Fungi, S Chand and Co, 2014.

Reference Books:

1. Vashista, Sinha B.R., Singh, V.P., 2013, Botany for Degree students, Algae 9th revised edition, S. Chand & Company Ltd., New Delhi.
2. Pandey B.P., 2000 Revised edition, Text Book of Botany Algae, S.Chand & Company, New Delhi.
3. Sharma O.P., 1992, Text Book of Algae, Tata McGraw Hill Publication Company Ltd., New Delhi
5. Pandey B.P., 1997 College Botany Vol. I Fungi & Pathology.
6. Mehrotra, R,S and Aneja, K.R.2003. An introduction to mycology. New age International (P) Ltd, Publishers, New Delhi.
8. Fritsch. F. E. Structure and reproduction of algae Vol I and II, Cambridge University Press, 1945.
9. Smith. G. M. Cryptogamic Botany Vol I, Mc Grawhill 1955.
10. Alexopoulos. C. J and Mims. C. V. Introductory mycology. John Willey and sons,1988.
11. Sharma P.D. The fungi. Rastogi, Merrut, 1989.

E-learning resources:

1. https://www.sciencedirect.com
2. https://www.frontiersin.org
3. https://www.springer.com
4. https://www.wiley.com
5. https://www.nature.com
6. https://www.wileyindia.com/a-textbook-of-algae.html 7. https://www.ikbooks.com/books/book/life-sciences/botany/a-textbook-algae
8. https://www.kopykitab.com/Botany-For-Degree-Students-ALGAE-by-B-R-Vashishta-Dr- A-K-Sinha-Dr-V-P-Singh
9. http://www.freebookcentre.net/biology-books-download/Fungi-(PDF-15P).html

e-book references:

1. Sambamurty A.V.S.S, 2017, Textbook of Algae, Publisher I. K. International Pvt Ltd.
2. Dinabandhu Sahoo, Joseph Seckbach, 2015, The Algae World, , Springer Netherlands.
3. Sarah C. Watkinson, Lynne Boddy, Nicholas Money, 2016 , The Fungi 3rd Edition. Academic Press- Elsevier.
4. Webster, John/Weber, Roland, 2007, Introduction to Fungi , Cambridge University Press.
5. Dr. Tarek Mohamed Abdel Ghany Hussein Hosny El-Sheikh , 2016, Mycology, OMICS International.
6. Thomas H &Nash, III. 2008, Lichen Biology, Cambridge university press, 2nd Edition.
7. K. G. Mukerji, 1999, Biology of lichens, Aravali Books International.

Course Outcome

After completion of the course students will be able to

CO No.	CO Statement
CO 1	Study the reproduction and life history patterns of algae and their current applications.
CO 2	Identify and distinguish the different algal forms and thallus organization.
CO 3	Explain the distribution pattern of fungi and its uses.
CO 4	Identify the different fungal forms.
CO 5	Compare the different types of lichens and discuss its economic and ecological importance.

Key: Strongly correlated- 3, Moderately correlated- 2, Weakly correlated- 1, Not correlated- 0

Mapping of CO with PSO

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	2	2
CO3	3	3	2	2	2
CO4	3	2	2	3	3
CO5	3	2	2	3	3
Average	3	2.6	2.4	2.6	2.6

Teaching Methodology

Lecture (Chalk and Talk-OHP-LCD)
Quiz-Seminar- Group discussion
Peer Learning
Field Visits

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I B. Sc. Plant Biology and Plant Biotechnology

QUESTION PAPER TEMPLATE-THEORY

Title of the Paper: CORE 1- PLANT DIVERSITY -1 (ALGAE, FUNGI AND LICHEN) **Max Marks: 100**
Course code: PB21/1C/AFL **Time: 3 hours**

Draw diagrams wherever necessary

QUESTION PAPER PATTERN-UG

Knowledge Level	Section	Word Limit	Marks	Total
K 1	A-10X2 marks	50	20	100
K1. K 2	B-5/8x8 marks	300	40	
K2, K 3	C-2/4x20 marks	1200	40	

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS) CHENNAI – 600 008
(For the candidates admitted during the year 2021-2022 onwards)

I B. Sc Advanced Zoology and Biotechnology

SEMESTER I

Title of the Paper: ALLIED BOTANY PAPER 1 **Course code : PB21/1A/AB1**
Teaching Hours: 4 Hrs/week (60 Hrs/ semester) **Credits : 3 LTP: 3 1 0**

Course Objectives:

To enable the students to

- Study different forms of algae and their importance.
- Apply knowledge in bacteria, fungi and viruses.
- Study the characters and importance of bryophytes, pteridophytes and gymnosperms.
- Know the anatomical structure of plants.
- Study about plant embryology.

UNIT - I: ALGAE (10 Hrs)

General characters of Algae - Structure, Life history of the following genera - *Nostoc, Chlorella, Sargassum* and *Polysiphonia* and Economic importance of Algae.

UNIT - II: FUNGI, BACTERIA & VIRUS (15 Hrs)

General characters of fungi, structure and life history of the following genera – *Mucor*, *Yeast, Agaricus* and Economic importance of fungi.

Bacteria - general characters, structure and Fission, Endospore, Genetic recombination in bacteria and Economic importance.

Virus - general characters. Structure of TMV and Bacteriophage.

UNIT - III: BRYOPHYTES, PTERIDOPHYTES AND GYMNOSPERMS (15 Hrs)

General characters and Economic importance of Bryophytes, Structure and life history of *Funaria*.

General characters and Economic importance of Pteridophytes, Structure and life history of *Lycopodium*.

General characters and Economic importance of Gymnosperms, Structure and life history of *Cycas*.

Economic importance of Gymnosperms**.**

UNIT - IV: ANATOMY (10 Hrs)

Tissues- Simple and Complex, Primary structure of dicot stem and dicot root. Normal secondary thickening of dicot stem. Lenticels - annual rings. Monocot stem and root. Dicot and Monocot leaf.

UNIT - V: EMBRYOLOGY (10 Hrs)

Structure of mature anther and ovule - Types of ovules – Orthotropous Anatropous and Campylotropous. Structure of male and female gametophyte, double fertilization, structure of dicotyledonous and monocotyledonous seeds.

Recommended books:

1. Narayanaswami. R.V. and K.N. Rao., Outlines of Botany, 1984.
2. Vasishta.B.R., Algae. S. Chand and Co. Pvt. Ltd. New Delhi, 2014.
3. Vasishta.B.R., Fungi. S. Chand and Co. Pvt. Ltd. New Delhi, 2011.
4. Vasishta.B.R., Bryophyta. S. Chand and Co. Pvt. Ltd. New Delhi, 2004.
5. Vasishta.B.R., Pteridophyta. S.chand and Co. Pvt. Ltd. New Delhi.2004.
6. Vasishta.B.R., Gymnosperms. S.chand and Co. Pvt. Ltd. New Delhi.2004.
7. Stanier, Y.R. General Microbiology. 4th edition, McMillan Educational Ltd. London. 1987.
8. Verma P.S.A and V.K. Agarwal. Cell Biology, Genetics, Molecular Biology, Evolution and Ecology. S.Chand & Co. Pvt. Ltd., 2004.
9. Dubey R.C. A text book of biotechnology, S.Chand & Co., Ltd., New Delhi, 1993.

E-Learning resources:

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

e-book references:

1. Sambamurty A.V.S.S, Textbook of Algae, 2017, Publisher I. K. International Pvt Ltd.
2. Sarah C. Watkinson, Lynne Boddy, Nicholas Money. 2016 , The Fungi 3rd Edition. Academic Press- Elsevier.
3. S. Srivastava, Understanding Bacteria, 2003, Springer Science & Business Media.
4. Rashid. A, An Introduction to Bryophyta.1998, Vikas Publication House Pvt Ltd; First edition.
5. Sharma, Pteridophytes and Gymnosperms, 2012. Tata McGraw-Hill Education private limited.
6. Thomas D. Pollard & William C. Earnshaw & Jennifer Lippincott-Schwartz & Graham Johnson. 2017. Cell Biology.
7. Ricroch, Agnes; Fleischer, Shelby; Chopra, Surinder , Plant Biotechnology. Experience and Future Prospects. 2014 ,Redaktion: . Springer International Publishing.
8. H. S. Chawla, Introduction to Plant Biotechnology. 2002, - Technology & Engineering. Science Publishers.

Course outcomes

After completion of the course students will be able to

CO No.	CO statement
CO1	Explain the characters, structure and life history of some common algae and their economic importance
CO2	Explain the characters, life history and significance of different fungi, bacteria and viruses
CO3	Apply the knowledge on structure and reproductive study of few forms of bryophytes, pteridophytes and gymnosperms and economic importance
CO4	Explain the primary and secondary anatomical structure of roots, stems and leaves of plants
CO5	Apply knowledge on structure of anther, ovule and seeds

Mapping of CO with PSO

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	2	2	3	3
CO2	2	2	2	3	3
CO3	2	2	2	3	3
CO4	2	2	2	2	2
CO5	3	3	3	3	3
Average	2.2	2.2	2.2	2.8	2.8

Teaching Methodology

Lecture (Chalk and Talk-OHP-LCD)
Problem Solving
Quiz-Seminar-Group discussion

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS) CHENNAI – 600 008
(For the candidates admitted during the year 2021-2022 onwards)

B.Sc. DEGREE EXAMINATION

I B. Sc Advanced Zoology and Biotechnology

QUESTION PAPER TEMPLATE-THEORY

Title of the Paper: ALLIED BOTANY PAPER 1 **Max Marks: 100**
Course code: PB21/1A/AB1 **Time: 3 hours**

Draw diagrams wherever necessary

QUESTION PAPER PATTERN-UG

Knowledge Level	Section	Word Limit	Marks	Total
K 1	A-10X2 marks	50	20	100
K1, K 2	B-5/8x8 marks	300	40	
K2, K 3	C-2/4x20 marks	1200	40	

SEMESTER II COURSE PROFILE-PROGRAMME OF STUDY
I B.Sc PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

SEMESTER	COURSE CODE	TITLE OF THE PAPER	INST Hr / Week	CREDIT	MARKS			LTP
					CIA	EXT.	TOTAL	
II		Part - I - Language – Paper II	5	3	40	60	100	-
		Part - II - English – Paper II	5	3	40	60	100	-
Core 3	PB21/2C/BMP	Part - III - Core Main- Basics In Microbiology and Plant Pathology	7	5	40	60	100	4 3 0
Core 4	PB21/2C/PR1	Core Practical I (covering core 1 & 3)	2	4	40	60	100	0 0 2
ALLIED 2	PB21/2A/AB2	Part -III - Allied Botany Paper – 2	4	3	40	60	100	3 1 0
	PB21/A/ABP	Allied Botany Practical (Covering Allied 1 & 2)	2	2	40	60	100	0 0 2
	UG21/2/VED	Value Education	2	2	-	-	50	2 0 0
		Part - IV - Soft Skill	2	3	-	-	50	2 0 0
		Total credits	30	**25**				

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS) CHENNAI – 600 008
(For the candidates admitted during the year 2021-2022 onwards)
SEMESTER – II

I B.Sc. PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

Title of the Paper: CORE 3- BASICS IN MICROBIOLOGY AND PLANT PATHOLOGY
Teaching Hours- 7 Hrs/Week (105 Hrs/Semester) **Course code: PB21/2C/BMP**
Credits: 5 LTP: 4 3 0

Course Objectives:
Enable the students to

- Study about the different types of microorganisms and their importance
- Provide knowledge on the basic sterilization techniques and control methods
- Impart knowledge on antibiotics and microbiology of water, milk and food products
- Understand the principles of plant pathology
- Gain knowledge about various plant diseases and their control.

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UNIT – I **(20 Hrs)**
History and scope of microbiology – introduction to microbial world - Protozoa, classification of microorganisms- Whittaker's Five Kingdom concept- Bacteria-general structure and multiplication. Viruses – Bacteriophages, Mycophages, Cyanophages. Viroids and prions their general structure and multiplication. Mycoplasma structure and multiplication. Economic importance of Bacteria.

UNIT - II **(15 Hrs)**
Cleaning and sterilization of glassware, media. Isolation techniques- Pour plate – Spread plate – Streak plate – Serial dilution – Types of culture media- staining techniques – simple and differential staining. Control of microbes – physical, chemical and biological methods.

UNIT – III **(15 Hrs)**
Fermentation - (Dairy product – Cheese) (antibiotic production – Streptomycin). Microbiology of air - Microbiology of potable water - MPN – technique - Microbiological analysis of dairy products. Food preservation methods.

UNIT – IV **(25 Hrs)**
A brief history of plant pathology; Principles of Plant pathology. Symptomology – Study of infection – entry of fungal, bacterial & viral pathogens. Role of toxins (Wild fire toxin &Victorin) & Enzymes (cellulases and chitinases) Host defense – Structural (Formation of cork and abscission layers) and biochemical (Phytoalexins). Disease Control Methods – Physical, Chemical and Biological– (*Trichoderma* & *Pseudomonas)*

UNIT – V **(30 Hrs)**

Causative organisms, symptoms, disease cycle and control measures of the following diseases

1) Blast of Paddy
2) Wilt of cotton
3) Citrus canker
4) Powdery mildew of Grapes
5) Red rot of sugar cane
6) Leaf spot disease of ground nut
7) Little leaf of brinjal
8) Bunchy top of banana
9) Early blight of potato
10) Black rust of Wheat
11) Root knot of tomato

Recommended books:

1. R.C. Dubey and D.K. Maheswari. A Text Book of Microbiology. S.Chand & Company Ltd. 2013.
2. M.J. Pelczar, R.D.Reid . Microbiology. McGraw Hill, Inc. 1998.
3. P. Tauro, K.K. Kapoor and K.S. Yadav. An Introduction to Microbiology. Wiley Eastern Ltd.1986.
4. V.Singh, P.C.Pandey and D.K. Jain. A text Book of Botany. Rastogi Publications.2009.
5. Purohit, S.S. 2008. Microbiology Fundamentals & Applications, Rastogi Publications, Meerut.
6. Mehrotra .R.S. Plant Pathology. Tata Mc-Graw Hill Publishing Co. Ltd, 2017.
7. Pandey B.P. –Plant Pathology-Pathogen & Plant Disease, 2011.
8. A.V.S.S. Sambamurthy-A text book of Plant Pathology, 2006
9. Singh.R.S. Plant diseases. Oxford and IBH Publishing Co., 2009.

Reference Books:

1. Agrios. Plant Pathology,2008. Elsivier
2. Adams, M.R. and M.O. Moss. Food Microbiology. 1995. New Age International (p) Ltd., Chennai.
3. Agarwal, Industrial Microbiolgy: Fundamentals and Application, 2006. IBD publishers,, New Delhi.
4. Ananthanarayanan, R and C.K.J. Panikar. Text book of Microbiology, 6th Edition, 2000. Orient Longman.
5. Atlas, R.M. . Microbiology- Fundamental and Applications. 1989. McMillan Publishing Company. New York.
6. Cruger F. and Anneliese Crueger, Biotechnology: Industrial Microbiology. 2000. Panima Publications.
7. O.P Sharma Fungi and Allied microbes. 2011. Tata McGraw Hill Pvt. Co.
8. P.D. Sharma. Fungi and Allied organisms. 2005. Narosa Publishing house Ltd.
9. P.D. Sharma . Plant Pathology. 2006Narosa Publishing house Ltd.
11. Madigan, M.T. and J.N. Martinko. Brock Biology of Microorganisms.11th edition,2006. Pearson Education, inc.Upper Saddle River, USA
12. Mackane, L. and J. kandel, . Microbiolgy-Essential and applications. 1996.

E-Learning resources:

1. http://www.microbiologysociety.org
2. http://www.freebookcentre.net/biology-books-download/A-text-book-of-mycology-and-plant-pathology.html
3. http://www.freebookcentre.net/Biology/Mycology-Books.html

e-book references:

1. Amita Jain, Parul Jain. Essentials of Microbiology, 2019. Elsevier Health Sciences.
2. Geeta Sumbali, R S Mehrotra. Principles of Microbiology, 2009. Tata McGraw-Hill.
3. George N. Agrios, 2005, Plant Pathology , Elsevier Science- Academic Press.
4. Ravichandra, N. G. Fundamentals of Plant pathology,2013. PHI Learning Pvt. Ltd.

Course Outcome

After completion of the course students will be able to

CO No.	CO Statement
CO 1	Identify the different types of microorganisms and discuss the economic importance of bacteria.
CO 2	Acquire skills on isolation and staining techniques
CO 3	Explain the role of microbes in food and pharmaceuticals applications and to examine the quality of water and milk.
CO 4	Discuss the toxins produced by different microorganisms and the interaction with the host plants
CO 5	Outline the various plant diseases and their impact on agriculture and measures adopted to control plant diseases

Mapping of CO with PSO

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	3	2
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	2	3	3
CO5	2	3	2	3	2
Average	2.8	3	2.4	3	2.6

Teaching Methodology

Lecture (Chalk and Talk-OHP-LCD)
Videos
Quiz-Seminar-Group discussion
Peer Learning

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS) CHENNAI – 600 008
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B.Sc. DEGREE EXAMINATION

I B.Sc. PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

QUESTION PAPER TEMPLATE-THEORY

Title of the Paper: CORE 3- BASICS IN MICROBIOLOGY AND PLANT PATHOLOGY
Course Code: PB21/2C/BMP **Max. Marks: 100**
Time: 3 Hours

Draw diagrams wherever necessary

QUESTION PAPER PATTERN-UG

Knowledge Level	Section	Word Limit	Marks	Total
K 1	A-10X2 marks	50	20	100
K1. K 2	B-5/8x8 marks	300	40	
K2, K 3	C-2/4x20 marks	1200	40	

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS) CHENNAI – 600 008
(For the candidates admitted during the year 2021-2022 onwards)

SEMESTER II

I B. Sc Advanced Zoology and Biotechnology

Title of the Paper: ALLIED BOTANY PAPER 2 **Course code : PB21/2A/AB2**
Teaching Hours: 4 Hrs/week (60 Hrs/Semester) **Credits : 3 LTP: 3 1 0**

Course objectives

To enable the students to

- Identify flowering plants based on their morphological characters.
- Classify plants and to know their economic importance.
- Impart knowledge on cell organelles and cell division
- Understand the physiology of plants.
- Understand the fundamental concepts of genetics and plant tissue culture.

UNIT - I: MORPHOLOGY OF FLOWERING PLANTS (10 Hrs)

Morphology - Modifications- root, stem. Leaf – types, venation, phyllotaxy. Inflorescence – racemose cymose Special Types - Cyanthium and Hypanthodium. Fruits: Types – Fleshy – Simple and Aggregate, Dry – Dry dehiscent and Dry indehiscent.

UNIT - II: TAXONOMY (15 Hrs)

General outline of Bentham and Hooker's system of classification Study of the range of characters and plants of economic importance in the following families: Annonaceae, Cucurbitaceae, Rubiaceae, Apocynaceae, Amarantaceae and Liliaceae.

UNIT - III: CELL BIOLOGY (10 Hrs)

Prokaryotic and Eukaryotic cell. Cell organelles - ultrastructure and function of chloroplast, mitochondria and nucleus. Cell division - mitosis and meosis and its significance.

UNIT - IV: PLANT PHYSIOLOGY (10 Hrs)

Absorption of water – Active and passive transport. Photosynthesis - Light reaction - Calvin cycle, Respiration - Glycolysis - Kreb's cycle . Nitrogen cycle.

UNIT - V: GENETICS AND PLANT BIOTECHNOLOGY (15 Hrs)

Mendelism - Monohybrid & dihybrid cross - Test cross - Back cross. Law of dominance, Law of Segregation, Incomplete dominance. Law of independent assortment.

Plant tissue culture - sterilization procedure and *in vitro* culture methods. Callus regenerations and its applications in Biotechnology (Agriculture, Horticulture and Medicine).

Recommended books

1. Narayanaswami. R.V. and K.N. Rao., Outlines of Botany, 1984.
2. Pandey. B.P. , Taxonomy Of Angiosperms. S.Chand and Co. Pvt Ltd. New Delhi, 2001.
3. Pandey B.P. Plant Anatomy. S. Chand and Co. Pvt Ltd. New Delhi, 2012.
4. Bhojwani.S.S. and Bhatnagar . S.P., The Embryology Of Angiosperms, Vikas Publications House Private ltd., 1981.
5. Jain. V. K. Fundamentals of Plant Physiology. S. Chand and Co. Pvt. Ltd. New Delhi, 2017.

E-Learning resources:

1. https://www.sciencedirect.com
2. http://khanacademy
3. https://books.google.co.in/books/about/Plant_Taxonomy.html?id=0bYs8F0Mb9gC&redir_ esc=y
4. https://books.google.co.in/books/about/PLANT_TAXONOMY_2E.html?id=Roi0lwSXFn UC&redir_esc=y
5. https://archive.org/details/plantanatomy031773mbp
6. https://www.amazon.in/Embryology-Angiosperms-6th-S-P-Bhatnagar-ebook/dp/B00UN5KPQG
7. https://www.crcpress.com/Plant-Physiology/Stewart-Globig/p/book/9781926692692

e-book references:

1. Quicke, Donald L.J. (Ed.). Principles and Techniques of Contemporary Taxonomy Editors: Springer Book Archive, 1993. Springer Netherlands.
2. S. K. Sinha. A Textbook of Plant Anatomy. 2013. Centrum Press.
3. H. P. Sharma. Plant Embryology, 2009. Alpha Science International.

Course outcomes

After completion of the course students will be able to

CO No.	CO statement
CO1	Identification of flowering plants based on their morphological characters
CO2	Use the classification of plants and their economic importance
CO3	Identify the ultra structure of cell, function of cell organelles and cell division
CO4	Utilize knowledge on the metabolic activities of plants
CO5	Utilize the concepts of Mendelism, plant tissue culture techniques and applications of biotechnology in different fields

Mapping of CO with PSO

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	3	3	3	3
CO2	3	3	3	3	3
CO3	1	3	1	3	3
CO4	1	3	3	3	3
CO5	3	3	3	3	3
Average	1.8	3	2.6	3	3

Teaching Methodology

Lecture (Chalk and Talk-OHP-LCD)
Quiz-Seminar-Group discussion
Peer Learning

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS) CHENNAI – 600 008
(For the candidates admitted during the year 2021-2022 onwards)

I B. Sc Advanced Zoology and Biotechnology

QUESTION PAPER TEMPLATE-THEORY

Title of the Paper: ALLIED BOTANY PAPER 2 **Max Marks: 100**
Course code : PB21/2A/AB2 **Time :3 Hours**

Draw diagrams wherever necessary

QUESTION PAPER PATTERN-UG

Knowledge Level	Section	Word Limit	Marks	Total
K 1	A-10X2 marks	50	20	100
K1. K 2	B-5/8x8 marks	300	40	
K2, K 3	C-2/4x20 marks	1200	40	

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS) CHENNAI – 600 008
(For the candidates admitted during the year 2021-2022 onwards)

SEMESTER – II

I B.Sc. PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

Title of the Paper: CORE PRACTICAL I (COVERING CORE 1 & 3)
Teaching Hours: 2Hrs/week **Course code: PB21/2C/PR1**
Credits: 4 LTP: 0 0 2

Course objectives

To enable the students to

- Identify and understand the different algae, fungi and lichen groups by comparing the external and internal structure of the plant body and their reproductive organs.
- Differentiate and identify the different types of microorganisms.
- Impart knowledge on the basic sterilization and isolation techniques used in microbiology.
- Gain knowledge on the etiology of plant diseases.
- Provide knowledge on various biological pesticides.

Plant diversity

1. Micro preparation of the types prescribed in the syllabus.
2. Identifying the micro slides relevant to the syllabus.
3. Identifying types of algal mixture.
4. Morphological study of Algae, Fungi and Lichens.
5. Economic Importance- Cultivation of Mushroom (Demonstration)

Microbiology

1) Cleaning and sterilization of glassware.
2) Preparation of different types of culture media.
3) Isolation of pure culture – streak, spread and pour plate methods.
4) Staining of bacteria – Simple staining, Gram staining.
5) Potability of Drinking water – MPN.
6) MBRT of milk.
7) Isolation of microbes from spoiled food items.
8) Photographs of micro organisms prescribed in the syllabus.

Plant Pathology

Study of the following diseases

9) Blast of Paddy.
10) Wilt of Cotton.
11) Citrus canker.

12) Red rot of sugar cane.
13) Leaf spot disease of ground nut - section
14) Bunchy top of Banana.
15) Black rust of wheat - section
16) Isolation of fungal pathogen – *Cercospora* Sp.
17) Biological pesticides.
18) White rust of *Albugo*

Course Outcome

After completion of the course students will be able to

CO No.	CO Statement
CO 1	Compare the vegetative and reproductive structures of different forms through sectioning.
CO 2	Identify the different types of microorganisms and its importance.
CO 3	Demonstrate the preparation of nutrient media and techniques used for isolation of microorganisms.
CO 4	Assess the quality of the basic commodities that include water, milk and food products.
CO 5	Identify the various plant diseases, their causal organism and control measures.

Teaching Methodology
Lecture (Chalk and Talk-OHP-LCD)
Field Visits

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS) CHENNAI – 600 008
(For the candidates admitted during the year 2021-2022 onwards)

SEMESTER – II

I B. Sc Plant Biology and Plant Biotechnology

QUESTION PAPER TEMPLATE- PRACTICAL

Title of the Paper: CORE PRACTICAL I (COVERING CORE 1 &3) Max marks -100

Course Code- PB21/2C/PR1 **Time- 3 hours**

I. Cut transverse sections of A, B, C & D stain and mount in glycerine. Identify giving reasons. Draw diagrams. Leave the slide for valuation.

(4 x 6 = 24 marks)

II. Make suitable micropreparation of E. Identify giving reasons. Draw labeled sketches. Submit the slide for valuation.

(5 marks)

III. Identify any 2 specimens given in the algal mixture F. Draw labeled diagrams. Notes not necessary.

(4 marks)

IV. Name the genus, group, morphology of the given part of G, H, I, J, & K.

(15 marks)

V. Cut transverse of L and leave the slide for valuation. Identify the causal organism and disease. Write about the symptoms and control measures.

(12 marks)

VI. Write critical notes on M, N, O, P, Q & R. Draw labelled diagrams.

(6 x 5 = 30 marks)

Practical - 90 Marks
Record - 10 Marks
Total - 100 Marks

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS) CHENNAI – 600 008
(For the candidates admitted during the year 2021-2022 onwards)

SEMESTER – II

I B. Sc Plant Biology and Plant Biotechnology

Title of the Paper: **ALLIED BOTANY PRACTICAL (COVERING ALLIED PAPER 1 &2)**

CourseCode-PB21/A/ABP

Teaching Hours: 2 Hrs/week **Credits: 2 LTP: 0 0 2**

Course objectives

To enable the students to

- Identify the angiospermic plants to their family.
- Impart knowledge on physiology of plant.
- Learn to dissect a flower.
- Impart knowledge on the morphology and anatomy of different plant groups.

1. To make suitable micro preparation, describe and identify materials of Algae, Fungi, Bryophyte, Pteridophyte and Gymnosperm prescribed.
2. Micro photographs of cell organelles ultra structure.
3. Simple genetic problems
4. To describe in technical terms, plants belonging to any of the family prescribed and to identify the family.
5. To dissect a flower, construct floral diagram and write floral formula
6. Demonstration experiments
7. Effect of varying wavelength of light on the rate of photosynthesis of an aquatic plant by using wilmott's bubble counter. (Two colour papers only – red and blue).
8. Comparison of rate of Respiration of different respiratory substrate by using by Ganong's respiroscope.
9. To make suitable micro preparations of anatomy materials prescribed in the syllabus.
10. Spotters- Algae, Fungi, Bryophytes, Pteridophytes, Gymnosperms and Angiosperm anatomy, Embryology, Cell biology and Biotechnology.

Course Outcome

After completion of the course students will be able to

CO No.	CO Statement
CO 1	Identify the plants using technical terms.
CO 2	Explain the Physiology of plants.
CO 3	Analyse the various floral parts.
CO 4	Identify the forms of Algae, Fungi, Bryophytes, Pteridophytes and Gymnosperms.
CO5	Apply the knowledge in understanding the basics of Anatomy, Embryology, Cell Biology and Plant Biotechnology

Teaching Methodology

Lecture (Chalk and Talk-OHP-LCD)

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS) CHENNAI – 600 008
(For the candidates admitted during the year 2021-2022 onwards)

SEMESTER – II

I B.Sc. Advance Zoology and Biotechnology

QUESTION PAPER TEMPLATE- PRACTICAL

Title of the Paper: ALLIED BOTANY PRACTICAL (COVERING ALLIED PAPER 1 & 2) **Max Marks : 100**

Course Code : PB21/A/ABP **Time : 3 hrs**

I) Cut transverse section of **A and B .** Stain and mount in glycerine. Identify giving reasons. Draw diagrams. Submit the slide for valuation. **(2 x 9 = 18 Marks)**

II) Refer **C** and **D** to their respective families giving reasons and describe in technical terms. Draw diagrams of Longitudinal section of flower and transverse section of Ovary only.
(2x 10= 20 Marks)

III) Solve the given problem in Genetics **E** and **F**. **(2 x 4 = 8 Marks)**

IV) Comment on the set up **G**. **(8 Marks)**

V) Write critical notes on **H, I, J,K, L and M.** **(6 x 5 = 30 Marks)**

VI) Name the Genus, Species and Family of **N** and **O.** **(2 x 3 = 6 Marks)**

Practicals – 90 Marks
Record - 10 Marks
Total - 100 Marks

SEMESTER III COURSE PROFILE-PROGRAMME OF STUDY

II B.Sc PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

SEMESTER	COURSE CODE	TITLE OF THE PAPER	INST Hr / Week	CREDIT	MARKS			LTP
					CIA	EXT.	TOTAL	
III		Part – I – Language – Paper III	5	3	40	60	100	-
		Part – II – English – Paper III	5	3	40	60	100	-
Core 5	PB21/3C/BPT	Part – III – Core Main –Bryophytes & Pteridophytes	7	5	40	60	100	4 3 0
Core 6	PB21/4C/PR2	Part – III – Core Main –Bryophytes & Pteridophytes – Practical –II	2	-	-	-	-	0 0 2
ALLIED 3	PB21/3A/APC	Part -III – Allied Phytochemistry Paper – 1	4	3	40	60	100	3 1 0
	PB21/A/PYP	Allied Phytochemistry Practical	2	-	-	-	-	0 0 2
	PB21/3N/NLS	Part – IV NME 1C Nursery and Landscaping	2	2	-	-	50	2 0 0
		Part-IV- Soft Skill	2	3	-	-	50	2 0 0
		Total credits	30	**19**				

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS) CHENNAI – 600 008
(For the candidates admitted during the year 2021-2022 onwards)

SEMESTER – III

II B.Sc. PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

Title of the Paper: CORE 5- BRYOPHYTES AND PTERIDOPHYTES
Teaching Hours- 7 Hrs/Week (105 Hrs/Semester) **Course code: PB21/3C/BPT**
Credits: 5 LTP: 4 3 0

Objectives:
To enable students to

- Study the general characters of bryophytes its importance.
- Impart knowledge to understand the different bryophytes.
- Know the general characters and type forms of pteridophytes.
- Differentiate and identify few forms of pteridophytes and the lifecycle patterns.
- Gain knowledge to know different stele types and organization of the sporangia.

UNIT- I (Bryophytes) **(20 Hrs)**
General characters – structure, reproduction and alternation of generation of Bryophytes, classification (Watson – 1963) and range of thallus organization, life cycle, origin and evolution of Bryophytes. Spore dispersal mechanisms in bryophytes. Economic importance.

UNIT- II **(20 Hrs)**

General characters of Hepaticopsida, Anthoceratopsida and Bryopsida.
Detailed study of structure and reproduction of

a) *Riccia* b) *Anthoceros*, c) *Polytrichum* (no developmental studies)

UNIT- III (Pteridophytes) **(20 Hrs)**

General characters, classification (Reimer – 1954), Apogamy, Apospory, Homospory, Heterospory and Seed habit. Origin and evolution of Pteridophytes. Economic importance.

UNIT- IV **(30 Hrs)**

Detailed study of morphology, anatomy, reproduction and life cycle of following genera:-

a) *Lycopodium*, b) *Equisetum*, c) *Dicranopteris*, d) *Marsilea* (no developmental studies)

UNIT- V **(15 Hrs)**

Stele- Types and evolution, Sporangia in Pteridophytes -organization of cone - cone, sori and sporocarp - evolution.

Recommended books:

1. Vasishta. B. R. Botany for degree students- Bryophyta, S. Chand and Co, 2010.
2. Vasishta. P. C. Botany for degree students- Pteridophyta, S. Chand and Co, 2010.
3. Vashishta B.R., A. K. Sinha and Adharsh Kumar. Botany for degree students- Bryophyta, S. Chand and Co., 2014.
4. Vashishta B.R., A. K. Sinha and Anil Kumar. Botany for degree students- Pteridophyta, S. Chand and Co., 2014.

Reference Books

1. Parihar, N.S. 2013. An introduction to Embryophyta, Vol.I– Bryophyta. Central Book Depot, Allahabad.
2. Parihar, N.S. 1996. The Biology and Morphology of Pteridophytes. Central Book Depot, Allahabad
3. Pandey B.R., 1977 – A text book of Botany, Pteridophytes and Gymnosperms, K. Nath & Meerut.
4. Parihar. N.S., 1967 – An introduction to Embryophyta, Vol.III – Pteriodophyta, Central book depot, Allahabad.
5. Smith.G.M., 1955- Cryptogamic Botany, Volume-II– McGraw Hill
6. Sporne.K.R., 1976 – Morphology of Pteriodophytes, 4th edition, B.I.Publication.
7. Prem Puri. 1973. Bryophytes-A broad perspective, Atma Ram & Sons, New Delhi.
8. Puri, P. 1980. Bryophytes. Atma Ram & Sons, New Delhi.

E-Learning resources:

1. https://www.sciencedirect.com
2. https://www.khanacademy.org/
3. http://www.bryoecol.mtu.edu/
4. https://www.amazon.in/Introduction-Bryophytes-Alain-Vanderpoorten ebook/dp/B007NWFWQK
5. http://scitec.uwichill.edu.bb/bcs/bl14apl/bryo1.htm
6. https://www.toppr.com/guides/biology/plant-kingdom/pteridophytes/
7. http://www.bsienvis.nic.in/Database/Pteridophytes-in-India_23432.aspx

e-book references:

1. Alain Vanderpoorten, Bernard Goffinet. Introduction to bryophytes, 2009. Cambridge. New York; Melbourne : Cambridge University Press.
2. Annie Ragland, Kumaresan.V, Arumugam, N; Bryophytes and Pteridophytes. . 2015. Publisher: Saras Publication, Edition.
3. Rashid. A. An Introduction to Bryophyta,1998. Vikas Publication House Pvt Ltd; First edition

4. Sharma. Pteridophytes and Gymnosperms, 2012. Tata McGraw-Hill Education private limited.
5. Rashid A. An Introduction to Pteridophyta, Diversity, Development & Differentiation, , 1919. Publisher: Vikas Publishing House Pvt Ltd.

Course Outcome

After completion of the course students will be able to

CO No.	CO Statement
CO 1	Outline the characteristics of bryophytes their phylogeny, habit, distribution and economic importance.
CO 2	Compare the vegetative and reproductive structure of bryophytes.
CO 3	Discuss origin, reproduction and evolution of pteridophytes
CO 4	Discuss the life cycle patterns of Pteridophytes
CO 5	Compare the stele types and spore producing organs.

Mapping of CO with PSO

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	3	2
CO2	3	2	3	2	3
CO3	3	3	3	3	3
CO4	3	3	2	3	2
CO5	2	2	2	1	2
Average	2.8	2.6	2.4	2.4	2.4

Teaching Methodology

Lecture (Chalk and Talk-OHP-LCD)
Quiz-Seminar-Group discussion
Peer Learning
Field Visits

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS) CHENNAI – 600 008
(For the candidates admitted during the year 2021-2022 onwards)

B.Sc. DEGREE EXAMINATION

II B.Sc. PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

QUESTION PAPER TEMPLATE-THEORY

Title of the Paper: CORE 5- BRYOPHYTES AND PTERIDOPHYTES
Course Code: PB21/3C/BPT **Max.Marks:100**
Time: 3 Hours

Draw diagrams wherever necessary

QUESTION PAPER PATTERN-UG

Knowledge Level	Section	Word Limit	Marks	Total
K 1	A-10X2 marks	50	20	100
K1. K 2	B-5/8x8 marks	300	40	
K2, K 3	C-2/4x20 marks	1200	40	

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS) CHENNAI – 600 008
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SEMESTER –III
II B.Sc. PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

Title of the Paper: ALLIED PHYTOCHEMISTRY PAPER 1
Teaching Hours: 4 hrs/ week (60 Hrs/ Semester) **Course code: PB21/3A/APC**
Credits: 3 LTP: 3 1 0

Objectives:
To enable the students to

- Understand the scope and importance of phytochemicals.
- Explain the principles of phytochemistry.
- Enhance the knowledge of the students in understanding the plant metabolites
- Impart knowledge Phytoconstituents and their significance.
- Apply the fundamental knowledge gained in pharmaceutical industries.

UNIT 1: **(10 Hrs)**

Phytochemistry – Definition, scope and its importance. pH- Definition and determination, Preparation of solutions- normality, molarity and molality, Buffer and Electrolytes. Structure of atom, Bond- Hydrogen Bond- Chemical Bond- Types -Electrovalent, Covalent and Co- ordinate.

UNIT 2: **(10 Hrs)**

Plant metabolites- Primary and Secondary – Collection, Processing and Method of extraction – cold and Soxhlet method Definition & Examples,

Carbohydrates- Definition and Classification, Structure and Properties of the following:

a) Monosaccharides- Glucose and Fructose
b) Disaccharides- Lactose and Sucrose
c) Polysaccharides- Starch and Cellulose

UNIT 3: **(10 Hrs)**

Lipids- Definition and Classification, Structure and Properties of the following:

a) Simple Lipid (Saturated and Unsaturated)
b) Compound Lipid (Phospholipids & Lecithin)
c) Derived Lipid (Ergosterol and stigmasterol)

UNIT 4: **(20 Hrs)**

Natural Products- Alkaloids- Definition, Classification, Sources and uses eg. Colchicine and Caffiene- Source, extraction and uses. Glycosides-Definition Classification, Sources and uses eg. Andrographolide and Amygdalin- Source, extraction and biological significance.

UNIT 5: **(10 Hrs)**

Natural products – Steroids – Definition, Classification, Sources and Uses eg. Digitoxin - Source, extraction and uses. Terpenoids- Definition Classification, Sources and Uses eg. Camphor and Eugenol - Source, extraction and biological significance.

Recommended books:

1. Jain.J.L. Fundamentals of Biochemistry, Vijaya Printers, Chennai, 2016
2. Agarwal O.P. Chemistry of Organic products. Volume 1, Goel Publishing house, 2014.
3.Gurdeep R. Chatwal, Organic Chemistry of Natural Products Volume 2, Himalaya Publishing House, 1997.
4.Mathew George, Lincy Joseph.Textbook of Pharmaceutical Chemistry.VivaBooks Pvt.Ltd. 2009.

Reference Books:

1. Stryer.J. Biochemistry.W.H. Freeman and Co.2015.
2. Lehninger.A.L. Biochemistry. CBS Publications, 2012.
3. Sujata.V. Bhat et al. Natural Products Chemistry and Applications. Narosa Publishing House Pvt Ltd.2009.
4. Roseline. P.Pharmacognosy. MJP Publishers 2011.
5. Kokate.C.K., Purohit, Gokhale. Pharmacognosy. Nirali Prakashan Publication. 2007.
6. Rumit M. Shah, Rupesh T. Nayak. Pharmacognosy. Global Academic Publishers and Distributors 2012.

E-Learning resources:

https://www.khanacademy.org/

e-book references:

1. Pharmacognosy, Nanomedicine, and Contemporary Issues,Volume (2) 2018. Apple Academic Press.
2. Herbert J. Fromm, Mark Hargrove. Essentials of Biochemistry, 2012 Springer-Verlag Berlin Heidelberg

Course outcomes

After completion of the course students will be able to

CO No.	CO statement
CO1	Apply the basic principles of biochemistry and the importance of phytochemicals.
CO2	Learn the structure, classification and properties of carbohydrates.
CO3	Compile the structure,classification and properties of Lipids
CO4	Know the sources,methods of extraction and classification of phytochemicals
CO5	Gain knowledge on classification of natural products and its applications.

Mapping of CO with PSO

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	2	3	2	3
CO2	2	2	3	2	3
CO3	2	2	3	2	3
CO4	3	3	3	2	3
CO5	3	3	3	3	3
Average	2.4	2.4	3	2.4	3

Teaching Methodology
Lecture (Chalk and Talk-OHP-LCD)
Quiz-Seminar-Group discussion
Peer Learning

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS) CHENNAI – 600 008
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B.Sc. DEGREE EXAMINATION

II B.Sc. PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

QUESTION PAPER TEMPLATE-THEORY

Title of the Paper: ALLIED PHYTOCHEMISTRY PAPER 1 Max. Marks: 100
Course Code: PB21/3A/APC Time: 3 Hours

Draw diagrams wherever necessary

QUESTION PAPER PATTERN-UG

Knowledge Level	Section	Word Limit	Marks	Total
K 1	A-10X2 marks	50	20	100
K1. K 2	B-5/8x8 marks	300	40	
K2, K 3	C-2/4x20 marks	1200	40	

SEMESTER IV COURSE PROFILE-PROGRAMME OF STUDY

II B.Sc PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

SEMESTER	COURSE CODE	TITLE OF THE PAPER	INST Hr / Week	CREDIT	MARKS			LTP
					CIA	EXT.	TOTAL	
IV		Part -I - Language – Paper IV	5	3	40	60	100	-
		Part - II - English – Paper IV	5	3	40	60	100	-
Core 7	PB21/4C/GPE	Part - III - Core Main -Gymnosperms, Paleobotany and Evolution	7	5	40	60	100	4 3 0
Core 8	PB21/4C/PR2	Part - III - Core Practical II (covering core 5 & 7)	2	4	40	60	100	0 0 2
ALLIED 4	PB21/4A/APC	Part -III – Allied Phytochemistry Paper – 2	4	3	40	60	100	3 1 0
	PB21/A/PYP	Allied Phytochemistry Practical (Covering Allied 3 & 4)	2	2	40	60	100	0 0 2
	PB21/4N/MRC	Part - IV – NME 1C Mushroom Cultivation	2	2	-	-	50	2 0 0
		Part IV-Soft Skill	2	3	-	-	50	2 0 0
		Total credits	30	**25**				

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SEMESTER –IV

II B. Sc. PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

Title of the Paper: CORE 7- GYMNOSPERMS, PALEOBOTANY AND EVOLUTION
Teaching Hours- 7 Hrs/Week (105 Hrs/Semester) Course code: PB21/4C/GPE
Credits: 5 LTP: 4 3 0

Objectives:
To enable students to

- Study the general characters of Gymnosperms its importance
- Impart knowledge to understand the different gymnosperms
- Acquire knowledge on the geological time scale and paleobotany
- Study and identify the different fossil forms
- Enable the students to acquire knowledge on evolution

UNIT – I **(20 Hrs)**

Gymnosperms – general characters- structure, reproduction and life-cycle. Classification (Sporne – 1954). Wood structure and economic importance in Gymnosperms.

UNIT – II **(25 Hrs)**

Morphology, structure and reproduction of *Cycas* , *Pinus* and *Gnetum* (No developmental studies) – Comparative study.

Unit – III **(25 Hrs)**

Geological time scale – era, period, epoch. Fossilization method- Fossil types compression, impression, casts, mold, petrification and coal ball, Radio carbon dating. Contribution of Birbal Sahni.

Unit – IV **(20 Hrs)**

Study of the following fossil form genera *Rhynia, Glossopteris, Lepidodendron, Lepidocarpon, Cordaites. and Williamsonia*,

Unit – V **(15 Hrs)**

Evolution –organic and inorganic- origin of life, chemosynthetic theory-evidences-theories of evolution-Darwin, Lamarck and De vries, modern synthetic theory. Variation – analysis and sources- Adaptation and selection.

Recommended books:

1. Vasishta. P. C. Botany for degree students- Gymnosperms, S. Chand and Co, 2003.
2. B. P. Pandey, College Botany Vol II , S. Chand and Co, 1979.
3. Verma P.S. and Agarwal V.K. Cell Biology, Genetics, Molecular Ciology, Evolution and Ecology. S.Chand and Co. Pvt. Ltd. 2007.
4. Shukla, R.S. and Chandel P.S. Cytogenetics, Evolution and Plant Breeding , 2016.

Reference books:

1. Sporne, K.R.1991. The Morphology of Gymnosperme. B.I. Publications, New Delhi.
2. Bhatnagar, S.P. and Moitra, A. 2018. Gymnosperms, New Age Int. Pvt. Ltd., New Delhi.
3. Stewart, W.N. and Rathwell, G.W. 1993. Paleobotany and the Evolution of Plants. Cambridge University Press.
4. Sinha and Sunitha Sinha, Cytogenetics, Plant Breeding and Evolution.
5. Arnold . C. A. Introduction to paleobotany, Mc Graw Hill,1947.
6. Shukla. A and Mishra. S. P. Essential of Paleobotany, Vikas Publishing house private limited, 1982.
7. Gupta. M. N., 1972, - The Gymnosperms (2nd Edition) Shiva Lal Agarwala & Co., Agra.

E-Learning resources:

1. https://www.khanacademy.org
2. https://www.sciencedirect.com
3. https://books.google.co.in/books/about/Gymnosperms.html?id=4dvyNckni8wC
4. https://arboretum.harvard.edu/wp-content/uploads/2013-70-4-beyond-pine-cones-an-introduction-to-gymnosperms.pdf
5. https://www.palaeontologyonline.com/
6. https://books.google.co.in/books/about/Paleobotany.html?id=HzYUAQAAIAAJ

e-book references:

1. Sharma. Pteridophytes and Gymnosperms, 2012. Tata McGraw-Hill Education private limited.
2. Thomas N. Taylor, Edith L. Taylor, Michael Krings. Paleobotany: The Biology and Evolution of Fossil Plants, 2009. Academic Press.
3. Wilson Nichols Stewart, Wilson M. Stewart, Wilson N. Stewart, Gar W. Rothwell. Paleobotany and the Evolution of Plants, 1993. Cambridge University Press.

Course Outcome

After completion of the course students will be able to

CO No.	CO Statement
CO 1	Outline the general characters, classes and features of Gymnosperms.
CO 2	Compare the vegetative and reproductive structure of Pteridophytes.
CO 3	Acquire knowledge on the geological time scale, fossilization methods and radiocarbon dating.
CO 4	Compare to know the different fossil forms and their mode of formation.
CO5	Analyse origin of life.

Mapping of CO with PSO

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	2	2	2	2
CO3	1	3	2	3	2
CO4	3	2	2	2	2
CO5	2	2	2	2	2
Average	2.4	2.4	2.2	2.4	2.2

Teaching Methodology

Lecture (Chalk and Talk-OHP-LCD)
Quiz-Seminar-Group discussion
Peer Learning
Field Visits

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS) CHENNAI – 600 008
(For the candidates admitted during the year 2021-2022 onwards)

B.Sc. DEGREE EXAMINATION

II B.Sc. PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

QUESTION PAPER TEMPLATE-THEORY

Title of the Paper: CORE 7- GYMNOSPERMS, PALEOBOTANY AND EVOLUTION
Course Code: PB21/4C/GPE **Max.Marks:100**
Time: 3 Hours

Draw diagrams wherever necessary

QUESTION PAPER PATTERN-UG

Knowledge Level	Section	Word Limit	Marks	Total
K 1	A-10X2 marks	50	20	100
K1. K 2	B-5/8x8 marks	300	40	
K2, K 3	C-2/4x20 marks	1200	40	

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS) CHENNAI – 600 008
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SEMESTER –IV

II B.Sc. PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

Title of the Paper: ALLIED PHYTOCHEMISTRY PAPER 2
Teaching Hours- 4 hrs/week (60 hrs /Semester) **Course code: PB21/4A/APC**
Credits: 3 LPT 3 1 0

Objectives:
To enable the students to

- Understand the structure ,classification and function of Biomolecules
- Impart knowledge different natural products and its significance.
- Facilitate the learners to understand the classification of phyto constituents
- Know the sources of phytoconstituents and methods of Extraction.
- Apply the fundamental Knowledge gained in food and dye industries.

UNIT 1: **(20 Hrs)**

Amino acids – Structure, Classification and function.
Proteins- –A brief account of Primary, Secondary, Tertiary and Quaternary structure, Classification, properties and functions.

UNIT 2: **(10 Hrs)**

Vitamins – Definition and Classification. Occurrence, Structure, role and deficiency diseases of
Water soluble vitamins- B1, B2, B6, B12 and C
Fat Soluble Vitamins- A, D, E and K

UNIT 3: **(10 Hrs)**

Natural Products - Carotenoids – Definition, Classification, Sources and Uses. eg. Lycopene, Beta-carotene - Source, Extraction and Uses. Flavonoids – Definition, Classification, Sources and Uses eg.*Citrus* flavonoids, Quercetin – Source, Extraction and biological significance.

UNIT 4: **(10 Hrs)**

Natural Products – Tannins- Definition, Classification, Sources and Uses. eg. Catechol – Source, Extraction and biological significance. Resins- Definition and classification. Resin from Asafoetida- Extraction and biological significance.

UNIT 5: **(10 Hrs)**

Natural Product from sea weeds – Agar Agar, Alginic acid, Kieselghur Natural plant Dyes-Classification based on application -Dyes obtained from root and tuber, wood, leaves and flowers.

Recommended books:

1. Jain.J.L. Fundamentals of Biochemistry, Vijaya Printers, Chennai, 2016.
2. Agarwal O.P. Chemistry of Organic products. Volume 1, Goel Publishing house, 2014.
3.Gurdeep R. Chatwal, Organic Chemistry of Natural Products Volume 2, Himalaya Publishing House, 1997.
4.Mathew George, Lincy Joseph.Textbook of Pharmaceutical Chemistry.VivaBooks Pvt.Ltd. 2009.

Reference Books:

1. Lehninger.A.L. Biochemistry. CBS Publications, 2012.
2. Stryer.J. Biochemistry.W.H. Freeman and Co.2015.
3.Sujata.V. Bhat et al. Natural Products Chemistry and Applications. Narosa Publishing House Pvt Ltd.2009.
4. Kokate.C.K., Purohit, Gokhale. Pharmacognosy. Nirali Prakashan Publication. 2007.
5. Rumit M. Shah, Rupesh T. Nayak. Pharmacognosy. Global Academic Publishers and Distributors 2012.

E-Learning resources:
https://www.khanacademy.org

e-book references:

1. Herbert J. Fromm, Mark Hargrove. Essentials of Biochemistry, 2012 Springer-Verlag Berlin Heidelberg.

2. Chukwuebuka Egbuna, Jonathan Chinenye Ifemeje, Jaya Vikas Kurhekar, Ph.D., Stanley Chidi Udedi, Shashank Kumar. Phytochemistry, 2019.Apple Academic Press.

Course outcomes

After completion of the course students will be able to

CO No.	CO statement
CO1	Gain knowledge on the structure, classification and functions of aminoacids and proteins.
CO2	Understand the type and role of vitamins.
CO3	Learn the sources,classifications,extractions and the importance of carotenoids and Flavonoids.
CO4	Study the types and sources of Tannins and Resins and learn the method of extractions.
CO5	Gain knowledge about see weeds and plant dyes used in industries.

Mapping of CO with PSO

CO/PSO	PO1	PO2	PO3	PO4	PO5
CO1	2	2	3	2	3
CO2	2	2	3	2	3
CO3	3	3	3	2	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Average	2.6	2.6	3	2.4	3

Teaching Methodology

Lecture (Chalk and Talk-OHP-LCD)
Quiz-Seminar-Group discussion
Peer Learning

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS) CHENNAI – 600 008
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B.Sc. DEGREE EXAMINATION

II B.Sc. PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

QUESTION PAPER TEMPLATE-THEORY

Title of the Paper: ALLIED PHYTOCHEMISTRY PAPER 2 **Max. Marks: 100**
Course Code: PB21/4A/APC **Time: 3 Hours**

Draw diagrams wherever necessary

QUESTION PAPER PATTERN-UG

Knowledge Level	Section	Word Limit	Marks	Total
K 1	A-10X2 marks	50	20	100
K1. K 2	B-5/8x8 marks	300	40	
K2, K 3	C-2/4x20 marks	1200	40	

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS) CHENNAI – 600 008
(For the candidates admitted during the year 2021-2022 onwards)
SEMESTER –IV
II B. Sc Plant Biology and Plant Biotechnology

Title of the Paper: CORE PRACTICAL II (COVERING CORE 5 & 7)
Teaching Hours: 2 Hrs/week **Course Code- PB21/4C/PR2**
Credits: 4 LTP: 0 0 2

Course objectives

To enable students to

- Identify and understand the different plant groups like bryophytes, pteridophytes and gymnosperms based on their morphological features.
- Know the variation between the plant groups and characterize them according to the anatomical structures of different plant parts.
- Understand the evolutionary trends witnessed in plant forms through sections and microscopical observations.
- Study the fossil plants with respect to their anatomical and morphological features.

BRYOPHYTES AND PTERIDOPHYTES

Study of morphology, anatomy and structure of the vegetative and reproductive organs of Bryophyte genera and fossils included in the theory syllabus .

Study of morphology, anatomy and structure of the vegetative and reproductive organs of Pteridophyte genera included in the theory syllabus.

GYMNOSPERMS, PALEOBOTANY AND EVOLUTION

Study of morphology, anatomy and structure of the vegetative and reproductive organs of Cycas and Gnetum.

Study of morphology, anatomy and structure of the vegetative and reproductive organs of Pinus and Fossil slides of *Rhynia, Glossopteris, Lepidodendron, Lepidocarpon, Williamsonia and Cordaites.*

Photograph of evolution scientists-Darwin, Hugo de vries and Lamarck.

Course Outcomes

After completion of the course students will be able to

CO No.	CO statement
CO1	Identify plants based on morphology, anatomy of the vegetative and reproductive organs of Bryophyte.
CO2	Compare and understand the morphology, anatomy of the vegetative and reproductive organs of Pteridophyte.
CO3	Categorize the plants based on the morphology, anatomy of the vegetative and reproductive organs of Gymnosperm.
CO4	Identify fossil plant forms belonging to pteridophytes and gymnosperms and analyse the evolutionary trend that occur in various groups of plants.

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS) CHENNAI – 600 008
(For the candidates admitted during the year 2021-2022 onwards)

II B.Sc. PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

QUESTION PAPER TEMPLATE-PRACTICAL

Title of the Paper: CORE PRACTICAL II (COVERING CORE 5 & 7) Max Marks : 100
Course Code : PB21/4C/PR2 Time : 3 HRS

I. Cut transverse sections of **A, B** and **C.** Stain and mount in glycerine. Identify giving reasons. Draw diagrams. Leave the slides for valuation.

(3 x 9 = 27 Marks)

II. Make suitable micropreparation of **D** and **E**. Identify giving reasons. Draw labeled sketches. Submit the slide for Valuation.

(2 x 6= 12 Marks)

III. Identify the Genus, Group and morphology of **F**, **G, H**, **I** and **J** Diagrams and notes not necessary**.** **(5 x 3 = 15 Marks)**

IV. Write critical notes on **K**, **L, M**, **N**, **O** and **P.** **(6 x 5 = 30 Marks)**

V. Identify the scientist and write critical notes for **Q.** **(1 x 6 = 6 Marks)**

Practicals - 90 Marks
Record - 10 Marks
Total - 100 Marks

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS) CHENNAI – 600 008
(For the candidates admitted during the year 2021-2022 onwards)
SEMESTER –IV

II B. Sc Plant Biology and Plant Biotechnology

SEMESTER IV

Title of the Paper: ALLIED PHYTOCHEMISTRY PRACTICAL (COVERING ALLIED 3 & 4)
Teaching Hours: 2 hrs/week **Course Code- PB21/A/PYP**
Credit: 2 LTP: 0 0 2

Course Objectives

To enable the students to

- Estimate different chemical compounds quantitatively.
- Analyse different carbohydrates and phytoconstituents qualitatively.
- Gain knowledge on natural plant products and vitamins.

I. Volumetric Analysis
a) Estimation of Potassium dichromate
b) Estimation of Ferric chloride
c) Estimation of Glycine
d) Estimation of oxalic acid

II. Qualitative Analysis
Carbohydrates- Glucose, Fructose, Lactose, Sucrose, Starch
Aminoacids-Arginine, Cystine, Tyrosine, Tryptophan
Qualitative test for lipids

III. Phytochemical Tests
Identification test for
a) Alkaloids
b) Glycosides
c)Terpenoids
d) Flavanoids
e) Tannins

IV. Natural plant products and vitamins – Spotters (prescribed in the Syllabus)
Product from sea weeds
Natural plant dyes
Water soluble vitamins-B1, B2, B6, B12 and C.
Fat Soluble vitamins- A,D, E and K.

Course outcomes
After completion of the course students will be able to

CO No.	CO statement
CO1	Evaluate quantitatively different chemical compounds through volumetric analysis
CO2	Identify qualitatively different mono and disaccharides, aminoacids and phytoconstituents like alkaloids, flavonoids, tannins and terpenoids.
CO3	Acquire knowledge on different vitamins, products of seaweeds and plant dyes.

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS) CHENNAI – 600 008
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II B.Sc. Plant Biology and Plant Biotechnology

QUESTION PAPER TEMPLATE-PRACTICAL

Title of the Paper: ALLIED PHYTOCHEMISTRY PRACTICAL **Max marks : 60**
Course Code : PB21/A/PYP **Time : 3 HRS**

I Estimate the amount of given solution **A** present in the whole of the given solution. You are provided with the standard solution (------- g/l) and a decinormal link solution. Submit the procedure and record your readings.

(25 Marks)

II Analyse the given sample **B** qualitatively. Record your observation and inference.

(25 Marks)

III Analyse the Phytochemical constituent present in the given sample **C** and **D**.

(20 Marks)

IV Give the chemical name, source and deficiency for **E, F, G** and **H**. **(4 x 3 = 12 Marks)**

V. Write notes on **I** and **J**. **(2 x 4 = 8 Marks)**

Practicals – 90 Marks
Record - 10 Marks
Total - 100 Marks

SEMESTER V COURSE PROFILE-PROGRAMME OF STUDY

III B.Sc PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

SEMESTER	COURSE CODE	TITLE OF THE PAPER	INST Hr / Week	CREDIT	MARKS			LTP
					CIA	EXT.	TOTAL	
V Core 9	PB21/5C/MTE	Part - III - Core - Plant Morphology, Taxonomy and Economic Botany	6	5	40	60	100	4 2 0
Core 10	PB21/5C/AAE	Part - III - Core - Plant Anatomy and Embryology	6	5	40	60	100	4 2 0
Core 11	PB21/5C/CGP	Part - III - Core - Cell Biology, Genetics and Plant Breeding	6	5	40	60	100	4 2 0
Core 12	PB21/6C/PR3	Practical covering – Core 9,10 and 11 Practical III	7	-	40	60	100	0 0 7
Elective I	PB21/5E/BIS	Bioinstrumentation and Biostatistics	5	5	40	60	100	4 1 0
Elective II	PB21/5E/EMC	Entrepreneurship in mushroom cultivation	5	5	40	60	100	4 1 0
(One Elective Only)		**Total credits**	30	**20**				

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS) CHENNAI – 600 008
(For the candidates admitted during the year 2021-2022 onwards)

SEMESTER –V

III B.Sc. PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

Title of the Paper: CORE 9-PLANT MORPHOLOGY, TAXONOMY AND ECONOMIC BOTANY
Teaching Hours- 6 Hrs/Week (90 Hrs/Semester) **Course code: PB21/5C/MTE**
Credits: 5 LTP: 4 2 0

Objectives:

To enable students to

- Gain knowledge on the morphological characters of angiosperms.
- Know the history and development of different system of classification of angiosperms.
- Learn various rules on principles and nomenclature of plants in taxonomy.
- Understand and practice the techniques of herbarium and floral variation in few selected families of angiosperms.
- Get detailed knowledge of history, development and application of few economically important plants.

UNIT - I (25 Hrs)

Morphology – root system – modifications. Shoot system – modifications – (Aerial, sub-aerial and underground). Leaf-simple and compound- phyllotaxy, modifications, (phyllode, pitcher) tendrils, stipules. Inflorescences – definition and types – racemose, cymose, mixed and special types. Fruits - classification.

UNIT - II (20 Hrs)

History of Angiosperm classification – Artificial, Natural and Phylogenetic system of classification. An outline of Bentham & Hooker system of classification, an overview of APG Classification.Herbarium technique – collection, pressing, drying, mounting and preservation of plant specimens. Botanical Survey of India. Botanical Nomenclature – rules, typification and author citation.

UNIT- III (15 Hrs)

Study of the following families based on the Natural system and their economic importance: Annonaceae, Nymphaeaceae, Capparidaceae, Rutaceae, Caesalpinaceae, Cucurbitaceae, Asteraceae, Apocynaceae.

UNIT – IV (15 Hrs)

Study of the following families based on the Natural system and their economic importance: Asclepiadaceae, Convolvulaceae, Acanthaceae, Lamiaceae, Amaranthaceae, Liliaceae and Poaceae.

UNIT – V **(15 Hrs)**

Source, cultivation method (brief) and the extraction/processing of the economically important products of the following – cereal (Rice), Sugar (Sugarcane), Fibre (Cotton), Beverage (Tea), Oil (Groundnut).

Recommended books:

1. Chopra.G.L., Angiosperms. Nagin and Co.1984
2. Pandey, B.P. Taxonomy of Angiosperms, K.Nath and Co., 2001.
3 .Dutta, S.E. Systematic Botany, Wiley Eastern, 2009
4. Sambamurthy et al., Economic Botany of crop plants, 1989.
5. Beryl and Molly. Economic Botany, McGraw Hill Publishing Co., 2000.
7. Pandey. B. P. Economic Botany, Chand and Co. Pvt. Ltd, 1999.
8. Ashok Bendre and Ashok Kumar. Economic Botany. Rastogi Publications. 2009.
10. Gurucharan Singh. Plant Systematics: An integrated approach. 1999.

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. Clive AS.1989. Plant Taxonomy and Biosystematics, Chapman and Hall Inc. New York.
5. Harborne, JB & Turner, BL. 1984. Plant Chemosystematics, Acad. Press, London.
6. Lawrence, GH. 1955. Taxonomy of Vascular Plants, MacMillan Co., USA.
7. Samuel, BJ & Arlene, EL. 1987. Plant Systematics, Mc Graw Hill Inc. New York
8. Bhatnagar, S.P. and Moitra, A. 1996. Gymnosperms. New Age International Pvt. Ltd., New Delhi
9. Grant, W.E. 1984. Plant Biosystematics. Academic Press London.
10. Heywood, V.H. and Moore, D.M. 1984. Current Concepts in Plant Taxonomy. Academic Press, London.
11. Jones, S.B. Jr. and Luchsinger, A.E. 1986. Plant Systematics (2nd edition). McGraw-HilI Book Co., New York.
12. Nordenstam, B., EI Gazaly, G. and Kassas, M. 2000 Plant Systematics for 21st Century. Portlant Press Ltd., London.
13. Radford, A.E. 1986. Fundamentals of Plant Systematics. Harper & Row Publications, USA.
14. Singh, H. 1978, Embryology of Gymnosperms, Encyclopaedia of Plant Anatomy X. Gebruder Bortraeger, Berlin.
15. Stace, C.A. 1989. Plant Taxonomy and Biosysteinatics (2nd edition) Edward Arnold Ltd., London.
16. Takhtajan, A.L. 1997. Diversity and Classification of Flowering Plants. Columbia University Press, New York.
17. Woodland, D.W. 1991. Contemporary Plant Systematics. Prentice Hall. New Jersey.
18. Hutchinson, J. The families of Flowering Plants.Vol I & II 3rd edition , Oxford University Press, UK, 1973.
19. Sivarajan,V.V. An Introduction to Principles of Plant Taxonomy. Oxford IBH, New

Delhi, 1989.
20. Takhtajan, A. Flowering Plants: Origin and Dispersal, Oliver and Boyd Ltd, Edinburgh, 1969.

E-Learning resources:

1. https://books.google.co.in/books/about/Plant_Taxonomy_2E.html?id=_px_WAwHiZIC&redirhttps://books.google.co.in/books/about/Plant_Taxonomy_and_Biosystematics.html?id=VfQnuwh3bw8C&redir_esc=y_esc=y
2. https://books.google.co.in/books/about/Economic_Botany.html?id=2ahsDQAAQBAJ&redir_esc=y
3. https://books.google.co.in/books/about/Textbook_Of_Economic_Botany.html?id=XmZFJO_JHv8C&redir_esc=y
4. https://books.google.co.in/books/about/Plant_Taxonomy.html?id=uWg76rCqA68C
5. https://www.amazon.in/PLANT-TAXONOMY-Sharma/dp/0070141592
6. https://www.kopykitab.com/Economic-Botany-By-Manoj-Kumar-Sharma-eBook.
7. https://www.khanacademy.org

e-book references:

1. Quicke, Donald L.J. (Ed.). Principles and Techniques of Contemporary Taxonomy Editors: Springer Book Archive, 1993. Springer Netherlands.
2. Germinal Rouhan, Myriam Gaudeul. Plant Taxonomy: A Historical Perspective, Current Challenges, and Perspectives. 2014. Springer.
3. Besse, Pascale. Molecular Plant Taxonomy Methods and Protocols. 2014. Humana Press
4. S. L. Kochhar, Economic Botany, 2016. Cambridge University Press.
5. A. V. Sambhamurty, N. S. Subrahmanyam. A textbook of economic botany, 1989. Wiley Easter.

Course outcomes

After completion of the course students will be able to

CO.No.	CO statement
CO1	Discuss the variation in the leaves, flowers and fruits of angiosperms.
CO2	Apply different system of classification in the systematic position of angiospermic plants and to prepare a herbarium and identify unknown plants to generic and specific levels.
CO3	Explain the vegetative and reproductive parts of few polypetalae and monocot families.
CO4	Explain the characters of few gamopetalae and monochlamydeae families.
CO5	Communicate the methods of cultivation and application of few common commercial crop plants.

Mapping of CO with PSO

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	2	3	2
CO2	2	2	2	3	3
CO3	3	2	3	3	3
CO4	3	2	3	3	3
CO5	3	3	3	3	3
Average	2.8	2.2	2.6	3	2.8

Teaching Methodology

Lecture (Chalk and Talk-OHP-LCD)
Videos and animations
Quiz-Seminar-Group discussion
Peer Learning
Field Visits

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS) CHENNAI – 600 008
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B.Sc. DEGREE EXAMINATION

III B.Sc. PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

QUESTION PAPER TEMPLATE-THEORY

Title of the Paper: **CORE 9-PLANT MORPHOLOGY, TAXONOMY AND ECONOMIC BOTANY**
Course Code: PB21/5C/MTE **Max. Marks: 100**
Time: 3 Hours

Draw diagrams wherever necessary

QUESTION PAPER PATTERN-UG

Knowledge Level	Section	Word Limit	Marks	Total
K 1	A-10X2 marks	50	20	100
K1. K 2	B-5/8x8 marks	300	40	
K2, K 3	C-2/4x20 marks	1200	40	

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS) CHENNAI – 600 008
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SEMESTER –V

III B.Sc. PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

Title of the Paper: CORE10- PLANT ANATOMY AND EMBRYOLOGY
Teaching Hours- 6 Hrs/Week (90 Hrs/Semester) Course code: PB21/5C/AAE
Credits: 5 LTP: 4 2 0

Objectives:
To enable students to

- Gain knowledge on the different types of cells and tissues that make up a plant.
- Impart knowledge on the internal structure of plant parts.
- Differentiate and identify the growth stages of plants.
- Study the structure of reproductive parts of plants and their role in embryo development.
- Enable the students to learn the applications of embryology.

UNIT – I (20 Hrs)

Meristems – Structure, function and Classification, Apical organization of shoot and root, theories – shoot apex; Apical cell theory, histogen theory, Tunica–Corpus theory and root apex – histogen theory and korper kappe theory. Tissues - Definition, types - Simple permanent - Parenchyma, Collenchyma and Sclerenchyma (fibers and sclereids). Complex permanent tissues - xylem and phloem.

UNIT – II (20 Hrs)

Tissue systems - Dermal tissue system, Epidermis, cuticle, trichome, stomata and types, bulliform cells and silica cells - fundamental or ground tissue system – Cortex, Endodermis,Pericycle, Pith & Pith rays. Vascular tissue system and types of vascular bundles - Vascular cambium. Stem - primary anatomical structure of dicotyledonous and monocotyledonous stem. Secondary growth in dicotyledonous stems. Anomalous secondary growth in *Nyctanthes, Boerhaavia* and *Dracaena.*

UNIT – III (15 Hrs)

Root - primary anatomical structure of dicotyledonous and monocotyledonous roots. Secondary growth in dicot root. Leaf - anatomy of dicot and monocot leaf. Leaf abscission. Kranz anatomy,Nodal Anatomy: Leaf trace, leaf gap, branch trace and branch gap–types. Ergastic substances

UNIT – IV (15 Hrs)

Anther – structure and development, microsporogenesis and development of male gametophyte. Ovule – structure of megasporangium and mature embryo sac.

(ovule) different types, megasporogenesis, development of female gametophyte - Monosporic *Polygonum* and *Oenothera*, Bisporic - *Allium*, Tetrasporic - *Penaea* and *Peperomia*.

UNIT – V **(20 Hrs)**

Double fertilization syngamy and triple fusion. Heterofertilization. Development of dicot embryo - *Capsella*. Development of monocot embryo - *Najas*. Endosperm and its types - free nuclear, cellular, helobial, ruminate. Endoperm haustoria. Apomixis – definition types and significance. Polyembryony - types Parthenogenesis and Parthenocarpy.

Recommended books:

1. Pandey.B.P., Plant Anatomy. S.Chand & Co., Pvt. Ltd. New Delhi. 2002.
2. Tayal, M.S. Plant Anatomy, Rastogi Publications, 2004.
3. Pandey B.P. Plant Anatomy. S. Chand and Co. Pvt Ltd. New Delhi, 200.
4. Bhojwani.S.S. and Bhatnagar . S.P., The Embryology of Angiosperms, Vikas Publications House Private ltd., 2015.
5. Bhojwani.S.S. and Bhatnagar . S.P. The Embryology of Angiosperms, Vikas Publications House Private ltd., 1981.
6. Bhojwani.S.S. and Bhatnagar . S.P., Dantu P.K. The Embryology of Angiosperms, Vikas Publications House Private ltd., 2015.

Reference Books:

1. Esau.K. (1985) – Anatomy of Seed Plants –John Willey
2. Cutter.E.G (1989) – Plant Anatomy – Part I – Addison – Wesley Publishing Co..
3. Vashista.P.C. (1988) – A Text Book of Plant Anatomy. S.Nagin & Co.
4. Maheswari.P. (1991) – An Introduction to Embryology of Angiosperms, Tata McGraw Hill Publishing Co. Ltd.,
5. Swamy B.G.L. and Krishnamoorthy. K.V. (1990) – From Flower to Fruits, Tata McGraw Hill Publishing Co. Ltd.
6. Bhojwani S.S. and Bhatnagar.S.P. (1987) – Embryology of Angiosperms, Vikas Publishing House Pvt. Ltd.,
7. Bhojwani, S S. & Bhatnagar, SP. 1994. Embryology of Angiosperms, Vikas
8. Bhojwani, S.S. and Bhatnagar, S.P. 2000. The Embryology of Angiosperms (4th revised and enlarged edition). Vikas Publishing House, New Deihi.
9. Singh V. Pande, P.C. Jain D.K. Anatomy of seed plants Rastogi Publications, 1998.
10. Burgess, J. 1985. An Introduction to Plant Cell Development. Cambridge University Press, Cambridge.
11. Fageri, K. and Van der Pijl, L. 1979. The Principle of Pol1ination Ecology. Pergamon Press, Oxford.
12. Fahn, A. 1982. Plant Anatomy. (3rd edition). Pergamon Press, Oxford.
13. Fosker, D.E. 1994. Plant Growth and Development. A Molecular Approach. Academic Press, San Diego.
14. Howell, S.H. 1998. Molecular Genetics of Plant Development. Cambridge University press, Cambridge.
15. Leins, P., TucKer, S.C. and Endress, P.K. 1988. Aspects of Floral Development, J. Cramer, Germany.

16. Lyndon, R.F. 1990. Plant Development. The Cellular Basis, Unnin Byman, London.
17. Murphy, T.M. and Thompson, W.E, 1988. Molecular Plant Development. Prentice Hall, New Jersey.
18. Raghavan, V. 1997. Molecular Embryology of Flowering Plants. Cambridge University Press, Cambridge.
19. Raghavan, V. 1999. Developmental Biology of Flowering Plants. Springer-Verlag, New York.
20. Raven, P.H., Evrt, R.F. and Eichhorn, S. 1992. Biology of Plants (5th edition). Worth, New York.
21. Steeves, T.A. and Sussex, I.M., 1989. Patterns in Plant Development (2nd edition). Cambridge University Press, Cambridge.
22. Waisel, Y., Eshel, A. and Kafkaki, U. (eds.). 1996. Plant Roots : The Hidden Hall (2nd edition). Marcel Dekker, New York.
23. Shivanna, K.R. and Sawhney, VK. (eds.) 1997. Pollen Biotechnology for Crop Production and Improvement. Cambridge University Press, Cambridge.
24. Shivanna, K.R. and Rangaswamy, N.S. 1992. Pollen Biology : A Laboratory Manual. Springer-Verlag. Berlin.
25. Shivanna, K.R. and Johri, B.M. 1995. The Angiosperm Pollen : Structure and Function. Wiley Eastern Ltd.. New York.
26. Eames J.A., MacDaniels, H. and Lawrence. An introduction to Plant Anatomy. McGraw Hill, 1978.

E-Learning resources:

1.https://www.khanacademy.org
2. https://www.kobo.com/us/en/ebook/a-textbook-of-plant-anatomy
3. https://archive.org/details/plantanatomy031773mbp
4. https://www.amazon.in/Embryology-Angiosperms-6th-S-P-Bhatnagar-ebook/dp/B00UN5KPQG
5. https://www.worldcat.org/title/embryology-of-angiosperms/oclc/742342811

e-book references:

1. S. K. Sinha. A Textbook of Plant Anatomy. 2013. Centrum Press.
2. Crang, Richard, Lyons-Sobaski, Sheila, Wise, Robert. Plant Anatomy A Concept-Based Approach to the Structure of Seed Plants, 2018. Springer International Publishing.
3. Dr. Manisha Majumdar (De). Plant Anatomy Tissue,2011. BookRix in the Media.
4. H. P. Sharma. Plant Embryology: Classical and Experimental, 2009. Alpha Science International.

Course outcomes

After completion of the course students will be able to

CO No.	CO statement
CO1	Identify the basic plant cell types, their structure and functions
CO2	Analyse the fundamentals of tissue system and the differences in normal and anomalous growth patterns of stem.
CO3	Identify and differentiate the internal structure of vegetative parts and ergastic substances
CO4	Create an understanding on the structure of reproductive parts and their development
CO5	Apply the knowledge gained on the development of embryo in horticulture industry

Mapping of CO with PSO

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	3	3	2
CO2	2	2	3	3	2
CO3	3	3	3	3	3
CO4	2	2	3	3	3
CO5	2	3	3	3	3
Average	2.4	2.4	3	3	2.4

Teaching Methodology

Lecture (Chalk and Talk-OHP-LCD)
Videos
Quiz-Seminar-Group discussion
Peer Learning

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III B. Sc. PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

QUESTION PAPER TEMPLATE-THEORY

Title of the Paper: CORE 10- PLANT ANATOMY AND EMBRYOLOGY
Course Code: PB21/5C/AAE **Max. Marks: 100**
Time: 3 Hours

Draw diagrams wherever necessary

QUESTION PAPER PATTERN-UG

Knowledge Level	Section	Word Limit	Marks	Total
K 1	A-10X2 marks	50	20	100
K1. K 2	B-5/8x8 marks	300	40	
K2, K 3	C-2/4x20 marks	1200	40	

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SEMESTER – V

III B. Sc. PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

Title of the Paper: Core 11- CELL BIOLOGY, GENETICS AND PLANT BREEDING
Teaching Hours- 6 Hrs/Week (90Hrs/Semester) **Course code: PB21/5C/CGP**
Credits: 5 LTP: 4 2 0

Objectives:
To enable students to

- Impart knowledge on the fundamentals of cell organization.
- Understand the organization and function of cellular organelles.
- Know the principles of heredity.
- Gain knowledge on the mechanism and types of inheritance patterns.
- Understand the process of crop improvement.

UNIT- I **(10 Hrs)**
Introduction – definition, scope, cell organization – Prokaryotic and Eukaryotic. Cell wall-structure and function. Plasma membrane, occurrence, structure (Fluid mosaic model), chemistry, function and origin. Cell cycle, cell division-mitosis and meiosis and cytokinesis.

UNIT- II **(30 Hrs)**
Occurrence, structure, function and origin of endoplasmic reticulum, golgi bodies, lysosomes, Ribosomes, Peroxisomes, Mitochondria and Chloroplast. Semi genetic autonomy of Mitochondrial and plastid DNA. Nucleus, nuclear membrane, chromosome structure, euchromatin, heterochromatin, giant chromosomes – polytene and lampbrush.

UNIT- III **(20 Hrs)**
Mendelian genetics – monohybrid, dihybrid crosses. Laws of Mendel, Reciprocal cross - Back cross and Test cross. Incomplete dominance - *Mirabilis jalaba.* Interaction of factors – Complementary genes, epistasis (dominant and recessive), duplicate genes. Multiple alleles. ABO Blood grouping in Human. Chromosome theory of linkage, crossing over, recombinations and mapping of genes on chromosomes. Sex determination in plants.

UNIT- IV **(10 Hrs)**
Sex linked inheritance – Haemophilia and colour blindness. Chromosome number and structure-Polyploid origin, types and significance. Mutation-types and significance. Extra nuclear inheritance and its significance - Male sterility in corn , Maternal inheritance – Plastid Inheritance in *Mirabilis jalaba*. Genetics of *Neurospora*. Population genetics – Hardy – Weinberg principle.

UNIT- V **(20 Hrs)**

Principles involved in plant breeding and its importance in green revolution with reference to wheat, rice, sugarcane, maize and cotton. Methods of crop improvement : selection (pure line, mass and clonal), hybridization, introduction and acclimatization. Heterosis – causes and effects. Polyploidy in plant breeding. Breeding for disease resistance. Improved seed production and seed testing techniques.

Recommended books:

1. Roy.S.C. & K. De. Cell Biology New Central Book Agency (P) Ltd Calcutta, 2011.
2. Verma P.S & V.K. Agarwal, Cytology, S. Chand & Co New Delhi, 2006.
3. Verma P.S.A and V.K. Agarwal. Cell Biology, Genetics, Molecular Biology, Evolution and Ecology. S.Chand & Co. Pvt. Ltd., 2005.
4. Chaudhry R.K. A text Book of Plant Breeding,
5. Rangaswami.R.A. A Text book of Agricultural Statistics., 1995.
6. Shukla, R.S. and Chandel P.S. Cytogenetics, Evolution and Plant Breeding , 2004.

Reference Books:

1. Verma, P.S. & V.K. Agarwal, 2003, Genetics. S. Chand & Co.Ltd., New Delhi-55. Freifelder, D.1987. Essentials of Molecular Biology, Jones & Bartlett, Boston.
2. Mithra Sandhya-Genetics-Blueprint of life, 1994, Tata McGraw hill Publications.
3. Gardner, EJ., Simmons, MJ. & Snustad, D. 2005. Principles of Genetics, John Wiley Sons Inc., 8th Edn., New York.
4. Sinnott, EW., Dunn, LL. & Dobzhansky, T. 1997. Principles of Genetics, Tata Mc Graw Hill Publishing Co., New Delhi.
5. Brown W.V. and Bertke.E.M., 1974, A text book of Cytology C.V.Mosley Co.,St. Louis.
6. Cohn.N.S., 1979, Elements of Cytology, Freeman Book Co.,
7. De Robritis E.D.P. and DeRobrities. E.M.F.jr 1987 – Cell and Molecular biology Lea and Febiger..
8. Freifelder.D., Essentials of Molecular Biology, Narosa. Publication, 2008.
9. Watson. J.D., et.al Molecular biology of the Gene The Benjamin/ Cummings,2013
10. De Robertis & De Robertis. 1990. Cell and Molecular Biology, Saunders College, Philadelphia, USA.
11. Glick, B.R. and Thompson, J.E. 1993. Methods in Plant Molecular, Biology and Biotechnology. CRC Press, Boca Raton, Florida.
12. Hackett, P.B., Fuchs, J.A. and Messing, J.W. 1988. An Introduction to Recombinant. DNA Techniques : Basic Experiments in Gene Manipulation. The Benjamin/Cummings Publishing Co. Inc., Menlo Park, California.

E-Learning resources:

1. https://www.khanacademy.org
2. http://www.freebookcentre.net/Biology/Cell-Biology-Books.html
3. https://www.amazon.in/Cell-Biology-Thomas-D-Pollard-ebook/dp/B01M7YAL2A
4. https://libguides.uthsc.edu/genetics/ebooks
5. https://www.kobo.com/us/en/ebook/principles-of-plant-genetics-and-breeding
6. http://sharebooks.com/content/plant-breeding-ebooks-raoul-robinson

e-book references:

1. Thomas D. Pollard & William C. Earnshaw & Jennifer Lippincott-Schwartz & Graham Johnson. Cell Biology, 2017.
2. Mathew Stubbs & Narin Suleyman. Mosby. Cell Biology & Genetics, 2013. 4th Revised edition.
3. Gardner, M. J. Simmons, D. P. Snustad John Wiley & Sons. Genetics. Principles of genetics,2006.
4. B. D. Singh, Textbook of Plant Breeding, 1999. Kalyani Publishers.
5. Mahabal ram, Plant Breeding Methods, 2014. PHI Learning Pvt. Ltd.
6. Jules Janick, Plant Breeding Reviews,2012. Volume 100, John Wiley & Sons.

Course outcomes

After completion of the course students will be able to

CO No.	CO statement
CO1	Identify the types of cells based on their organization and to differentiate the types of cell division.
CO2	Apply the knowledge gained to identify the cellular organelles of eukaryotic cells.
CO3	Analyse the laws of inheritance, types of gene interactions and the role a gene plays in determining the characters of plants.
CO4	Assess the concepts of types of inheritances, chromosomal variations and population genetics.
CO5	Employ the principles and methods of plant breeding for plant improvement and seed production

Mapping of CO with PSO

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	2	3	3	3
CO3	2	3	3	3	3
CO4	2	3	3	3	3
CO5	2	3	3	3	3
Average	2.4	2.4	3	3	3

Teaching Methodology

Lecture (Chalk and Talk-OHP-LCD)
Videos and animations
Problem Solving
Quiz-Seminar-Group discussion
Peer Learning
Field Visits

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III B.Sc. PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

QUESTION PAPER TEMPLATE-THEORY

Title of the Paper: CORE 11-CELL BIOLOGY, GENETICS AND PLANT BREEDING
Course Code: PB21/5C/CGP **Max. Marks: 100**
Time: 3 Hours

Draw diagrams wherever necessary

QUESTION PAPER PATTERN-UG

Knowledge Level	Section	Word Limit	Marks	Total
K 1	A-10X2 marks	50	20	100
K1. K 2	B-5/8x8 marks	300	40	
K2, K 3	C-2/4x20 marks	1200	40	

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SEMESTER – V

III B.Sc. PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

Title of the Paper: ELECTIVE I-BIOINSTRUMENTATION AND BIOSTATISTICS
Teaching Hours- 5 Hrs/Week (75Hrs/ week) **Course code: PB21/5E/BIS**
Credits: 5 LTP: 4 1 0

Objectives:
To enable students to

- Understand the basic principles , construction and working methods of the instruments.
- Learn the special techniques necessary for separation of phytoconstituents .
- Assess the techniques involved in separation of biomolecules.
- Impart the basic knowledge and applications of biostatistics in analysis of the experimental data.

UNIT – I **(20 Hrs)**

Microscopy – Light microscope, Principle, construction, operation and uses of bright field microscope, dark field microscope, phase-contrast microscope, Confocal and fluorescent types, Transmission Electron Microscope (TEM) and Scanning Electron Microscope (SEM).Microscopic measurements – micrometry, hemocytometer. Microscopy drawing: Camera Lucida

UNIT - II **(20 Hrs)**

Chromatographic Principles and Applications of Paper chromatography, Thin Layer Chromatography (TLC), Column chromatography, Gas chromatography – Mass spectrometry (GCMS – outline only), High Performance Liquid Chromatography (HPLC)

UNIT – III **(15 Hrs)**

Spectrophotometry – Principle and law of absorption, construction, operation and uses of colorimeter and UV – Visible Spectrophotometer, Centrifugation. Principles, methods of centrifugation – Preparative – differential and Analytical – density gradient, types of centrifuge and applications

UNIT – IV **(10 Hrs)**

pH meter – Basic principle, construction, operation and applications.
Electrophoresis – Principle, operation and applications, Gel Electrophoresis -Agarose gel electrophoresis , Polyacrylamide gel electrophoresis (PAGE), pH meter – Basic principle, construction, operation and applications.

UNIT – V (Biostatistics) **(10 Hrs)**

Sampling methods – Population, sample. Representation of data – Tabular & Graphical Histogram – frequency curve – Bar diagram. Frequency distribution, Measures of central tendency – Mean – Median and Mode. – Standard deviation – Standard error – Chi-square test for goodness of fit – Student's t–test.

Recommended books :

1. Veerakumari, Bioinstrumentation, MYP Publishers, 2009.
2. Keith Wilson & H.Goulding. A Biologist 's guide to Principles and techniques of Practical Bio-Chemistry.Cambridge University Press, 1993.
3. Raman, N. Phytochemical Techniques. New India Publishing Agency, New Delhi, 2006.
4. Rangaswami.R.A. A Text book of Agricultural Statistics., 2010

Reference Books:

1. Sharma VK (1991). Techniques in microscopy and cell biology, Tata McGraw Hill, New Delhi.
2. N. Gurumani, Research Methodology, MJP Publishers, 2017.
3. Sawhney SK and Randhir Singh (2000). Introductory practical biochemistry, Narosa Publishing House.
4. Asokan P (2001). Basics of analytical biochemistry. Chinna Publications.
5. Bajpai PK (2006) Biological instrumentation and methodology. S. Chand & Company, New Delhi.
6. Rana SVS (2009). Biotechniques: Theory and Practice. Rastogi Publications.

E-Learning resources:

https://www.khanacademy.org
https://www.sciencedirect.com

e-book references:

1. L. Veerakumari. Bioinstrumentation, 2006. Copyright: MJP Publishers. Publishers: C. Janarthanan.
2. John D Enderle. Bioinstrumentation. Publisher: San Rafael, Calif. Morgan & Claypool Publishers.
3. A.K. Sharma, Text Book of Biostatistics I,, 2005. Discovery Publishing House.
4. Bernard Rosner, Fundamentals of Biostatistics, 2010. Cengage Learning,

Course outcomes

After completion of the course students will be able to

CO No.	CO statement
CO1	Gain knowledge in understanding the principles, construction, operation and uses of different types of Microscopes and learn the Microscopic measurements
CO2	Provides analytical insights to students on chromatographic techniques .
CO3	Impart knowledge on the basic principles, construction and operation of different types of Electrophoresis and pH meter.
CO4	Apply the concept of centrifugation and spectrometry used in analytical techniques .
CO5	Demonstrate the ability to analyse the data using appropriate statistical tools and learn to interpret the results.

Mapping of CO with PSO

CO/PSO	PSO1	PSO2	PSO3	PSO4	PS05
CO1	1	2	3	3	2
CO2	1	3	3	3	3
CO3	1	3	3	3	3
CO4	1	3	3	3	3
CO5	1	3	3	3	3
Average	1	2.8	3	3	2.8

Teaching Methodology

Lecture (Chalk and Talk-OHP-LCD)
Videos and animations
Problem Solving
Quiz-Seminar-Group discussion
Peer Learning
Field Visit

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS) CHENNAI – 600 008
(For the candidates admitted during the year 2021-2022 onwards)

III B.Sc. PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

QUESTION PAPER TEMPLATE-THEORY

Title of the Paper: ELECTIVE 1-BIOINSTRUMENTATION AND BIOSTATISTICS
Course Code: PB21/5E/BIS **Max. Marks: 100**
Time: 3 Hours

Draw diagrams wherever necessary

QUESTION PAPER PATTERN-UG

Knowledge Level	Section	Word Limit	Marks	Total
K 1	A-10X2 marks	50	20	100
K1. K 2	B-5/8x8 marks	300	40	
K2, K 3	C-2/4x20 marks	1200	40	

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS) CHENNAI – 600 008
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SEMESTER – V

III B.Sc. PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

Title of the Paper: ELECTIVE II- ENTREPRENEURSHIP IN MUSHROOM CULTIVATION

Course code: PB21/5E/EMC

Teaching Hours- 5 Hrs/Week (75Hrs/Semester) **Credits: 5 LTP: 4 1 0**

Course Objective

To enable the students to

1. Teach how to identify mushrooms
2. Study the cultivation technique of mushroom
3. Understand the uses of mushroom and their nutritional value.
4. Study the factors affecting mushroom cultivation

Unit I **(10 Hrs)**

Introduction-History, prospects and scope of Mushroom Cultivation-occurrence of mushrooms-natural habitat-types of mushrooms-keys to differentiate edible from poisonous mushrooms-Mushrooms available in India.

Unit II **(15 Hrs)**

Morphology-button, straw and oyster mushrooms-Identification and culture of mushrooms-life cycle of common edible mushroom- *Pleurotus, Agaricus, Calocybe* species.

Unit III **(20 Hrs)**

Cultivation of paddy straw, oyster and button mushrooms-spawn production, growth media-substrates, materials for compost preparation-bed preparation-spawn running and harvesting of mushroom. Preservation and marketing technology of mushrooms.

Unit IV **(15 Hrs)**

Diseases and post- harvest technology, insect pests, nematodes, mites, viruses, fungal competitors and other important diseases-methods of pest management-influence of abiotic factors affecting mushroom production.

Unit V **(15 Hrs)**

Production of mushroom based foods-Nutrient values-protein, aminoacids, calorific values, carbohydrates, fats, vitamins and minerals-health benefits-antidiabetic, antibacterial, antifungal, anti-tumour effect, cardiovascular and renal effects. Mushroom research centres.

Recommended Books

1. Handbook of Mushroom Cultivation, 1999, TNAU publication.
2. Nita Bahl, 2002, Handbook on Mushroom 4th edition vijayprimlani for oxford & IBH publishing co., Pvt., Ltd., New Delhi. Dr.C. Sebastian Rajesekaran Reader in Botany Bishop Heber College, Trichy – 17.
3. Suman, 2005, Mushroom Cultivation Processing and Uses, M/s. IBD Publishers and Distributors, New Delhi.
4. Sing, 2005, Modern Mushroom Cultivation, International Book Distributors, Dehradun.

Reference Books

1. Bahl, N., Handbook on Mushroom, Oxford and IBM, New Delhi.
2. Dey S.C., Mushroom growing, Agrobios (India), Jodhpur.
3. Handbook of Edible Mushroom Today and Tomorrows printers and publishers.
4. Kapoor J.N., Mushroom cultivation, Krishi Bhavan, New Delhi.
5. Manibushan Rao, K., Text Book of Horiculture, Mac Millan India Ltd.,
6. Parthiban, Malathi and Bala Mohan, Mushroom culture (Tamil).
7. Pathak, V.N., Yadav N. and Gaur, M., Mushroom production and processing Technology Agrobios (India), Jodhpur.
8. Sharma, O.P., Textbook of Fungi, Tata McGrawHill Publishing Co., New Delhi.
9. Sharma V.P., 2006, Diseases and Pests of Mushrooms, M/s. IBD Publishers and Distributors, New Delhi.

e-book references:

1. Tavis Lynch . Mushroom Cultivation An Illustrated Guide to Growing Your Own Mushrooms at Home. 2018. Quarry Books; Ill edition.
2. B.C. Suman, V.P. Sharma . Mushroom Cultivation in India. 2007. Daya Books.
3. Willie Crosby. Learn Oyster Mushroom Cultivation with Our Free Book. 2017. Fungi News.

Course outcomes

After completion of the course students will be able to

CO. No.	CO statement
CO1	Identify and compare edible mushroom with poisonous mushroom and utilize its nutritional value
CO2	Explain the prospects and scope of mushroom cultivation in small scale industries
CO3	Explain the life cycle of Pleurotus sp. And Agaricus sp
CO4	Demonstrate the cultivation, harvesting and marketing of mushroom
CO5	Explain the pest control measures and post harvesting techniques

Mapping of CO with PSO

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Average	3	3	3	3	3

Teaching Methodology

Lecture (Chalk and Talk-OHP-LCD)
Videos
Quiz-Seminar-Group discussion
Peer Learning
Field Visits

III B.Sc. PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

QUESTION PAPER TEMPLATE-THEORY

Title of the Paper: ELECTIVE II- ENTREPRENEURSHIP IN MUSHROOM CULTIVATION

Course Code: PB21/5E/EMC **Max. Marks: 100**
Time: 3 Hours

Draw diagrams wherever necessary

QUESTION PAPER PATTERN-UG

Knowledge Level	Section	Word Limit	Marks	Total
K 1	A-10X2 marks	50	20	100
K1. K 2	B-5/8x8 marks	300	40	
K2, K 3	C-2/4x20 marks	1200	40	

SEMESTER VI COURSE PROFILE-PROGRAMME OF STUDY

III B.Sc PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

SEMESTER	COURSE CODE	TITLE OF THE PAPER	INST Hr / Week	CREDIT	MARKS			LTP
					CIA	EXT.	TOTAL	
VI Core 13	PB21/6C/EBP	Part - III - Core Main – Plant Ecology, Biodiversity and Phytogeography	4	4	40	60	100	3 1 0
Core 14	PB21/6C/MPB	Part - III - Core Main - Molecular Biology and Plant Biotechnology	4	4	40	60	100	3 1 0
Core 15	PB21/6C/PPB	Part - III - Core Main - Plant Physiology and Plant Biochemistry	4	4	40	60	100	3 1 0
	PB21/6C/PR3	Practical covering – Core 9, 10 and 11 Practical III	-	4	40	60	100	-
Core 16	PB21/6C/PR4	Practical covering – Core 13,14 and 15 Practical IV	7	4	40	60	100	0 0 7
Elective III	PB21/6E/HOR	Horticulture	5	5	40	60	100	4 1 0
Elective IV	PB21/6E/HBS	Herbal Science	5	5	40	60	100	4 1 0
Elective V	PB21/6E/EBT	Environmental Biotechnology	5	5	40	60	100	4 1 0
Elective VI	PB21/6E/ABY	Aquatic Botany	5	5	40	60	100	4 1 0
Elective VII	PB21/6E /CAB	Computer application and Bioinformatics	5	5	40	60	100	4 1 0
(Two Electives only)		Extension Activities	1	1	-	-	-	-
		Total credits	30	**31**				

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SEMESTER – VI

III B.Sc. PLANT BIOLOGY AND PLANT BIOTECHNOLOGY
(For the candidates admitted during the year 2021-2022 onwards)

Title of the Paper: CORE 13-PLANT ECOLOGY, BIODIVERSITY AND PHYTOGEOGRAPHY

Teaching Hours- 4 Hrs/Week (60 Hrs / Semester) **Course code: PB21/6C/EBP**
Credits: 4 LTP: 3 1 0

Objective:

To enable the students to

- Provide information on the various factors influencing vegetation.
- Impart knowledge on the ecosystems and their significance.
- Acquire knowledge on the biodiversity, major plant communities and their distribution.
- Understand the importance of management and conservation of natural resources.
- Provide an insight on the major issues of environmental concern.

UNIT - I **(10 Hrs)**

Ecosystem – concept processes and components. Food chain, food web, energy flow in ecosystem. Types of Ecosystems : Fresh water (Pond), Coastal (estuary) and Terrestrial (grassland). Ecological pyramids. Plant succession – primary and secondary – xerosere, hydrosere.

UNIT – II **(10 Hrs)**

Biotic and abiotic factors and their influence on vegetation – a brief account of microbes, plants, animals, soil, wind, light, temperature, rain fall and fire. Nutrient cycling (Carbon, Phosphorus and Sulphur) Ecological adaptation in xerophytes, hydrophytes and epiphytes.

UNIT – III **(20 Hrs)**

Biodiversity : Types- Genus, species and ecosystem diversity Concept :-classical and modern. Inter and intra specific species diversity. Allopatric and sympatric speciation. Raunkiaer's life forms, Endemism and Hotspots. Natural resources and its conservation (*In situ* – Biosphere reserve, reserve forest, national park, sanctuary and *ex-situ* – Seed bank, Gene bank, Pollen bank, DNA bank, MTCC and afforestation.). A brief account of national and international agencies of conservation. Afforestation.

UNIT- IV **(10 Hrs)**

Pollution – Air, Water, soil-causes and consequences. Types of pollution: Primary and Secondary. Green house effect, Global warming, ozone depletion, acid rain and their impacts. Remedial measures – Green building.

UNIT – V **(10 Hrs)**

Phytogeography - Principles - wides, endemics and discontinuous species – factors influencing Phytogeography. Vegetation types of India – tropical evergreen forest, deciduous forest, mangrove vegetation and scrub jungle with reference to Tamil Nadu.

Recommended books:

1. Krishnamurthy. K.V., An advanced Text book on Biodiversity. Principles and practice. Oxford and IBH publishing Co. Pvt. Ltd., 2008.
2. Shukla, R.S. and Chandel, P.S. Ecology and Utility of Plants, S. Chand and Co. Pvt. Ltd. 2008.
3. Shrivatsava. M.B. Introduction to forestry, 1998
4. Sharma .P.D. Ecology and Environment, Rastogi Publications, 2005.
5. Grand W. Sharpe, Clare W. Hendee, Wenonah F. Sharpe, Introduction to forestry, McGraw-Hill Book Company, 1986.
6. Tejwani, K.G, Agroforestry in India, Oxford and IBH Publishing Co. Pvt. Ltd, 1994.
7. Dadhich, L.K. and Sharma, A.P. Biodiversity- strategies for conservation. APH publishing Corporation, New Delhi, 2002.

Reference Books :

1. Atlas. R.M. and Bartha.R. (1987) – Microbial Ecology : Fundamentals and applications. The Benjamin/ Cummings Publishing Co. Inc.
2. Colinvaux.P. (1986) – Ecology, John Wiley and Sons.
3. Kumar.H.D. (1994) – Modern concepts of Ecology, Vikas Publishing House Pvt. Ltd.,
4. Krishna Iyer.V.R (1992) Environmental protection and legal defence. Sterling Publishers Pvt. Ltd.,
5. Mabberley.D.J. (1983) – Tropical Rain forest \ecology, Blackie and Son Ltd.,
6. Odum.E.P. (1983) – Basic Ecology, Holt-Saunders International Editions.
7. Smith.W.H. (1981) – Air pollution and forest : Interactions between air contaminants and forest ecosystems.
8. Vickery.M.L. (1984) – Ecology of Tropical plants, John Wiley and Sons.
9. Melchias, G., 2001. Biodiversity and Conservation, Science Publishers Inc. USA.
10. Asthana, DK & Meera Asthana. 2006. A text book of Environmental studies. S.Chand & Company Ltd. New Delhi.
11. Brian Groombridge. 1992. Global Biodiversity, Chapman and Hall, UK.
12. IUCN, 1985. The World Conservation Strategy, IUCN, Switzerland.
13. Odum, EP. Fundamentals of Ecology, 3rd edn, Cengage, 2004
14. Antony Joseph Raj and S.B. Lal- Forestry, Principles and Applications, Scientic Publishers, 2012.
15. Simmons et al., 1980, Conservation of Threatened Plants, NATO Scientific affairs, New York.

E-Learning resources:

https://www.khanacademy.org

https://www.sciencedirect.com

https://www.edx.org

e-book references:

1. Mick Crawley, Plant Ecology, 1997. Wiley, 31-Jan-
2. Paul A. Keddy, Plant Ecology, 2017. Cambridge University Press.
3. Francisco Pugnaire, Fernando Valladares. Handbook of Functional Plant Ecology, 1999. CRC Press.
4. George Simonds Boulger, Plant Geography 1912. J.M. Dent & Son,

5. Pier Luigi Nimis, T.J. Crovello, Quantitative approaches to phytogeography, 2012.Springer Science & Business Media.
6. Léon Croizat, Manual of phytogeography: or, An account of plant-dispersal throughout the world, W. Junk, 1952

Course outcomes

After completion of the course students will be able to

CO No.	CO statement
CO1	Gain knowledge on the factors affecting vegetation, adaptations in plants and development of plant communities
CO2	Identify the types of ecosystem and the nutrient cycles that exists in an environment
CO3	Acquire knowledge on biodiversity and the methods of conservation of natural resources.
CO4	Analyse the impact of pollution on natural resources and the remedial measures to solve the issues.
CO5	Apply the principles of phytogeography and identify the vegetational types of India and Tamilnadu.

Mapping of CO with PSO

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Average	3	3	3	3	3

Teaching Methodology

Lecture (Chalk and Talk-OHP-LCD)
Videos and animations
Problem Solving
Quiz-Seminar-Group discussion
Peer Learning
Field Visit

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

III B. Sc. PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

QUESTION PAPER TEMPLATE-THEORY

Title of the Paper: CORE 13-PLANT ECOLOGY, BIODIVERSITY AND PHYTOGEOGRAPHY
Course code: PB21/6C/ EBP

Max Marks: 100
Time: 3 Hours

Draw diagrams wherever necessary

QUESTION PAPER PATTERN-UG

Knowledge Level	Section	Word Limit	Marks	Total
K 1	A-10X2 marks	50	20	100
K1. K 2	B-5/8x8 marks	300	40	
K2, K 3	C-2/4x20 marks	1200	40	

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS) CHENNAI – 600 008
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SEMESTER – VI

III B.Sc. PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

Title of the Paper: CORE 14-MOLECULAR BIOLOGY AND PLANT BIOTECHNOLOGY
Teaching Hours- 4 Hrs/Week (60 Hrs/ Semester) **Course code: PB21/6C/MPB**
Credits: 4 LTP: 3 1 0

Objective:
To enable students to

- Gain knowledge on the nature, types and functions of Genetic material.
- Impart knowledge in the process of protein synthesis and gene regulation.
- Develop knowledge in recombinant DNA technology.
- Apply the fundamental concepts in the application of Plant Biotechnology in various fields.
- Learn the concepts of tissue culture and its applications.

UNIT – I **(10 Hrs)**

Nature and function of genetic materials Nucleic acid – base paring – Chargaff's rule, DNA – structure (Watson and Crick model). Types of DNA (A, B, C, D, E & Z), denaturation - renaturation. DNA replication in prokaryotes. DNA repair mechanism – mismatch repair- thymidine dimer repair- light induced (Photoreactivation) and light independent repair (Excision, Recombinational and SOS Repair).

UNIT – II **(10 Hrs)**

RNA structure and types. Transcription – Enzymology – RNA polymerase – transcription in prokaryotes. Genetic code – characteristics – Wobble Hypothesis - codons and anticodons. Translation - Gene regulation in Prokaryotes (Negative and Positive) – lac operon and trp operon.

UNIT - III **(10 Hrs)**

Vectors- plasmid, cosmids and phagemids. Recombinant DNA technology - Restriction enzymes and ligases, gene transfer – indirect method - *Agrobacterium* mediated gene transfer, Direct method – Biolistic method and electroporation. Development of transgenic plants with reference to insect resistance (Bt Brinjal and β-carotene (Golden Rice), edible vaccine. GM crops - Pros and cons.Bioethics.

UNIT – IV **(20 Hrs)**

Biotechnology – definition, history and scope Application of plant biotechnology in various fields. Agriculture – Biofertilizers (BGA, VAM), Biopesticides, Bt (*Trichoderma*, Neem). Medicine – Antibiotics (Penicillin), recombinant vaccines, insulin and interferons. Enviornment – Bioremediation (Phytoremediatation) and Biofuel (*Jatropa*). Industry –Production and Applications - Ethanol (yeast), Citric acid (*Aspergillus niger*) & Proteases (*Bacillus sp.*).

UNIT – V **(10 Hrs)**

Introduction – plant tissue culture, concept of totipotency, organogenesis, embryogenesis, aseptic techniques in plant tissue culture – Sterilization, explant preparation and inoculation. Media preparation (MS), callus culture, micropropagation, anther culture and embryo culture, synthetic seed. Application of plant tissue culture in Agriculture, Horticulture and Forestry.

Recommended Books:

1. Verma P.S.A and V.K. Agarwal. Cell Biology, Genetics, Molecular Biology, Evolution and Ecology. S.Chand & Co. Pvt. Ltd., 2004.
2. David Friefielder. Molecular Biology. Narosa Publishers House, 1987.
3. Dubey R.C. Advanced Biotechnology, S.Chand & Co., Ltd., New Delhi, 2014.
4. Ignacimuthu S. Basic Bio-technology, Tata Mc Graw Hill, Publishing Co., Ltd., New
5. Delhi, 2007.
6. Kumar H.D. A text book of Biotechnology, East West Affiliated Press Ltd., New Delhi,1993.

Reference Books:

1. Bernard R Glick & Jack J Pasternak. 2001. Molecular biotechnology-principles and applications of recombinant DNA, (2nd Edition), ASM Press, Washington, D.C.
2. Jogdand, SN. 2016. Gene biotechnology, Himalaya Publishig House, New Delhi. Books for Reference
3. Ernst L. Winnaccker, 2002. From Genes to Clones-introduction to gene technology, VCR Pub., Weintein.
4. James D Watson et al., 1992. Recombinant DNA (2nd Edition), WH Freeman and Co., New York.
5. Maniatis & Sambrook. 2003. Molecular Cloning- A lab manual Vol.I, II & III, Coldspring Harbor Laboratory Press, New York.
6. Old, RW & Primrose, SB. 2001. Principles of Gene Manipulation-an introduction to genetic engineering, Black Well Science Ltd., New York.
7. Bajaj, Y.P.S. Plant, cell and organ culture. Springer – Verlag.
8. Bajaj, Y.P.S. (1987). Biotechnology in agriculture and forestry. Springer – Verlag
9. Halder, T. and Gadgil, V.N., 1981. Plant cell culture in crop improvement. Plenum, New York.
10. Neuman, K.H., Barz, W., and E.Reinhard, 1985. Primary and secondary metabolism

of plant cell cultures – Springer – Verlag, Berlin.
11. Mantell, S.H., and Hedsmith, 1983. Plant biotechnology, SEB Seminar series 18, Cambridge University Press, Cambridge.
12. Barz, W., Reinhard, E., and Zenk, M.H., 1977. Plant tissue culture and its Biotechnology application – Springer – Verlag, Berlin.
13. Mizrahi, A., (1988). Biotechnology in agriculture, advances in biotechnological processes, Vol. 9, Alen R. Liss Loc; New York.
14. Hu, C.Y. and P.J.Wang, 1984. Hand book of plant cell culture Vol.1. Mac million, New York.
15. Reinert, J. and Y.P.S.Bajaj, 1977. Applied and fundamental aspects of plant cell – tissue culture and organ culture – Springer – Verlag, Heidelbery, Berlin.
16. Gleba, Y.Y. and Sytnik, K.M. (1984). Genetic engineering in higher plants – Springer – Verlag, Heidelbery.
17. Bhajwani. S., and Razdan, 1984. Plant tissue culture-Theory and practice.

E-Learning resources:

https://www.khanacademy.org
https://www.sciencedirect.com
https://www.edx.org

e-book references:

1. Pragya Khanna, Cell and Molecular Biology, I.2013. K. International Pvt Ltd.
2. Bruce Alberts, Molecular Biology of the Cell, , 2017. Garland Science.
3. John M. Walker, Ralph Rapley, Molecular Biology and Biotechnology, Royal Society of Chemistry, 2009.
4. Ricroch, Agnes; Fleischer, Shelby; Chopra, Surinder. Plant Biotechnology. Experience and Future Prospects. 2014. Redaktion: . Springer International Publishing.
5. 2. H. S. Chawla., Introduction to Plant Biotechnology - Technology & Engineering, 2002. Science Publishers.

Course outcomes

After completion of the course students will be able to

CO No.	CO statement
CO1	Discuss the nature of Genetic material
CO2	Learn the process of Transcription and Translation involved in protein synthesis and gene regulation in prokaryotes.
CO3	Undestand the role of vectors in rDNA technology and methods of gene transfer in transgenic plants.
CO4	Elucidate the importance of plant biotechnology in the field of agriculture,Environment,Medicine and Forestry
CO5	Impart knowledge in techniques in plant tissue culture and its applications in Horticulture and Forestry

Mapping of CO with PSO

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	2	2	3	2
CO2	2	2	3	3	2
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Average	2.6	2.8	3	3	2.6

Teaching Methodology

Lecture (Chalk and Talk-OHP-LCD)
Videos and animations
Quiz-Seminar-Group discussion
Peer Learning
Field Visits

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SEMESTER – VI

III B.Sc. PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

QUESTION PAPER TEMPLATE-THEORY

Title of the Paper: CORE 14- MOLECULAR BIOLOGY AND PLANT BIOTECHNOLOGY
Course code: PB21/6C/MPB **Max Marks: 100**
Time: 3 Hours

Draw diagrams wherever necessary

QUESTION PAPER PATTERN-UG

Knowledge Level	Section	Word Limit	Marks	Total
K 1	A-10X2 marks	50	20	100
K1. K 2	B-5/8x8 marks	300	40	
K2, K 3	C-2/4x20 marks	1200	40	

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SEMESTER – VI

III B.Sc. PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

Title of the Paper: CORE 15- PLANT PHYSIOLOGY AND PLANT BIOCHEMISTRY
Teaching Hours- 4 Hrs/Week (60 Hrs/ week) **Course code: PB21/6C/PPB**
Credits: 4 LTP: 3 1 0

Objective :
To enable students to

- Understand the basic principles of plant physiology.
- Know the physicochemical organization and the functional aspects of plants.
- Facilitate the learners to understand effectively the concepts on photomorphogenesis.
- Learn the structure and properties of biomolecules

UNIT – I **(10 Hrs)**

Water relations – Properties of water, Imbibition, diffusion, permeability, osmosis, Ascent of sap. Water potential and its components. Mechanism of water, Absorption of water, apoplast and symplast, mechanism – Passive and Active, Transpiration – types and factors affecting transpiration and significance. Opening and closing of stomata- mechanisms. Guttation.

UNIT – II **(15 Hrs)**

Photosynthesis :- Radiant energy, absorption spectrum and action spectrum of chlorophyll molecules. Photosynthetic unit – Quantasomes. Interaction between photosynthetic pigments and radiant energy. Red drop phenomenon, Emerson's enhancement effect, pigment systems I and II. Electron transport system in the chloroplast (Z scheme), cyclic and non-cyclic photo phosphorylation. Calvin cycle, Hatch and Slack pathway CAM and photorespiration- mechanism and significance.Factors affecting photosynthesis. Mineral absorption.

UNIT – III **(10 Hrs)**

Respiration and Nitrogen metabolism:-
Respiration Aerobic, Anaerobic – Glycolysis, Kreb's Cycle, electron transport system, oxidative phosphorylation, respiratory quotient, factors affecting respiration.

Nitrogen metabolism
Importance of nitrogen in plant life – sources of nitrogen – conversion of nitrate to ammonia by plants, Biological nitrogen fixation – nitrogen fixing organisms, legume – *Rhizobium* symbiosis.

UNIT – IV **(10 Hrs)**

Growth – plant growth regulators (auxins, gibberellins, cytokinins, ethylene and abscisic acid) - Practical applications - Photomorphogenesis – photoperiodism – vernalization – dormancy-phytochromes.

Stress Physiology – **Types of biological strain** – water deficit and drought resistance – salt stress – temperature stress. Mechanism of salt and temperature stress tolerance.

UNIT – V **(15 Hrs)**

Enzyme kinetics – Elementary concept of bioenergitics – entrophy and free energy. Enzyme – properties – classification – nomenclature of enzymes – mode of enzyme action – Lock and Key mechanism-Enzyme kinetics-Michaelis Menten hypothesis-enzyme inhibition-competitive, non-competitive and allosteric – factors affecting enzyme action.

Recommended books:

1.Jain. V. K. Fundamentals of Plant Physiology. S. Chand and Co. Pvt. Ltd. New Delhi, 2004.
2.Devlin O.P. Plant Physiology ,Affiliated East West Press Pvt.Ltd, 1974.
3. Jain V.K. Fundamentals of plant physiology, Chand and Company Ltd., 1997.
4. J.L. Jain. Fundamentals of Biochemistry, Chand and Company Ltd., 2006.
5.Mukerjee S. and A. K. Ghosh. Plant Physiology, New Central Book agency, 2009.

Reference Books :

1. Buchanan, B.B., Gruissem, W. and Jones, R.L. 2000. Biochemistry and Molecular Biology of Plants, American Society of Plant Physiologists, Maryland, USA.
2. Dennis, D.T., Turpin, D.H., Lefebvre, D.D. and Layzell, D.B. (Eds) 1997. Plant Metabolism (second edition). Longman Essex, England.
3. Galston, A.W. 1989. Life Processes in Plants. Scientific American Library, Springer-Verlag, New York, USA.
4. Hooykaas, P.J.J., Hall M.A. and Libbenga, K.R. (eds) 1999. Biochemistry and Molecular Biology of Plant Hormones, Elsevier, Amsterdam, The Netherlands.
5. Hopkins, W.G. Introduction to Plant Physiology. John Wiley & Sons, Inc., New York, USA, 2015
6. Lodish, H., Berk, A., Zipursky, S.L., Matsudaira P., Baltimore, D. and Darnell, J. 2000. Molecular Cell Biology (6th edition). W.H. Freeman and Company, New York, USA, 2007
7. Moore, T.C. 1989. Biochemistry and Physiology of Plant Hormones (second edition). Springer-Verlag, NewYork, USA.
8. Nobel, P.S. 1999. Physiochemical and Environmental Plant Physiology (second edition), Academic Press, San Diego, USA.
9. Salisbury, F.B. and Ross, C.W. 1992. Plant Physiology (4th edition). Wadsworth Publishing Co., California, USA.
10. Singhal, G.S., Renger, G., Sopory, S.K., Irrgang, K.D. and Govindjee 1999., Concepts in Photobiology : Photosynthesis and Photomorphogenesis. Narosa Publishing House, New Delhi.

11. Taiz, L. and Zeiger, E. 1998. Plant Physiology (2nd edition). Sinauer Associates, Inc., Publishers, Massachusetts, USA.
12. Thomas, B. and Vince-Prue, D. (1997) Photoperiodism in Plants (second edition). Academic Press, San Diego. USA.
13. Westhoff, P. (1998) Molecular Plant Development from Gene to Plant. Oxford University Press, Oxford, UK.
14. Jain, VK. 2006. Fundamentals of Plant Physiology, S.Chand&Company Ltd.,
15. Verma, SK. 2006. A Textbook of Plant Physiology, S.K.Chand & Co., New Delhi
16. Conn, E & Stumpf, PK. 1979. Outline of Biochemistry Wiley Eastern Ltd., New Delhi
17. Metz, ET. 1960. Elements of Biochemistry. V.F & S (P) Ltd., Bombay
18. Noggle and Fritz, 1976. Introductory Plant Physiology, Prentice Hall, New Delhi
19. Pandey, SN & Sinha, BK. 1989. Plant Physiology, Vikas Publishing House Ltd., New Delhi.

E-Learning resources:

1.https://www.khanacademy.org
2. https://www.kobo.com/us/en/ebook/biochemistry-and-molecular-biology-of-plants
3. https://www.kobo.com/us/en/ebook/a-textbook-of-plant-physiology-1
4. https://www.amazon.in/Advances-Plant-Physiology-P-Trivedi-ebook/dp/B01JP5L0YA
5. https://www.crcpress.com/Plant-Physiology/Stewart-Globig/p/book/9781926692692

e-book references:

1. William G. Hopkins. Introduction to Plant Physiology, 4th Edition. 2008. PDF DRIVE
2. S. K. Sinha. A Textbook of Plant Physiology. 2013. Centrum Press.

Course outcomes

After completion of the course students will be able to

CO No.	CO statement
CO1	Apply on the significance of water relations in the functioning of a plant cell.
CO2	Understand the mechanism of photosynthesis and analyse the factors affecting it.
CO3	Identify the mechanism involved in respiration and nitrogen metabolism in plants
CO4	Analyse and identify stresses that affect plant growth and development and apply the knowledge for plant improvement.
CO5	Study the structure, properties, classification and significance of biomolecules functioning in plants

Mapping of CO with PSO

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	3	2	3	3
CO2	1	3	3	3	3
CO3	1	3	3	3	3
CO4	1	3	3	3	3
CO5	1	2	3	3	3
Average	1	2.8	2.8	3	3

Teaching Methodology

Lecture (Chalk and Talk-OHP-LCD)
Videos and animations
Problem Solving
Quiz-Seminar-Group discussion
Peer Learning
Field Visits

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS) CHENNAI – 600 008
(For the candidates admitted during the year 2018-2019 onwards)

B.Sc.DEGREE EXAMINATION

III B.Sc. PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

QUESTION PAPER TEMPLATE-THEORY

Title of the Paper: CORE 15- PLANT PHYSIOLOGY AND PLANT BIOCHEMISTRY
Course code: PB21/6C/PPB **Max Marks: 100**
Time: 3 Hours

Draw diagrams wherever necessary

QUESTION PAPER PATTERN-UG

Knowledge Level	Section	Word Limit	Marks	Total
K 1	A-10X2 marks	50	20	100
K1. K 2	B-5/8x8 marks	300	40	
K2, K 3	C-2/4x20 marks	1200	40	

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS) CHENNAI – 600 008
(For the candidates admitted during the year 2021-2022 onwards)

III B.Sc. PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

Title of the Paper: Core 12-PRACTICAL PAPER III (Covering core 9, 10 and 11)
Teaching Hours- 7 Hrs/Week **Course code: PB21/6C/PR3**
Credits: 4 LTP: 0 0 7

Course objectives

To enable students to

- Acquire skill to study the internal structure of monocot and dicot roots, stem, leaves and reproductive organs.
- Explain the dynamic nature of cellular organization in relation to function and impart skill in squash and smear techniques to study the stages in cell division.
- Understand the basic concepts in genetics, mapping of chromosomes and hybridization techniques.
- Acquire skills in assessing the variations in vegetative and floral parts of plants and for identification of plants to their respective families.
- Impart knowledge on various economically important plant products and their identification.

Plant Morphology, Taxonomy and Economic Botany

Morphology of leaves, stem, root, and modification, types of inflorescence.

Plants of local flora included under theory syllabus and family identification and derivation based on reasoning.

Dissection, identification, observation and sketching the floral parts of the plants belonging to the families included in the syllabus.

Twenty (20) Herbarium sheets, field note book and bonafide record to be submitted.

Economic uses of plants and plant parts included under theory syllabus.

Field trips to places for observation, study and collection of plants prescribed in the syllabus for 2 to 5 days under the guidance of faculties.

Anatomy

Study of simple and complex tissues by maceration. Study of internal structure of primary (young) and secondary (old) stems. Internal structure of Dicot and monocot stem. Anomalous secondary growth in the stems of *Boerhaavia*, *Nycthanthes* and *Dracaena*. Anatomy of aerial roots (monocot and dicot) . T.S. of dicot and monocot leaves. Stomatal types. Nodal anatomy**.**

Embryology
T.S. of (young and mature) anther (section).
Observation of pollinia (slide only).
Types of ovules.
Types of Endosperm - Nuclear, cellular and helobial.
Dissection and display of any two stages of embryo in *Tridax*.

Cell biology
Squash technique
Ultra structure of plant cell and cell organelles with the help of ultra micrographs
Ergastic substances – starch grains, aleurone grains, crystals – cystolith, raphide and druse

Genetics
Genetic problems –monohybrid cross, dihybrid cross , test cross, incomplete dominance and allelic interaction
Gene mapping – 3 point test cross
Multiple alleles problems

Plant Breeding
Hybridization technique – Bagging and emasculation
To test the viability of seeds using Tetrazolium chloride.(Demonstration)
Genetic models of Heterosis
Phenotype of Heterosis (Maize)

Course outcomes

After completion of the course students will be able to

CO. No.	CO statement
CO1	Compare the anatomy of roots, stem and leaves in dicots and monocots.
CO2	Identify the various cell components, structure and their functions.
CO3	Demonstrate mitotic and meiotic stages in plant cell.
CO4	Predict the solution for genetics problem and chromosome mapping.
CO5	Analyse vegetative and floral characteristics for identification of angiospermic plants using floral mounts.
CO6	Identify and describe various economically important plant products.

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS) CHENNAI-600 008
(For the candidates admitted during the year 2021-2022 onwards)

SEMESTER – VI

III B.Sc. PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

QUESTION PAPER TEMPLATE-PRACITCAL

Title of the Paper: CORE 12-PRACTICAL III (COVERING PAPERS – CORE 9, 10 &11)
Course CodePB21/6C/PR3 **Max marks : 100**
Time : 3 Hrs

I Cut a transverse section of **A** and **B**. Stain and mount in glycerine . Identify giving reasons. Draw diagrams. Leave the slides for valuation. **(2 x7 = 14 Marks)**

II Derive the family of the given plant **C** and **D** based on the diagnostic features (only up to family level). **(2 x 3 = 6 Marks)**

III Mount the floral parts of **E**. **(5 Marks)**

IV Identify the family and the binomial name of **F** and **G**. Describe it in technical terms. Draw labeled diagrams of the L.S. of flower, T.S. of ovary, floral diagram and write the floral formula. **(2 x 5 = 10 Marks)**

IV Mount any one stage of the embryo **H**. Draw neat labeled diagram and submit the slide for Valuation. **(4 Marks)**

V Make acetocarmine preparation of **I** showing any 2 dividing stages and draw diagrams and leave the slide for valuation.(Notes not necessary) **(6 Marks)**

VI Solve the genetic problem **J**. **(5 Marks)**

VII Construct a chromosome map **K** with the data provided. **(5 Marks)**

VIII Identify the materials **L, M** and **N** and give their economic uses. **(3x3 = 9 Marks)**

IX Write critical notes on **O**, **P, Q, R and S**. **(5 x 3 = 15 Marks)**

Herbarium – 10 Marks
Record - 10 Marks
Practical – 80 Mark
Total - 100 Marks

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS) CHENNAI – 600 008
(For the candidates admitted during the year 2021-2022 onwards)

SEMESTER – VI

III B.Sc. PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

Title of the Paper: Core 16-PRACTICAL PAPER IV (COVERING PAPERS – CORE 13,14 &15)
Teaching Hours- 7 Hrs/Week **Course code: PB21/6C/PR4**
Credits: 4 LTP: 0 0 7

Course objectives

To enable students to

- Practically study the morphological and anatomical adaptations of plants belonging to different habitats.
- Study the diversity of plant communities of a given area by standard methods and by phytogeographical methods.
- Handle experiments to understand the physiology and biochemistry of plants.
- Understand the structure of biomolecules through photographs and have hands on training in plant tissue culture.

Plant Ecology and Phytogeography

1. Study of morphological and structural adaptations of locally available hydrophytes, mesophytes, halophytes and epiphytes and correlate to their particular habitats.

   Hydrophyte : *Nymphaea, Hydrilla*. (Any one)
   Xerophyte : *Nerium, Casuarina*. (Any one)
   Mesophyte : *Tridax, Mango*.(Any one)
   Halophyte : *Avicennia, Rhizophora*.(Any one)
2. Map of the phytogeographical regions of India.
3. Quadrate study – line transect.
4. Plan for a green building
5. Field trip to any one scrub jungle or wet land (Guindy National park / Nanmangalam Scrub jungle / Pallikaranai Marsh / Siruthavur Scrub / Vedanthangal Bird Sanctuary / Kelampakkam Marsh / Adyar Poonga).

Molecular Biology and Plant Biotechnology & Plant Physiology and Plant Biochemistry

Molecular Biology – Photographs

1. DNA Structure – Watson and Crick model
2. tRNA
3. DNA – Replication- Semi-conservative
4. DNA – Repair-Mismatch repair, Thymidine dimer repair- Photoreactivation
5. Genetic code

Plant Biotechnology - Demonstration

1. Sterilization techniques in plant tissue culture.
2. MS - Media preparation.
3. Explant sterilization, Callus induction.

Plant Physiology & Plant Biochemistry

1. Determination of OP by plasmolytic method.
2. Determination of DPD by gravimetric method.
3. Effect of chemicals on membrane permeability
4. Effect of temperature on membrane permeability.
5. Study of relative rates of transpiration in different plants.
6. Determination of ratio of water absorption and transpiration by weighing method
7. Separation of plant pigments by paper chromatogrphy.
8. Study of rate of photosynthesis under different light intensities by using willmott's bubble counter
9. Study of rate of photosynthesis under different wavelengths (red & blue) of light.
10. Comparison of rate of respiration of different respiratory substrates.
11. Biochemical test for carbohydrates, proteins and lipids.

Demonstration – Experiments

1. Demonstration of Stomatal movement.
2. Induction of roots in leaves by auxins.
3. Measurement of pH of expressed cell sap and different soils using pH meter
4. Enzyme activity – catalase

Course outcomes

After completion of the course students will be able to

CO. No.	CO statement
CO1	Develop skills to analyse the structure of plants of different habitats by microscopical observations of the plant sections.
CO2	Identify and know the dominant plant communities in a locality by quadrat analysis and mapping of phytogeographical regions.
CO3	Assess the physiology of plants by handling experiments individually.
CO4	Identify the structure of biomolecules and practically handle basic plant tissue culture techniques.

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS) CHENNAI-600 008
(For the candidates admitted during the year 2021-2022 onwards)

III B.SC. PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

QUESTION PAPER TEMPLATE-PRACITCAL

Title of the Paper: CORE 16-PRACTICAL IV (COVERING PAPERS – CORE 13, 14 &15)
Course CodePB21/6C/PR4 **Max marks : 100**
Time : 3 Hrs

I Cut transverse section of **A** and **B**. Identify its habitat giving suitable reasons. Draw labeled diagrams and submit the slide for valuation. **(2x9 = 18 Marks)**

II Record the data and interpret quadrat **C.** **(12 Marks)**

III Write the protocol for **D.** **(10 marks)**

IV Outline the procedure, apparatus and materials required for investigating physiological problem **E** assigned. Set up the experiment. Tabulate the data observed and report the result. Leave the set up for valuation. **(15 Marks)**

V Draw and comment on the set up **F.** **(5 Marks)**

VI Write critical notes on **G, H, I and J**. **(4 x 5 = 20 Marks)**

VII Identify the compound **K** using a biochemical test. Write the procedure and give the result. **(5 Marks)**

Field Trip - 5 Marks
Record - 10 Marks
Practicals – 85 Marks
Total -100 Marks

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS) CHENNAI – 600 008

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SEMESTER – VI

III B.Sc. PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

Title of the Paper: ELECTIVE III- HORTICULTURE
Teaching Hours- 5 Hrs/Week (75Hrs/Semester) **Course code: PB21/6E/HOR**
Credits: 5 LTP: 4 1 0

Objective;
To enable students

- To know the importance and scope of horticulture and cultivation of mushroom.
- Have a fundamental knowledge on floriculture.
- To promote skills on propagation methods and landscaping.
- Provide basic knowledge on horticultural crops and technology of fruit preservation.
- The course opens the door for students to become entrepreneur.

UNIT- I **(20 Hrs)**
Brief history of horticulture and its importance. Classification of horticultural crops. Types of pots and containers , Pot mixtures and potting media for ornamentals . Use of manures and fertilizers in horticultural crop production . Irrigation of horticultural crops.

UNIT- II **(10 Hrs)**
General account of Annuals, Biennials and Herbaceous perennials. - Cut flowers- Rose, Carnation and Gladiolus- varieties, harvesting and storage. Flower arrangement –Types (Fresh and dry), Ikebana.

UNIT- III **(15 Hrs)**
Landscaping – components and principles, garden components – Green House, Lawn, Rockery,Flower bed, Topiary, Trophy, Sunken Garden, Water Garden. Indoor Garden - Bonsai, Terrarium and Hanging pots

UNIT- IV **(15 Hrs)**
Plant propagation - cutting, layering, grafting. Horticultural crops protection - Biological method, cultural method, mechanical method and chemical method.

UNIT- V **(15 Hrs)**
Technology of horticultural crops - harvesting and handling and storage of fruits (general) Preservation of fruits – types – Jam, Jelly, Squash, Syrup, Pickle and Marmalades. Food processing – Freezing, Bottling, Canning, Drying and Chemical preservation.

Recommended Books:

1. Arora.J.S., Introductory Ornamental Horticulture, Kalyan Publishers, 6th edition, 2010.
2. Kumar . N. Introduction to Horticulture, Rohini Agencies, 1986.
3. Handbook of Mushroom Cultivation, 1999, TNAU publication.
4. Nita Bahl, Handbook on Mushroom 4th edition vijayprimlani for oxford & IBH publishing co., Pvt., Ltd., New Delhi. Dr.C. Sebastian Rajesekaran Reader in Botany Bishop Heber College, Trichy – 17, 2017.
5. Suman, 2005, Mushroom Cultivation Processing and Uses, M/s. IBD Publishers and Distributors, New Delhi.
6. Singh, 2005, Modern Mushroom Cultivation, International Book Distributors, Dehradun.

Reference Books:

1. H.T. Hartmann and D.E. Kester 2002. Plant propagation – principles and practices. Printice Hall.
2. T.K.Bose and Mitra and Sadhu, 1991. propagation of tropical and subtropical horticultural crops. Naya Prakash.
3. Bose, T.K., and Bhattacharjee, S.C., 1980. Orchids of India.
4. Mukherjee, S.K., 1983. Orchids ICAR, New Delhi.
5. Bhatcharjee, B.S., 1959. Rose growing in tropics. Thackarspink and Co., Calcutta.
6. Biswas, T.D., 1984. Rose growing – Principles and Practices – Assoc., Pub., Co., New Delhi.
7. Champneys, H.P., 1956. Pearsons encyclopedia of roses. Arthur Pearsons Ltd., New Delhi.
8. Larsen, R.A., 1981. Introduction to floriculture. Academic Press, New York.
9. Abraham, A. and Vatsala, P., 1981. Introduction to Orchids. Trop. Bot. Garden, Trivendrum.
10. Bose, T.K. and Yadav, L.P., 1989. Commercial flowers. Naya Prakash, Calcutta. Mc Daniel, G.L., 1982. Ornamental horticulture. Reston Publ., London.
11. Chadha, K.L., 1986. Ornamental horticulture in India ICAR, Krishi Bhavan, New Delhi.
12. Trivedi, P.P., 1983. Home gardening, ICAR, New Delhi.
13. Bose, T.K., and Mukharjee, D., 1977. Gardening in India. Oxford & IBH Pub., Co., Calcutta.
14. Gopalswamy Iyyangar, 1970. Complete gardening in India, Kalyan Printers, Bangalore
15. Rangaswami, G. and Mahadevan, A. 1999. Diseases of Crop Plants in India (4th edition). Prentice Hall of India Pvt. Ltd., New Delhi.
16. Handbook of Edible Mushroom Today and Tomorrows printers and publishers.
17. Mushroom cultivation. Kapoor, J.N., KrishiBhavan, New Delhi.
18. Mushroom Production and Processing Technology. Pathak, V.N., Yadav, N. and Gaur, M., Agrobios (India), Jodhpur.
19. Diseases and pests of Mushroom. Sharma, V.P., 2006, M/S. IBD Publishers and Distributors, New Delhi.
20. Viswa nath Pathak, Nagendra Yadav, Maneesha Gaur. Mushroom Production and Processing Technology, agro botanical publishers,1998.

E-Learning resources:

1. https://www.kopykitab.com/Precision-Horticulture-by-Archarya-SK
2. https://www.ebooks.com/en-us/subjects/science-horticulture-ebooks/423/
3. http://www.agrimoon.com/horticulture-icar-ecourse-pdf-books/
4. https://www.worldcat.org/title/handbook-of-horticulture/oclc/688653648
5. https://www.khanacademy.org

e-book references:

1. Tavis Lynch . Mushroom Cultivation An Illustrated Guide to Growing Your Own Mushrooms at Home. 2018. Quarry Books; Ill edition.
2. B.C. Suman, V.P. Sharma . Mushroom Cultivation in India. 2007. Daya Books.
3. Willie Crosby. Learn Oyster Mushroom Cultivation with Our Free Book. 2017. Fungi News.
4. K L Chadha. Handbook of horticulture. Indian Council of Agricultural Research. 2001. Directorate of Information and Publications on Agriculture.
5. C R Adams K M Bamford M P Early. 2008. Principles of Horticulture Elsevier Science

Course outcomes

After completion of the course students will be able to

CO. No.	CO statement
CO1	Discuss the classification of crops, container, potting media, fertilizers and irrigation methods of horticultural crops.
CO2	Identify ornamental plants and to explain the nursery structure and flower arrangement.
CO3	Plan for garden components, types of cutting, layering, grafting and methods of crop protection.
CO4	Apply the techniques of fruit preservation – jams, jelly, squash, syrup and marmalades.
CO5	Explain the techniques of cultivation of paddy straw and oyster mushroom and its marketing.

Mapping of CO with PSO

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	2	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Average	2.8	3	3	3	3

Teaching Methodology

Lecture (Chalk and Talk-OHP-LCD)
Videos and animations
Quiz-Seminar-Group discussion
Peer Learning
Field Visits

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS) CHENNAI – 600 008
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B. Sc. DEGREE EXAMINATION

SEMESTER – VI

III B. Sc. PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

QUESTION PAPER TEMPLATE-THEORY

Title of the Paper: ELECTIVE III- HORTICULTURE
Course code: PB21/6E/HOR **Max Marks: 100**
Time: 3 Hours

Draw diagrams wherever necessary

QUESTION PAPER PATTERN-UG

Knowledge Level	Section	Word Limit	Marks	Total
K 1	A-10X2 marks	50	20	100
K1. K 2	B-5/8x8 marks	300	40	
K2, K 3	C-2/4x20 marks	1200	40	

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS) CHENNAI – 600 008
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SEMESTER – VI

III B.Sc. PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

Title of the Paper: ELECTIVE IV- HERBAL SCIENCE
Teaching Hours- 5 Hrs/Week (75Hrs/Semester) **Course code:PB21/6E/HBS**
Credits: 5 LTP: 4 1 0

Objective:
To enable students to

- Impart fundamental knowledge on historical perspective of medicine and medicinal plants.
- Provide information on nutritional value of natural food to prevent and control diseases.
- Incorporate natural remedies and role of herbs for human welfare.
- Train the students in herbal preparation and enable them to understand about drugs and drug adulteration.
- Enable the students to understand the phytochemistry and uses of common medicinal herbs

UNIT – I **(20 hrs)**

Naturopathy - Historical perspective, Role of plants in Naturopathy.
Salient feature and usage of Herbal drugs in Indian system of Medicines viz, Siddha, Ayurveda, General account of Homepathy and Unani.
Classification of crude drugs.
Study of crude drugs derived from the following and their uses
1. Root - *Withania somnifera*
2. Stem - Zingiber officinale
3. Leaf – *Adathoda vasica*
4. Flower - *Syzygium aromaticum*
5. Fruit – *Terminalia chebula*
6. Seed – *Carum copticum*
7. Whole plant-*Phyllanthus niruri*

UNIT – II **(15 Hrs)**

Herbal remedies for common ailments-Acne, common cold, cough and fever, dandruff, dental caris, dysentery and diarrohoea, head lice, sinusitis, sore throat. Medicinal uses and Health hazards of coffee and tea. Raw juice therapy.

UNIT – III **(10 Hrs)**

Natural food for human welfare - Antioxidants, plant resources, importance, free radicals, Antiaging foods, Nutritional aspects of sprouts. Food and herbs to prevent and control diabetes, Carcinoma and Cardiac arrest.

UNIT – IV **(15 Hrs)**

Pharamacogonstic studies of herbal drugs and types of herbal preparations (Chooranam- Thirikadu, Thiripala, Leghiyem- Inji Leghiyem, Kudineer- Thiratchai kudineer, Nilavembu Kudineer, Thailam- Meni, Kaiyan and Cheeraka thailam). Drug adulteration. Fumigatories and Masticatories - Chemical constituents, medicinal uses and deleterious effect to human health: Tobacco, Areca nut, *Cannabis*, *Opium* and Cocaine.

UNIT – V **(15 Hrs)**

Study of some common plants of medicinal value – Binomial, common name, and part used active principles and medicinal uses. *Acalypha indica, Andrographis paniculata, Azadirachta indica, Boerhaavia diffusa, Ocimum sanctum and Syzygium cumini.*

Recommended Books:

1. Nadkarni K.M. Indian Materia Medica Vol. I and II. Popular Prakasham Pvt. Ltd. 2007.
2. IMCOPS: Formulary Of Siddha Medicine.
3. Murugesa Mudaliar, History of Siddha Medicine.

Reference Books:

1. Text book of Pharmacognosy, Wallis, T.E. 1999. CBS Publishers and Distributors, New Delhi.
2. Practical Pharmacognosy, Kokate. 2000. Vallabh, New Delhi.
3. Herbal cure for common diseases. Acharya Vipul Rao, 2000. Diamond books, Pvt. Ltd.
4. Indian medicinal plants used in Ayurvedic preparations, Dey. A.C. 1998. Bishen Singh Mahendra pal singh.
5. Herbal drug microscopy. Vasudevan, T.N. and Laddha, K.S. 2003. Yucca Pub. House.
6. Kokata, Purohit and Ghokale, 2007. Pharmacognosy, Nirali Prakasham Publishers.

E-Learning resources:

1.https://herbs.org.nz/

2.https://theherbalcademy.com

3. https://www.kopykitab.com/Herbal-Science

4.http://cms.herbalgram.org/heg/volume8/07July/HerbalEBooks.html?t=1310004932&ts=1579066352&signature=1dd0d5aef818b19bcdcd6c063a78e404

5. https://www.dattanibookagency.com/books-herbs-science.html

6. https://www.springer.com/gp/book/9783540791157

e-book references:

1. Lyle E. Craker, James E. Simon , . Herbs, Spices, and Medicinal Plants: Recent Advances in Botany, Horticulture, and Pharmacology, Volume 1. .1992. Psychology Press,
2. M. K. Rai, Geoffrey A. Cordell, Jose L. Martinez, Mariela Marinoff, Luca Rastrelli. 2012, Medicinal Plants: Biodiversity and Drugs. CRC Press.

Course outcomes

After completion of the course students will be able to

CO. No.	CO statement
CO1	Compare the principles of various traditional systems of medicine and crude drugs from medicinal plants. Discuss the classification and principles of various traditional systems of medicine and crude drugs from medicinal plants.
CO2	Apply herbal remedies to combat common ailment like cold, cough, fever, headache, achiene, etc using natural remedies and raw juice.
CO3	Asses the significance of antioxidants, food and herbs to prevent and control diabetes, cancer and cardiac arrest.
CO4	Prepare and utilize herbal products like Chooranam, Leghiyem, Thilam and to analyze the deleterious effect of adulterants, fumigastories and masticatories.
CO5	Discuss the phytochemical constituents and medical uses of few commonly available herbal plants.

Mapping of CO with PSO

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	2	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Average	2.8	3	3	3	3

Teaching Methodology

Lecture (Chalk and Talk-OHP-LCD)
Videos and animations
Problem Solving
Quiz-Seminar-Group discussion
Peer Learning
Field Visits

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS) CHENNAI – 600 008
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B. Sc. DEGREE EXAMINATION

III B. Sc. PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

QUESTION PAPER TEMPLATE-THEORY

Title of the Paper: ELECTIVE IV- HERBAL SCIENCE **Max Marks: 100**
Course code: PB21/6E/HBS **Time: 3 Hours**

Draw diagrams wherever necessary

QUESTION PAPER PATTERN-UG

Knowledge Level	Section	Word Limit	Marks	Total
K 1	A-10X2 marks	50	20	100
K1. K 2	B-5/8x8 marks	300	40	
K2, K 3	C-2/4x20 marks	1200	40	

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS) CHENNAI – 600 008
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SEMESTER –VI

III B.Sc. PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

Title of the Paper: ELECTIVE: V - ENVIRONMENTAL BIOTECHNOLOGY
Teaching Hours- 6 Hrs/Week (90 Hrs/Semester) **Course code: PB21/6E/EBT**
Credits: 5 LTP: 4 1 0

Course Objective
To enable students to

- Study different energy resources and utilization of biogas and petroplants.
- Understand the hazards of rapid industrialization, urbanization and other developments and its effect on the environment.
- Be aware of constant threat to the clean environment and to the depleting natural resources.
- Know the implications and applications of biotechnology in the wider context of environment.
- Gain knowledge on application of various organisms in regard to the environment.

UNIT I:
Energy resources- Conventional and Non-Conventional sources. Sources of Wastes, Waste as renewable source of energy. Biogas production, Petroplants.
UNIT II:
Environmental Monitoring- Definition and importance. Biosensors and its applications. Bioindicators- Plants and Microbes.
UNIT III:
Biological treatment of domestic and sewage water. Biological treatment of industrial effluents- Dyeing and Tannery.
UNIT IV:
Vermicompost technology and its applications. Biopesticides- Bacterial, Viral, Fungal and higher plants.
UNIT V:
Bioremediation of Soil, Water, Air pollutants. Oil spills- superbug. Bioleaching- Definition, microorganisms and methods. GEMs and Biosafety.
Recommended Textbooks

1. Dubey. R. C. A Text Book of Biotechnology S. Chand and Company Ltd. New Delhi, 2005.
2. Sharma P. D, Environmental microbiology Narosa publishing House Pvt. Ltd. New Delhi, 2005.
3. Mohapatra P. K. Text Book of Environmental Biotechnology. I. K. International Publishing House Pvt Ltd, 2017.

References

1. Ahmed N, F. M. Quresh and O. Y. khan, Industrial Environmental Biotechnology. Horizon press, 2001.
2. Alexender. N. Glazer and Hiroshi Nilkaido; Microbial biotechnology. Fundamentals of applied microbiology, W. H. Free man and Co , New York, 1995
3. Bruce. E Ratman and Perry, L. Mc Carty, Environmental biotechnology- Principles and applications, Mc Graw Hill, New York, PP- 1- 75, 2001.
4. Ronald M. Atlas and Richard Bartha. Microbial Ecology: Fundamentals and Applications, 4th Edition.1998.

Journals:

Journal of Environmental Research
Journal of Environmental and Biotechnology Research
Journal of Agricultural and Environmental Ethics.

e Learning Resources

www.khanacademy.com
www.onlinelibrary.wiley.com

Course Outcome

After completion of the course students will be able to

CO No.	CO Statement
CO 1	Compare the conventional and non-conventional energy resources and evaluate biogas production and petroplants.
CO 2	Assess environment with the help of biosensors and bioindicators.
CO 3	Utilise various biological methods for treatment of domestic, sewage water and industrial effluents.
CO 4	Apply knowledge on Vermicompost technology and use bacteria, virus, fungi and higher plants as biopesticides.
CO 5	Explain bioremediation, bioleaching and safety of GEMs.

Mapping of CO with PSO

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	3	3	2	3
CO2	3	3	3	2	3
CO3	3	3	3	2	3
CO4	2	3	3	2	3
CO5	3	3	3	2	3
Average	2.6	3	3	2	3

Teaching Methodology

Lecture (Chalk and Talk-OHP-LCD)
Videos and animations
Problem Solving
Quiz-Seminar-Group discussion
Peer Learning
Field Visits

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS) CHENNAI – 600 008
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B. Sc. DEGREE EXAMINATION

III B. Sc. PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

QUESTION PAPER TEMPLATE-THEORY

Title of the Paper: ELECTIVE V- ENVIRONMENTAL BIOTECHNOLOGY

Max Marks: 100

Course code: PB21/6E/EBT **Time: 3 Hours**

Draw diagrams wherever necessary

QUESTION PAPER PATTERN-UG

Knowledge Level	Section	Word Limit	Marks	Total
K 1	A-10X2 marks	50	20	100
K1. K 2	B-5/8x8 marks	300	40	
K2, K 3	C-2/4x20 marks	1200	40	

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SEMESTER –VI

III B.Sc. PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

Title of the Paper: ELECTIVE: VI – AQUATIC BOTANY
Teaching Hours- 5 Hrs/Week (75 Hrs/Semester) **Course code: PB21/6E/ABY**
Credits: 5 LTP: 4 1 0

Course Objective
To enable students to

- Develop their understanding on commonly occurring marine and limnetic algae of The Indian coasts along with the current understanding of its biology.
- Analyze the properties of mangroves, other aquatic angiosperms and microalgae.
- Reflect upon the values and uses of aquatic plants.

UNIT I
Marine and Limnetic Macro algae: Common seaweeds of Indian subcontinent: *Ulva, Caulerpa, Sargassum, Gracilaria*, etc. Common terrestrial algae, including cyanobacteria and lichen photobionts of Indian subcontinent and its life cycle, ecology and taxonomy: *Anabaena, Chlorella, Scenedesmus*.

UNIT II
Mangroves: Mangrove forests of India, including Sundarbans, Pichavaram, Kerala mangroves, Rathnagiri mangroves. Common species of mangroves and mangrove associated plants, including *Avicennia, Rhizophora, Acanthus* and *Aegiceras*. Ecological significance of mangroves.

UNIT III
Phytoplanktons, Cyanobacteria, Dinoflagellates and Diatoms: Common marine microalgae of India, including phytoplanktons and picoplanktons, Common diatoms and dinoflagellates of Indian Ocean, Common limnetic and terrestrial cyanobacteria of India.

UNIT IV
Aquatic Angiosperms: Common aquatic angiosperms of India, including Lotus, Water Lilly, Water hyacinth and so on. Ecology, life cycle, taxonomy and economic importance of aquatic angiosperms.

UNIT V
Values and Uses of Aquatic Plants: Economic importance of aquatic plants, Ecosystem services of aquatic plants, including biogeochemical cycles, oxygen production and carbon sequestration and so on, edible seaweed and algal resources of India, aesthetic, cultural, spiritual importance of aquatic plants.

References:

1. Lee, R.E. 2008. Phycology. 4th edition. Cambridge University Press, Cambridge.
2. Wile, J.M, Sherwood, L.M and Woolverton, C.J. 2013.. Prescott's Microbiology. 9th Edition. Mc Graw Hill International.
3. Kumar, H.D. 1999. Introductory Phycology. Affiliated East-West Press, Delhi.
4. Hoek, C. Van, D. 1999. An Introduction to Phycology. Cambridge University Press.
5. Daubenmire, R.F.1973. Plant and Environment. John Willey.
6. Sharma, J.P.2004. Environmental Studies, Laxmi Publications (P) Ltd. New Delhi.
7. Bast, F. 2014. Seaweeds: Ancestors of land plants with rich diversity. Resonance, 19(2) 1032-1043 ISSN: 0971-8044.

Web Resources:

1. http://kyry6.gq/73447c/aquatic-botany-published-by-elsevier-science.pdf
2. http://fuls7.gq/82442e/aquatic-botany-published-by-elsevier-science.pdf
3. https://www.springer.com/gp/book/9788132221777
4. http://dwit21.cf/7744a1/aquatic-botany-published-by-elsevier-science.pdf
5. https://www.amazon.in/Aquatic-Plants-iFlora-Plant-Guide-ebook/dp/B07NS9V7LN

Mapping of CO with PSO

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Average	3	3	3	3	3

Teaching Methodology

Lecture (Chalk and Talk-OHP-LCD)
Videos and animations
Problem Solving
Quiz-Seminar-Group discussion
Peer Learning
Field Visits

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B. Sc. DEGREE EXAMINATION

III B. Sc. PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

QUESTION PAPER TEMPLATE-THEORY

Title of the Paper: ELECTIVE VI- AQUATIC BOTANY

Max Marks: 100

Course code: PB21/6E/ABY **Time: 3 Hours**

Draw diagrams wherever necessary

QUESTION PAPER PATTERN-UG

Knowledge Level	Section	Word Limit	Marks	Total
K 1	A-10X2 marks	50	20	100
K1. K 2	B-5/8x8 marks	300	40	
K2, K 3	C-2/4x20 marks	1200	40	

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SEMESTER –VI

III B.Sc. PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

Title of the Paper: ELECTIVE: VII – COMPUTER APPLICATION AND BIOINFORMATICS
Teaching Hours- 5 Hrs/Week (74 Hrs/Semester) **Course code: PB21/6E/CAB**
Credits: 5 LTP: 4 1 0

Course Objective
To enable students to

- Recognize advanced resources for accessing scholarly literature from the internet.
- Utilize bibliography management software while typing and downloading citations.
- Operate various software resources with advanced functions and its open office substitutes.
- Understand the concept of databases and use of different public domain for DNA and proteins sequence retrieval.
- Understand the concept of pair wise alignment of DNA sequences using algorithms and structure of proteins homology modeling approach using SWISS MODEL and SWISS-PDB.

UNIT - I
Introduction to computers and Bioinformatics. Types of hardware and software operating systems. Fundamentals of networking, operation of networks, telnet, ftp, www, Internet.

UNIT - II
Biological Research on the web: Using search engines, finding scientific articles.

UNIT - III
Public biological databases, searching biological databases. Use of nucleic acid and protein data banks.

UNIT - IV
NCBI, EMBL, DDBJ, SWISSPORT.

UNIT - V
Protein prediction and Gene finding tools.

References:
1. Khan imtiyaz Alam, 2006. Elementary Bioinformatics (HB), Dehradun.
2. Harshitha D. 2006. Techniques of Teaching Computer Science, International Book Distributor, Dehradun.
3. Irfan Ali Khan and Attiya Khanum (eds.). 2005. Basic concepts of Bioinformatics,

Ukaaz Publications, Hyderabad. Irfan Ali Khan and Attiya Khanum (eds.). 2004. Introductory Bioinformatics. Ukaaz Publications, Hyderabad.
5. Krane Dan, E and Raymer M.L. 2004. Fundamental concepts of Bioinformatics. Pearson education. New Delhi. Second Indian reprint.
6. Rastogi, S.C., Mediratta, N and Rastogi. P. 2004. Bioinformatics, methods and applications, genomics, proteomics and drug discovery, Prentice hall of India, Pvt. Ltd., New Delhi.

Web Resources:

1. http://www.agrimoon.com/introduction-to-computer-applications-pdf-book/
2. https://www.ebooks.com/en-us/subjects/computers/
3. https://it.careers360.com/download/ebooks
4. http://www.aun.edu.eg/molecular_biology/Procedure%20Bioinformatics22.23-4-2015/Xiong%20-%20Essential%20Bioinformatics%20send%20by%20Amira.pdf
5. http://www.freebookcentre.net/Biology/BioInformatics-Books.html
6. https://courses.cs.ut.ee/MTAT.03.242/2017_fall/uploads/Main/Basics_of_Bioinformatics.

Mapping of CO with PSO

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	1	2	1	1
CO2	1	1	3	3	1
CO3	1	1	2	3	3
CO4	1	1	1	2	1
CO5	1	1	2	3	3
Average	1	1	2	2.4	1.8

Teaching Methodology

Lecture (Chalk and Talk-OHP-LCD)
Videos and animations
Problem Solving
Quiz-Seminar-Group discussion
Peer Learning
Field Visits

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B. Sc. DEGREE EXAMINATION

III B. Sc. PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

QUESTION PAPER TEMPLATE-THEORY

Title of the Paper: ELECTIVE IV- COMPUTER APPLICATION AND BIOINFORMATICS

Max Marks: 100

Course code: PB21/6E/CAB **Time: 3 Hours**

Draw diagrams wherever necessary

QUESTION PAPER PATTERN-UG

Knowledge Level	Section	Word Limit	Marks	Total
K 1	A-10X2 marks	50	20	100
K1. K 2	B-5/8x8 marks	300	40	
K2, K 3	C-2/4x20 marks	1200	40	

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS) CHENNAI – 600 008
(For the candidates admitted during the year 2021-2022 onwards)

SEMESTER – III
II YEAR B. A/B. Sc. /B. Com
NON- MAJOR ELECTIVE

Title of the Paper: PART IV NURSERY AND LANDSCAPING
Teaching Hours- 2 Hrs/Week (30 Hrs/ Semester) **Course code: PB21/3N/NLS**
Credits: 2 LTP: 2 0 0

Course Objective:
To enable the students to

- Understand the prospects and scope of nursery and landscaping.
- Learn plant propagation methods along with floriculture and cultivation techniques.
- Learn the types of gardening and designing and maintenance of landscapes and lawn.
- Design various types of gardens and their maintenances.
- Have knowledge on manures and composting.

UNIT - I **(5 Hrs)**
Introduction, prospects and scope of Nursery and landscaping.

UNIT – II **(10 Hrs)**
Methods of Propagation – cutting, layering, grafting, budding, Floriculture – Rose, Chrysanthemum, Jasmine – cultivation.

UNIT III : **(5 Hrs)**
Gardening – formal garden, informal garden, vegetable garden, landscaped layout designing – formation and maintenance of lawn.

UNIT IV : **(5 Hrs)**
Nursery structures – Green house – shade house, Mist chamber – topiary, Bonsai culture.

UNIT V : **(5Hrs)**
Manures, composting – vermicomposting.

Recommended Books:
1. Kumar N. Introduction to Horticulture, Raja Lakshimi Publication, Nagercoil, India.
2. Edmond Musser and Andres Fundamentals of Horticulture McGraw Hill Book Co.,
3. Amarnath V., 2006, Nursery and Lanscaping, M/s IBD Publishers, New Delhi.
4. Manibushari Rao K. Text Book of Horticulture, MacMillon India Ltd.

Reference Books:

1. Edmond Muser and Andres. Fundamentals of Horticulture, McGrawHill Book co.,
2. Gardener, Basic Horticulture Mac Millon N.
3. Lex Lauries and victor H. Rise, Floriculture Fundamentals and practices, McGrawhill publishers.
4. Mukherjee D. Gardening in India, Oxford IBH publishing co, New Delhi.
5. Randhawa, Ornamental Horticulture in India Today and Tomorrow Publishers, New Delhi.
6. Sandhu M.K., plant propogation, willey Easter Ltd., New Delhi.
7. Sundararajan, J.S., Muthuswamy J, shanmugavelu, K.G., and Balakrishnan R., A Guide to Horticulture, Thiruvenkadam Printers, Coimbatore.

e-book references:

1. V Amarnath . Nursery And Landscaping. 2010. Agrobios Publications.
2. Ted Lare Design & Build. The 2019 Landscaping trends eBook. 2019. Trends eBook

Course outcomes

After completion of the course students will be able to

CO. No.	CO statement
CO1	Explain the prospects and scope of nursery and landscaping
CO2	Use various propagation methods in the cultivation of ornamental and crop plants
CO3	Design different types of gardens using the basic principles of landscaping
CO4	Explain and communicate the various garden components
CO5	Prepare and use manures and vermicompost

Mapping of CO with PSO

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Average	3	3	3	3	3

Teaching Methodology

Lecture (Chalk and Talk-OHP-LCD)
Videos
Quiz-Seminar-Group discussion
Peer Learning
Field Visits

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS) CHENNAI – 600 008
(For the candidates admitted during the year 2021-2022 onwards)

SEMESTER – III
II YEAR B. A/B. Sc. /B. Com

NON- MAJOR ELECTIVE

Title of the Paper: PART IV NURSERY AND LANDSCAPING

Teaching Hours- 2 Hrs/Week (30 Hrs/ Semester) **Course code: PB21/3N/NLS**
Credits: 2 LTP: 2 0 0

Draw diagrams wherever necessary

Answer any 10 questions from the following. Twelve questions should be given of which 10 should be answered. All questions carry equal marks. Five marks for each question and questions should cover all the units.

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS) CHENNAI – 600 008
(For the candidates admitted during the year 2021-2022 onwards)

SEMESTER – IV

II YEAR B. A/B. Sc. /B. Com

NON- MAJOR ELECTIVE

Title of the Paper: PART IV- MUSHROOM CULTIVATION
Teaching Hours- 2 Hrs/Week (30 Hrs/Semester) **Course code: PB21/4N/MRC**
Credits: 2 LTP: 2 0 0

Objective:
To enable students to

- Give a knowledge on cultivation of mushroom and its nutritional values.
- Acquire knowledge on the morphology and nutritive value of mushroom.
- Understand the prospects and scope of mushroom cultivation in small scale industries.
- Know the life cycle of edible mushrooms Pleurotus sp. And Agaricus sp.
- Learn various procedures of mushroom cultivation and its marketing.
- Have knowledge on pests control and post harvesting procedures of mushroom.

UNIT - I **(5 Hrs)**

Introduction: Morphology, Types of Mushroom, identification of edible and poisonous mushroom, Nutritive values, lifecycle of common edible mushrooms.

UNIT – II **(5 Hrs)**
Mushroom cultivation, prospects and scope of Mushroom cultivation in small scale Industry.

UNIT – III **(5 Hrs)**
Life cycle of *Pleurotus* spp., *Agaricus* spp.,

UNIT - IV **(10 Hrs)**
Spawn production, growth media, spawn running and harvesting of mushrooms and marketing.

UNIT – V **(5 Hrs)**
Diseases and post harvest technology, Insect pests, nematodes, mites, viruses, fungal competitors and other important diseases.

Recommended Books

5. Handbook of Mushroom Cultivation, 1999, TNAU publication.
6. Nita Bahl, 2002, Handbook on Mushroom 4th edition vijayprimlani for oxford & IBH publishing co., Pvt., Ltd., New Delhi. Dr.C. Sebastian Rajesekaran Reader in Botany Bishop Heber College, Trichy – 17.
7. Suman, 2005, Mushroom Cultivation Processing and Uses, M/s. IBD Publishers and Distributors, New Delhi.
8. Sing, 2005, Modern Mushroom Cultivation, International Book Distributors, Dehradun.

Reference Books

10. Bahl, N., Handbook on Mushroom, Oxford and IBM, New Delhi.
11. Dey S.C., Mushroom growing, Agrobios (India), Jodhpur.
12. Handbook of Edible Mushroom Today and Tomorrows printers and publishers.
13. Kapoor J.N., Mushroom cultivation, Krishi Bhavan, New Delhi.
14. Manibushan Rao, K., Text Book of Horiculture, Mac Millan India Ltd.,
15. Parthiban, Malathi and Bala Mohan, Mushroom culture (Tamil).
16. Pathak, V.N., Yadav N. and Gaur, M., Mushroom production and processing Technology Agrobios (India), Jodhpur.
17. Sharma, O.P., Textbook of Fungi, Tata McGrawHill Publishing Co., New Delhi.
18. Sharma V.P., 2006, Diseases and Pests of Mushrooms, M/s. IBD Publishers and Distributors, New Delhi.

e-book references:

1. Tavis Lynch . Mushroom Cultivation An Illustrated Guide to Growing Your Own Mushrooms at Home. 2018. Quarry Books; Ill edition.
2. B.C. Suman, V.P. Sharma . Mushroom Cultivation in India. 2007. Daya Books.
3. Willie Crosby. Learn Oyster Mushroom Cultivation with Our Free Book. 2017. Fungi News.

Course outcomes

After completion of the course students will be able to

CO. No.	CO statement
CO1	Identify and compare edible mushroom with poisonous mushroom and utilize its nutritional value
CO2	Explain the prospects and scope of mushroom cultivation in small scale industries
CO3	Explain the life cycle of Pleurotus sp. And Agaricus sp
CO4	Demonstrate the cultivation, harvesting and marketing of mushroom
CO5	Explain the pest control measures and post harvesting techniques

Mapping of CO with PSO

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Average	3	3	3	3	3

Teaching Methodology

Lecture (Chalk and Talk-OHP-LCD)
Videos
Quiz-Seminar-Group discussion
Peer Learning
Field Visits

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS) CHENNAI – 600 008
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SEMESTER – IV

II YEAR B. A/B. Sc. /B. Com

NON- MAJOR ELECTIVE

Title of the Paper: PART IV- MUSHROOM CULTIVATION
Teaching Hours- 2 Hrs/Week (30 Hrs/Semester) **Course code: PB21/4N/MRC**
Credits: 2 LTP: 2 0 0

Answer any 10 questions from the following. Twelve questions should be given of which 10 should be answered. All questions carry equal marks. Five marks for each question and questions should cover all the units.

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS) CHENNAI – 600 008
(For the candidates admitted during the year 2021-2022 onwards)

SEMESTER I
I B.Sc. PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

Title of the paper: ENVIRONMENTAL STUDIES
Teaching Hours: 2 Hrs/ Week (30 Hrs/Semester) **Course code: UG21/1/EVS**
Credits: 2 LTP: 2 0 0

Objectives
To enable students to

- Acquire basic knowledge on scope and importance of environment
- Study different natural resources
- Enable students to study the environmental changes and disasters
- Gain knowledge in biodiversity, their conservation and threats
- Incorporate knowledge on legal awareness

UNIT –I **(10 Hrs)**
Environmental studies – Definition , Scope and importance.
Pollution – Definition, causes and control measures of
Air pollution – climate change, Global warming, Acid rain, Ozone layer depletion.
Water pollution – Water conservation – rainwater harvesting and watershed management
Soil pollution
Noise pollution

(8 Hrs)

UNIT II
Natural Resourses – Renewable and Non – renewable resources – importance and associated problems – forest, Water, Mineral, Food, energy and land resources. Role of an individual in conservation of natural resourses.

Unit III **(3 Hrs)**
Natural disasters and rehabilitation – earthquake, Cyclone, Flashfloods and Tsunami

(5 Hrs)

Unit IV
Biodiversity – Biological classification of India, Values, Hot spots, Threats to biodiversity, Conservation of Biodiversity –In– situ and Ex- Situ Types. Population – Growth and associated problems.

(4 Hrs)

Unit V
Environmental ethics – Issues ansd possible solutions.
Legal awareness – Environmental protection act – Issues involved in enforcement of environmental legislation.

Recommended books

Sharma.P.D., Environmental Microbiology, Narosa Publishing House Pvt.Ltd. New Delhi 2005. Arul.P. A Textbook of Environmental Studies, 2004. Shukla. R.S. and Chandel.P.S. , Plant Ecology, S.Chand and Co. Pvt. Ltd. 1990.

e-book references:

1. B. S. Chauhan. Environmental Studies,2008.Firewall Media.
2. Arvind Kumar.A Text Book Of Environmental Science, 2004.APH Publishing.

Course outcomes

After completion of the course students will be able to

CO No.	CO statement
CO1	Explain pollution, global warming and water management
CO2	Explain about few resources like water, mineral, land and food resources and their conservation
CO3	Identify the hotspots, endangered and endemic species of India, their conservation and threats to biodiversity
CO4	Communicate about earthquake, cyclone, flash floods and tsunami
CO5	Apply environmental ethics, environmental protection act and legislation

Mapping of CO with PSO

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	2	3	3	3
CO2	2	3	3	3	3
CO3	3	3	3	3	3
CO4	2	3	2	3	3
CO5	2	3	3	3	3
Average	2.2	2.8	2.8	3	3

Teaching Methodology

Lecture (Chalk and Talk-OHP-LCD)
Videos and animations
Problem Solving-Group Discussion
Peer Learning
Field Visits

ETHIRAJ COLEGE FOR WOMEN (AUTONOMOUS) CHENNAI- 600 008
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I B.Sc. DEGREE EXAMINATION

I B.Sc. PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

QUESTION PAPER TEMPLATE-THEORY

Title of the paper: Environmental Studies/Non-major Elective **Max. Marks: 50**
Course Code: UG21/1/EVS//PB21/3N/NLS//PB21/4N/MRC **Time: 2 Hrs**

Answer any 10 questions from the following. Twelve questions should be given of which 10 should be answered. All questions carry equal marks. Five marks for each question and questions should cover all the units.

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III B. Sc. PLANT BIOLOGY AND PLANT BIOTECHNOLOGY
SEMESTER – V
Self Study Course/Advanced Learner Course

Title of the Paper: FORENSIC BOTANY

Course code: PB21/5S/FOB
Credits: 2

Course objectives:
To enable students to

- Conceptualize classification of plants from forensic point of view.
- Understand forensic importance of different parts of plants
- Collect and preserve botanical evidences of crime and analyze classic and DNA based forensic botany cases.

UNIT – I **(20 Hrs)**
Practical plant classification schemes: vegetables and herbs, fruits bearing trees and plants, landscaping plants: trees, shrubs and vines, grasses, plant cell structure and functions. Identification and matching of various types of wood, timber varieties, seeds and leaves.

UNIT- II **(25 Hrs)**
Various types of planktons and diatoms and their forensic importance. Study and identification of pollen grains, Identification of starch grains, powder and stains of spices etc.

UNIT – III **(20 Hrs)**
Various types of poisonous plants: *Abrus precatorius, Anacardium occidentale, Claviceps purpurea, Croton tiglium, Jatropha curcas, Nerium indicum, Nicotiana tabacum, Thevetia nerifolia.* Types of plants yielding drugs of abuse – opium, cannabis, coco, tobacco, datura, Psilocybin mushrooms.

UNIT – IV **(25 Hrs)**
Collection and preservation of botanical evidences: Botanical samples, outdoor crime scene consideration

UNIT – V **(15 Hrs)**
Analysis of samples, DNA analysis, plant DNA typing, Classic forensic botany cases: Case histories by using Plant anatomy and systematic, Palynology, Plant ecology, Limnology, Plant Molecular Biology and DNA.

REFERENCES:

1. Coyle, H.M. 2004. Forensic Botany: Principles and Applications to Criminal Casework. CRC Press.
2. James, S.H., Nordby J.J., Bell, S. 2015. Forensic Science: An Introduction to Scientific and Investigative Techniques. CRC Press; 4 edition

3. Hall, D.W and Byrd, J. 2012. Forensic Botany: a practical guide. Wiley-Blackwell, 1edition.
4. Bock, J.H and Norris, D.O. 2016. Forensic Plant Science, Academic Press
5. Nicholas Marquez Grant, John Wiley. 2012. Forensic Ecology Handbook. Wiley Backwell.
6. David W. Hall, Dr. Jason H. Byrd. Forensic Botany. Wiley-Blackwell; United Kingdom.

e-learning resources:

1. https://www.kobo.com/us/en/ebook/forensic-botany
2. https://www.worldcat.org/title/forensic-botany-a-practical-guide/oclc/796086574
3. https://www.buecher.de/shop/pflanzenoekologie/forensic-botany-ebook-pdf/hall-david-w-- byrd-jason/products_products/detail/prod_id/37354547/
4. https://www.crcpress.com/Forensic-Botany-Principles-and-Applications-to-CriminalCasework/Miller-Coyle/p/book/9780849315299
5. http://docshare02.docshare.tips/files/25818/258183613.pdf

Course outcomes
After completion of the course students will be able to

CO. No.	CO statement
CO1	Explain the importance of plants from Forensic point of view
CO2	Apply knowledge the forensic importance of different groups and parts of plants.
CO3	Utilize knowledge on harmful effects of poisonous plants.
CO4	Make use of techniques on preservation on evidences of crime.
CO5	Explain and analyze the classic and DNA based forensic Botany Cases.

QUESTION PAPER PATTERN

Knowledge Level	Section	Word Limit	Marks	Total
K 1	**A-10X2 marks**	**50**	**20**	**100**
K1. K 2	**B-5/8x8 marks**	**300**	**40**	
K2, K 3	**C-2/4x20 marks**	**1200**	**40**	

Note: only those students with more than 70% marks as aggregate may opt for self study/ advanced learner paper.

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS) CHENNAI – 600 008
(For the candidates admitted during the year 2021-2022 onwards)

III B. Sc. PLANT BIOLOGY AND PLANT BIOTECHNOLOGY
SEMESTER – V
Self Study Course/Advanced Learner Course

Title of the Paper: HOME GARDENING

Course code: PB21/5S/HOG
Credits: 2

Course objectives:
To enable students to

- To understand the prospects and scope of Olericulture, Pomology and Floriculture.
- To learn the cultivation methods of vegetable crops and their uses.
- To learn the propagation techniques and maintenance of fruit trees.
- To have knowledge on the preservation strategy of fruits and fruit products.
- To acquire knowledge on cut flowers and floral arrangement patterns.

ALGAE

UNIT – I **(20 Hrs)**

Introduction and scope of Olericulture, Pomology and Floriculture. Pots and containers. Potting media and pot mixture for different crops. Kitchen garden – site and layout of kitchen gardening.

UNIT- II **(25 Hrs)**

A short account on the methods of cultivation and uses of the following vegetables: Tomato, Brinjal, Ladies-finger, Chillies, Country bean, Ash gourd, Amaranthus, Curry leaf, Fenugreek and Drumstick.

UNIT – III **(20 Hrs)**

A brief account on the method of propagation and maintenance of the following fruit trees: Mango, Jack fruit, Banana, Lemon, Papaya and Guava, their uses.

UNIT – IV **(25 Hrs)**

Preservative techniques of fruits – drying, freezing, heat, sugar, salt, chemicals and fermentation. A short account on fruit products – jam, jelly, marmalade, squash, syrup, pickles and vinegar.

UNIT – V **(15 Hrs)**

Cut flowers, preservation, prolong vase life. Flower arrangement massing, ikebana, bouquets.

Recommended Books:

1. Arora.J.S., Introductory Ornamental Horticulture, Kalyan Publishers, 6th edition, 2010.
2. Kumar . N. Introduction to Horticulture, Rohini Agencies, 1986.

Reference Books:

1. H.T. Hartmann and D.E. Kester 2002. Plant propagation – principles and practices. Printice Hall.
2. T.K.Bose and Mitra and Sadhu, 1991. propagation of tropical and subtropical horticultural crops. Naya Prakash.
3. Bose, T.K., and Bhattacharjee, S.C., 1980. Orchids of India.
4. Mukherjee, S.K., 1983. Orchids ICAR, New Delhi.
5. Bhatcharjee, B.S., 1959. Rose growing in tropics. Thackarspink and Co., Calcutta.
6. Biswas, T.D., 1984. Rose growing – Principles and Practices – Assoc., Pub., Co., New Delhi.
7. Champneys, H.P., 1956. Pearsons encyclopedia of roses. Arthur Pearsons Ltd., New Delhi.
8. Larsen, R.A., 1981. Introduction to floriculture. Academic Press, New York.
9. Abraham, A. and Vatsala, P., 1981. Introduction to Orchids. Trop. Bot. Garden,

E-Learning resources:

1. https://www.kopykitab.com/Precision-Horticulture-by-Archarya-SK
2. https://www.ebooks.com/en-us/subjects/science-horticulture-ebooks/423/
3. http://www.agrimoon.com/horticulture-icar-ecourse-pdf-books/
4. https://www.worldcat.org/title/handbook-of-horticulture/oclc/688653648
5. https://www.khanacademy.org

e-book references:

1. Tavis Lynch . Mushroom Cultivation An Illustrated Guide to Growing Your Own Mushrooms at Home. 2018. Quarry Books; Ill edition.
2. B.C. Suman, V.P. Sharma . Mushroom Cultivation in India. 2007. Daya Books.
3. Willie Crosby. Learn Oyster Mushroom Cultivation with Our Free Book. 2017. Fungi News.
4. K L Chadha. Handbook of horticulture. Indian Council of Agricultural Research. 2001. Directorate of Information and Publications on Agriculture.
5. C R Adams K M Bamford M P Early. 2008. Principles of Horticulture Elsevier Science

Course outcomes
After completion of the course students will be able to

CO. No.	CO statement
CO1	Understand the principles of home gardening
CO2	Gain knowledge on cultivation and uses vegetables
CO3	Apply knowledge on the methods of propagation
CO4	Analyse the various preservation techniques
CO5	Utilize the different types of floral arrangements

Mapping of CO with PSO

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	2	2
CO2	2	2	3	3	3
CO3	3	3	3	3	2
CO4	2	2	2	2	3
CO5	3	3	3	3	3
Average	2.6	2.6	2.8	2.6	2.6

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III B. Sc. PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

Internship (Summer Vacation after IV Semester) - Optional

Minimum number of days is 14 and must consist of an Internship report with an Internship certificate.

List of MOOC Courses offered by NPTEL/SWAYAM (Related to the curriculum) (Optional/extra credits)

S.No.	Title	Duration	Credits
1	Academic and Research report writing – Dr. Samir Roy	8 weeks	2
2	Food Microbiology – Dr.Niranjan Raj. S	12 weeks	4
3	General Microbiology – Dr.Laitonjam Ishwori	12 weeks	4
4	Introduction to developmental biology – Prof. Subramaniam. K	12 weeks	3
5	Certificate Course in environmental sustainably – Dr. M. Rajesh/Dr.Sindhu P Nair	8 weeks	4
6	Ecology & Environment – Prof Abhijit P Deshpande	8 weeks	2
7	Environmental nd Development – Prof. NganjahaoKipger	12 weeks	3
8	Evironmental Biotechnology – Prof. PinakiSar	12 weeks	3
9	Environmental Studies – Dr. Monica Jain	12 weeks	4
10	Plant Cell Bioprocessing – Prof. Smita Srivatsava	8 weeks	2
11	Plant pathology and soil health – Dr. Vindhya. K	12 weeks	4