

**ETHIRAJ COLLEGE FOR WOMEN  
(AUTONOMOUS) CHENNAI**

**DEPARTMENT OF PLANT BIOLOGY AND  
PLANT BIOTECHNOLOGY  
M. Sc., SELF SUPPORTING**

**SYLLABUS**

**(FOR CANDIDATES ADMITTED DURING THE  
ACADEMIC YEAR 2018-2019 ONWARDS )**

**ETHIRAJ COLLEGE FOR WOMEN**

**DEPARTMENT OF PLANT BIOLOGY AND PLANT BIOTECHNOLOGY**

**REVISED SYLLABUS JUNE 2018**

Department of Plant Biology and Plant Biotechnology is revising syllabus with effect from the academic year 2018-2019.

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

**REGULATIONS**

**I. ELIGIBILITY FOR ADMISSION :**

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

**II. ELIGIBILITY FOR THE AWARD OF DEGREE:**

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

**III. COURSE OF STUDY:**

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

- a) Core Subjects
- b) Soft skills
- c) Elective subjects
- d) Extra disciplinary elective subjects
- e) Internship
- f) Research Project

#### **IV. PASSING MINIMUM**

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

#### **V. CLASSIFICATION OF SUCCESSFUL CANDIDATES**

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

**ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)**

**CHOICE BASED CREDIT SYSTEM**

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

(with effect from the Academic Year 2018 - 2019 and thereafter)

**COURSE PROFILE**

**TOTAL CREDITS -15**

**I YEAR - FIRST SEMESTER**

SEM	COURSE CODE	COURSE TITLE	HRS/ WK	CREDI TS	CA MARKS	END SEMESTE R MARKS	TOTAL
I	10SP18/1C/AFV	CorePaper-I Plantdiversity-I:Algae, Fungi,Lichens, Bryophytes, Bacteria and Viruses	6	4	40	60	100
I	10SP18/1C/PGP	CorePaper-II Plantdiversity - II: Pteridophytes, Gymnosperms and Paleobotany	6	3	40	60	100
I	10SP18/2C/PR1	Practical – I**: Covering Core Papers - I & II	8	-	-	-	-
I	10SP18/1E1/PPA (or) 10SP18/1E1/BPT	Elective-I* Plant Pathology (or) Biopesticide Technology	4	3	40	60	100
I	10SP18/1E2/MTE (or) 10SP18/1E2/ALB	Elective-II* Microbial Technology (or) Algal Biotechnology	4	3	40	60	100
I		Soft skill-I Personality Enrichment for Women	2	2	-	50	50

**\*No practicals for elective paper**

**\*\* Core practical will be conducted at the end of the year.**

**COURSE PROFILE**  
**TOTAL CREDITS -29**  
**I YEAR - SECOND SEMESTER**

SEM	COURSE CODE	COURSE TITLE	HRS / WK	CREDITS	CA MARKS	END SEMESTER MARKS	TOTAL
II	10SP18/2C/TEB	CorePaper-III Taxonomy and Economic Botany of Angiosperms	5	4	40	60	100
II	10SP18/2C/AEP	CorePaper-IV Developmental Botany - Anatomy, Embryology and Palynology of Angiosperms	4	4	40	60	100
II	10SP18/2C/EPE	CorePaper-V Ecology, Phytogeography and Evolution	4	3	40	60	100
II	10SP18/2C/PR1	Practical – I: Covering Core Papers - I & II	-	5	40	60	100
II	10SP18/2C/PR2	Practical - II: Covering Core Papers III, IV & V	8	5	40	60	100
II	10SP18/2E3/HTE (or) 10SP18/2E3/ETB	Elective-III Herbal Technology (or) Ethnobotany	3	3	40	60	100
II	10SP18/2E/EBO	Extra Disciplinary- I Entrepreneurial Botany (offered to other Department students)	4	3	40	60	100
II		Soft skill-II	2	2	-	50	50

**COURSE PROFILE**  
**TOTAL CREDITS -21**  
**II YEAR - THIRD SEMESTER**

SEM	COURSE CODE	COURSE TITLE	HRS/ WK	CREDITS	CA MARKS	END SEMESTER MARKS	TOTAL
III	10SP18/3C/CGP	CorePaper-VI Cell Biology, Genetics and Plant Breeding	5	4	40	60	100
III	10SP18/3C/PMB	CorePaper-VII Plant Molecular Biology	4	4	40	60	100
III	10SP18/3C/PBI	CorePaper-VIII Plant Biotechnology	4	3	40	60	100
III	10SP18/4C/PR3	Practical – III**: Covering Core Papers VI, VII & VIII	8	-	-	-	-
III	10SP18/3E4/BIS (or) 10SP18/3E4/WOT	Elective-IV Biostatistics (or) Wood technology	3	3	40	60	100
III	10SP18/3E/MBD	Extra Disciplinary – II Medicinal Botany and Dietetics (offered to other Department students)	4	3	40	60	100
III	10SP18/3I/INT	Internship*	-	2	-	-	100
III	10SP18/3S/CBR	Soft skill-III Computing for Biological Research	2	2	-	50	50

**\*A minimum of fifteen days internship programme to be carried out in recognized institution during the II Semester vacational holidays.**

**\*\* Core practical will be conducted at the end of the year.**

**COURSE PROFILE**  
**TOTAL CREDITS -26**  
**II YEAR - FOURTH SEMESTER**

SEM	COURSE CODE	COURSE TITLE	HRS/ WK	CREDITS	CA MARKS	END SEMESTER MARKS	TOTAL
IV	10SP18/4C/PPH	Core Paper-IX Plant Physiology	5	3	40	60	100
IV	10SP18/4C/PBB	Core Paper-X Plant Biochemistry and Biophysics	6	4	40	60	100
IV	10SP18/4C/PR3	Practical - III: Covering Core Papers VI, VII and VIII	-	5	40	60	100
IV	10SP18/4C/PR4	Practical - IV: Covering Core Papers IX and X	8	5	40	60	100
IV	10SP18/4C/PRO	Research Project	5	4	40	60	100
IV	10SP18/4E5/BME  (or)  10SP18/4E5/NBT	Elective-V Bioinstrumentation and Methodology (or) Nanobiotechnology	4	3	40	60	100
IV	10SP18/4S/BIN	Soft skill-IV Bioinformatics	2	2	-	50	50

**As per the guidelines a student has to study five elective papers in her curriculum.**

**ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)**

**CHOICE BASED CREDIT SYSTEM**

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

(with effect from the Academic Year 2018 - 2019 and thereafter)

**COURSE PROFILE**

**TOTAL CREDITS - 91**

SEM	Course code	Course title	Hrs/ wk	CRD	INT	EXT	Total	LTP
I	10SP18/1C/AFV	Plantdiversity-I: Algae, Fungi, Lichens, Bryophytes, Bacteria, and Viruses	6	4	40	60	100	3-3-0
I	10SP18/1C/PGP	Plantdiversity - II: Pteridophytes, Gymnosperms and Paleobotany	6	3	40	60	100	3-3-0
I	10SP18/2C/PR1	Practical - I: Covering Core Papers - I & II	8	-	-	-	-	0-0-8
I	10SP18/1E1/PPA (or) 10SP18/1E1/BPT	Plant Pathology* (or) Biopesticide technology	4	3	40	60	100	2-2-0
I	10SP18/1E2/MTE  (or ) 10SP18/1E2/ALB	Microbial Technology*(or) Algal Biotechnology	4	3	40	60	100	2-2-0
I		Soft skill-Personality Enrichment for Women	2	2	-	50	50	
II	10SP18/2C/TEB	Taxonomy and Economic Botany of Angiosperms	5	4	40	60	100	3-2-0
II	10SP18/2C/AEP	Developmental Botany - Anatomy, Embryology and Palynology of Angiosperms	4	4	40	60	100	3-2-0
II	10SP18/2C/EPE	Ecology, Phytogeography and Evolution	4	3	40	60	100	3-1-0
II	10SP18/2C/PR1	Practical - I: Covering Core Papers - I & II	-	5	40	60	100	-
II	10SP18/2C/PR2	Practical - II: Covering Core Papers III, IV and V	8	5	40	60	100	0-0-8
II	10SP18/2E3/HTE  (or) 10SP18/2E3/ETB	Herbal Technology (or) Ethnobotany	3	3	40	60	100	2-2-0
II	10SP18/2E/EBO	Extra Disciplinary – I Entrepreneurial Botany (offered to other Department students)	4	3	40	60	100	3-0-0
II		Soft skill	2	2	-	50	50	
III	10 SP18/3C/CGP	Cell Biology, Genetics and Plant Breeding	5	4	40	60	100	3-2-0
III	10SP18/3C/PMB	Plant Molecular Biology	4	4	40	60	100	3-2-0
III	10SP18/3C/PBI	Plant Biotechnology	4	3	40	60	100	3-1-0



III	10SP18/4C/PR3	Practical - III: Covering Core Papers VIII, IX and X	8	-	-	-	-	0-0-8
III	10SP18/3E4/BIS (or) 10SP18/3E4/WOT	Biostatistics (or) Wood Technology	3	3	40	60	100	2-1-0
III	10SP18/3E/MBD	Extra Disciplinary – II Medicinal Botany and Dietetics (offered to other Department students)	4	3	40	60	100	3-0-0
III	10SP18/3I/INT	Internship*	-	2	-	-	100	-
III	10SP18/3S/CBR	Soft skill III- Computing for Biological Research	2	2	-	50	50	
IV	10SP18/4C/PPH	Plant Physiology	5	3	40	60	100	3-2-0
IV	10SP18/4C/PBB	Plant Biochemistry and Biophysics	6	4	40	60	100	3-3-0
IV	10SP18/4C/PR3	Practical - III: Covering Core Papers VI, VII and VIII	-	5	40	60	100	-
IV	10SP18/4C/PR4	Practical - IV: Covering Core Papers IX and X	8	5	40	60	100	0-0-8
IV	10SP18/4C/PRO	Research Project	5	4	40	60	100	0-0-5
IV	10SP18/4E5/BME (or) 10SP18/4E5/NBT	Bioinstrumentation and Methodology  (or) Nanobiotechnology	4	3	40	60	100	2-2-0
IV	10SP18/4S/BIN	Soft skill IV-Bioinformatics	2	2	-	50	50	

\*No practicals for elective paper

\*A minimum of fifteen days internship programme to be carried out in recognized institution during the II Semester vacational holidays

As per the guidelines a student has to study five elective papers in her curriculum.

## EVALUATION PATTERN

Continuous assessment – 40 marks, End semester – 60 marks

### EVALUATION FOR CONTINUOUS ASSESSMENT

2 Test for 2 hours each	20 marks
Seminar/Assignment/Quiz /Industrial visit / Field study	10 marks
Participatory learning / Group discussion	10 marks
Total	40 marks

### RUBRICS FOR CONTINUOUS ASSESSMENT (THEORY)

Seminar - Organization/ subject knowledge/ visual aids/ confidence level/presentation

Assignment-Contents/originality/presentation/schematicrepresentation and diagram/Bibliography

Industrial visit / field study - Participation /Attitude/Conduct

Participatory learning / Group discussion – Answering question/ Clearing doubts/ participation in discussion/ attendance/communication and language.

### RUBRICS FOR CONTINUOUS ASSESSMENT (PRACTICALS)

Paper Code	Model exam	Class work	Record	Herbarium	Field visit	Total
10SP18/2C/PR1	10	20	5	-	5	40
10SP18/2C/PR2	10	15	5	5	5	40
10SP18/4C/PR3	10	25	5	-		40
10SP18/4C/PR4	10	25	5	-	-	40

### QUESTION PAPER PATTERN FOR END SEMESTER PRACTICAL EXAM

**Practical Exam – 85 Marks**

**Record – 10 Marks**

**Viva – voce – 05 Marks** (Marks obtained will be converted to 60)

Total Marks = External Marks – 60 + Internal Marks - 40

### QUESTION PAPER PATTERN FOR END SEMESTER EXAM

COMPONENT	NATURE OF THE QUESTION	MAXIMUM MARKS
<b>PART-A</b>	<b>Definition</b>	<b>20</b>
<b>PART-B</b>	<b>Understanding description</b>	<b>40</b>
<b>PART- C</b>	<b>Application/Analysis/Synthesis/Evaluation</b>	<b>40</b>

**PART-A – 20 Marks:** Answer all 10 questions each carrying 2 marks.

**PART-B – 40 Marks:** Answer 5 questions out of 8 each carrying 8 marks

**PART- C – 40 Marks:** Answer 2 questions out of 3 each carrying 20 Marks

#### **EXTRA DISCIPLINARY ELECTIVE SUBJECTS OFFERED TO OTHER DEPARTMENT**

**PART-A 40 marks:** Can answer 5 questions from 8 each carrying 8 marks

**PART-B 60 marks:** Has 5 questions and 3 questions to be answered each carrying 20 Marks.

#### **QUESTION PAPER PATTERN FOR SOFT SKILL**

**PART –A – 10 Marks:** Answer all 5 questions each carrying 2 marks

**PART – B- 20 Marks:** Answer 4 questions out of 6 each carrying 5 marks.

**PART - C - 20 Marks:** Answer 1 question out of 2 carrying 20 Marks.

#### **QUESTION PAPER PATTERN FOR CONTINUOUS ASSESSMENT TEST**

**PART –A – 10 Marks:** Answer all 5 questions each carrying 2 marks

**PART – B- 20 Marks:** Answer 4 questions out of 6 each carrying 5 marks.

**PART - C - 20 Marks:** Answer 1 question out of 2 carrying 20 Marks.

## SEMESTER-I

### CORE PAPER- I PLANT DIVERSITY –I

#### ALGAE, FUNGI, LICHENS, BRYOPHYTES, BACTERIA AND VIRUSES

COURSE CODE-10SP18/1C/AFV

Teaching hours: 6/ Week

Credits: 4

90/ Semester

L-T- P

3 -3- 0

#### OBJECTIVES:

To enable the students to

- Understand structure, reproduction, life cycles of Algae, Fungi, Lichens, Bryophytes, Bacteria and Viruses
- To acquire knowledge of Food, Pharmaceutical and Industrial application of Fungi, Lichens, Bryophytes, Bacteria and Viruses

#### UNIT - I: Algae

(20Hrs)

History of Algology, Classification of algae by Fritsch (1935-45) and Christensen (1964) system. General characteristic features of algae: Chlorophyceae, Xanthophyceae, Chrysophyceae, Bacillariophyceae, Cryptophyceae, Dinophyceae, Chloromonadineae, Euglenophyceae, Phaeophyceae, Rhodophyceae, and Cyanophyceae. Structure, reproduction and life histories of the following genera: *Anaebaena*, *Scytonema*, *Ulva*, *Codium*, *Cyclotella*, *Padina*, *Gelidium*.

#### UNIT - II: Fungi

(20Hrs)

History of Mycology, Classification of Fungi Alexopoulos and Mims (1979). Heterothallism in fungi, sexuality in fungi, Parasexuality, sex hormones in fungi. Cultivation of mushrooms – *Pleurotus*, Mycorrhizal Fungi, Economic importance of fungi.

Structure, reproduction and life histories of the following genera:

Plamsodiophromycetes	: <i>Plasmodiophora</i>
Oomycetes	: <i>Phytophthora</i>
Zygomycetes	: <i>Rhizopus</i>
Ascomycetes	: <i>Taphrina</i>
Basidiomycetes	: <i>Polyporus</i>
Deuteromycetes	: <i>Fusarium, Alternaria, Colletotrichum</i>

### **UNIT - III: Lichens**

**(15Hrs)**

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

### **UNIT - IV: Bryophytes**

**(20Hrs)**

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

### **UNIT - V: Bacteria and Viruses**

**(15Hrs)**

Classification, structure and reproduction of Bacteria, Mycoplasma, Viruses - Harmful and beneficial microbes. Important plant diseases caused by bacteria, viruses and viroids.

### **RECOMMENDED BOOKS**

1. Kumar . H. D. and H. N. Singh. A text book of Algae. Affiliated Esat West Press. Pvt. Ltd. New Delhi (1979)
2. C.J. Alexopoulos, Introductory Mycology (First Edition)
3. C.J. Alexopoulos, C.W. Mims, M. Blackwell. Introductory Mycology (Fourth Edition) Wiley India Pvt. Ltd (2007).
4. Gangulee and Khar. College Botany The New Central Book Agency Calcutta, 6<sup>th</sup> edition (2011)
5. Fritsch, F. E. 1967. The Structure and Reproduction of Algae, Vol. I. University Press Cambridge
6. Fritsch, F. E. 1967. The Structure and Reproduction of Algae, Vol II. I. University Press Cambridge
7. Alexopoulos, C. J. And Bold, H. C. Algae and Fungi. The Macmillan Co. London (1967)
8. Kumar H. D and H. N. Singh. 1982. A text Book on Algae. Affiliated East- West Press Pvt. Ltd
9. R C Dubey & D K Maheshwari, A Textbook of Microbiology, 3<sup>rd</sup> edition, 2013.

### **REFERENCE BOOKS**

1. Bold, H. C and Wynne, M. J. 1978. Introduction to the Algae: Structure and Function. Prantice Hall of India New Delhi
2. Chapman, V. J. 1962. The Algae. Macmillan and Co. Ltd. New York.
3. Dioxn, P. S. 1973. Biology of Rhodophyta. Hafner Press. New York.
4. Dodge, J. E. 1953. The Fine Structure of Algal Cells. AP London

5. Fogg., G. E. 1953. The Metabolism of Algae. Methuen & Co. London
6. Fott, B.1959. Studies in Phylogeny. Academia Prague
7. Harley, J. L. 1969. The Biology of Mycorrhiza Leonard Hill. London
8. Morris, I. 1968. An Introduction to the Algae, Hutchinson University Library, London
9. Phillips, J. M. and Hayman, D. S. 1970.Improved procedures for clearing roots and staining parasitic and vesicular arbuscular mycorrhizal fungi for rapid assessment and infection. Trans. Br. Mycol.Soc. 55:158-161.
10. Pickett\_Heaps, J. D.1975. Green Algae. Sinauer Associates, Sunderland, Mass
11. Prescott, G. W. 1969.The Algae: A Review. Thomson Nelson & Sons. London
12. Round, F. E. 1973. The Biology of Algae. Edward Arnold. London
13. Schenck,N. C. and Perez,Y. 1990.Manual for the identification of VA mycorrhizal fungi. Publications, Gainesville, Florida USA pp283
14. Smith, G. M.1951. Manual of Phycology. Chronica Botanica Co., Waltham Mass
15. Smith, G. M.1955. Cryptogamic Botany Vol. I Mc Graw – Hill Co.New York
16. Smith, S and Reed, D. J.1997. Mycorrhizal Symbiosis Academic Press.
17. Stein, J. R. 1980. Hand Book of Phycological Methods. University Press. Cambridge
18. Chapman. V. J and H. J. Chapman .The Algae. 2 nd Edition (1961)
19. Elizabeth Moore and Landecker Fundamentals of Fungi. Benjamin-Cummings Publishing Company (1996).

#### **ONLINE REFERENCE**

<https://www.nybg.org/bsci/lichens/>

<https://www.ncbi.nlm.nih.gov/books/NBK7637/>

**ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)**

**CHENNAI-600 008.**

(For candidates admitted during the academic year 2018-2019)

**M. Sc DEGREE EXAMINATION**

**I M. Sc PLANT BIOLOGY AND PLANT BIOTECHNOLOGY**

**CORE PAPER- I PLANT DIVERSITY –I**

**ALGAE, FUNGI, LICHENS, BRYOPHYTES, BACTERIA AND VIRUSES**

**COURSE CODE-10SP18/1C/AFV**

**QUESTION PAPER TEMPLATE**

**Max Marks: 100**

**Time : 3 hrs**

**Section –A (10x2=20 marks)**

Answer all questions. All questions carry equal marks. Each answer should not exceed 50 words.

(Question number 1-10. 2 Questions from each unit covering all the 5 units)

**Section-B (5x8=40 marks)**

Answer any five questions. All questions carry equal marks. Each answer should not exceed 300 words. [Question number 11- 18. (Eight questions). One Question from each unit, the remaining 3 questions from the bigger units covering all the 5 units]

**Section- C (2x20 =40 marks)**

Answer any two questions. Both questions carry equal marks. Each answer should not exceed 1200 words. (Question number 19-21 (3 questions).

## CORE PAPER- II

### PLANT DIVERSITY- II PTERIDOPHYTES, GYMNOSPERMS AND PALEOBOTANY

Teaching hours: 6 / Week  
90/Semester

COURSE CODE-10SP18/1C/PGP  
Credits: 3  
L-T- P  
3 -3- 0

#### OBJECTIVES:

- To study about the classification, reproduction and life history of Pteridophytes and Gymnosperms
- To understand the gametophytes and sporophytes of Pteridophytes.
- To understand the importance of fossils in evolution

#### UNIT - I: Pteridophytes

(15Hrs)

General characteristics and classification (Reimer, 1954). Apospory - Apogamy, Origin and evolution of stele and soral evolution. Heterospory and seed habit, Telome theory, morphogenesis, Economic importance.

#### UNIT - II

(20Hrs)

Structure, reproduction and life cycle of the following genera: *Isoetes*, *Angiopteris*, *Osmunda*, *Pteris*, *Polypodium*, *Salvinia*

#### UNIT - III: Gymnosperms

(15Hrs)

General characters - Range of structure, Anatomy, Reproduction, Phylogeny and Classification (K.R.Sporne, 1954). Phylogeny and Economic importance of Gymnosperms.

#### UNIT - IV

(20Hrs)

Structure, reproduction and life cycle of the following genera: *Araucaria*, *Podocarpus*, *Cupressus*, *Ephedra*.

#### UNIT - V: Paleobotany

(20Hrs)

Study of fossils - Importance of Fossils: Formation and types of fossils, techniques of study of fossils, geological time scale. Applied aspects of paleobotany; use in coal and petroleum exploration. Study of organ genera: *Calamites*, *Sphenophyllum*, *Calamostachys*. Study of organ genera: *Lyginopteris*, *Medullosa*, *Pentoxylon*.



## **RECOMMENDED BOOKS**

1. Pandey B.P., 2006 – A text book of Botany, Pteridophytes and Gymnosperms, Vol.II, S.Chand & Co
2. Parihar N.S. 1996. Biology and Morphology of Pteridophytes. Central Book Depot, Allahabad.
3. Bhatnagar, S.P. and Moitra, A. 1996. Gymnosperm New Age International pvt. Ltd., NewDelhi.
4. Stewart, W.N and Rathwell, G.W.1993. Paleobotany and the evolution of plants, Cambridge University press.
5. Vashista. P.C. 2010, Gymnosperms, S.Chand & Co.
6. Vashista.P.C., 2010 – Botany for Degree students : Pteridophyta. S.Chand & Co.

## **REFERENCE BOOKS**

1. Eames.A, 1963 – Morphology of lower vascular plant, McGraw Hill.
2. Forster and Gifford, 1959 – Comparative Morphology of a Vascular Plants.
3. Smith.G.M. 1955- Cryptogamic Botany, Volume-III – McGraw Hill.
4. Sporne.K.R., 1991– The Morphology of Pteridophytes, , B.I.Publishing pvt. Ltd
5. Sharma.O.P.,2012- Pteridophyta , Tata McGraw-Hill Education private limited.
6. Chainberlain.C.J. – Gymnosperms structure and evolution, Chicago,1935
7. Sporne. K.R., - Morphology of Gymnosperms, Hutchinson University Library,1965.

## **ONLINE REFERENCE**

[www.britannica.com/science/apogamy](http://www.britannica.com/science/apogamy)

<http://www.biologydiscussion.com/articles/pteridophytes-features-economic-importance-and-classification/5698>

**ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)**

**CHENNAI-600 008.**

(For candidates admitted during the academic year 2018-2019)

**M. Sc DEGREE EXAMINATION**

**I M. Sc PLANT BIOLOGY AND PLANT BIOTECHNOLOGY**

**CORE PAPER- II**

**PLANT DIVERSITY- II PTERIDOPHYTES, GYMNOSPERMS AND  
PALEOBOTANY**

**COURSE CODE-10SP18/1C/PGP**

**QUESTION PAPER TEMPLATE**

**Max Marks: 100**

**Time : 3 hrs**

**Section –A (10x2=20 marks)**

Answer all questions. All questions carry equal marks. Each answer should not exceed 50 words.

(Question number 1-10. 2 Questions from each unit covering all the 5 units)

**Section-B (5x8=40 marks)**

Answer any five questions. All questions carry equal marks. Each answer should not exceed 300 words. [Question number 11- 18. (Eight questions). One Question from each unit, the remaining 3 questions from the bigger units covering all the 5 units]

**Section- C (2x20 =40 marks)**

Answer any two questions. Both questions carry equal marks. Each answer should not exceed 1200 words. (Question number 19-21 (3 questions).

### **CORE PAPER-III**

#### **PRACTICAL-I : COVERING THEORY PAPERS I AND II**

**COURSE CODE-10SP18/2C/PR1**

**Teaching hours : 8/ Week**

**Credits: 5**

**120/ Semester**

**L-T- P**

**0-0- 8**

#### **Algae**

Study of algae in the field and laboratory of the genera included in theory. External morphology and internal anatomy of the vegetative and reproductive structures of genera given in the theory. Preparation of culture media and Culture of Green Algae and Blue Green Algae in the Laboratory (Demonstration). Haemocytometer, TDS meter.

#### **Fungi**

Study of morphological and reproductive structures of the genera mentioned in theory. Isolation and identification of fungi from soil, air, and Baiting method. Preparation of culture media.

#### **Lichens**

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

#### **Bryophytes**

External morphology and internal anatomy of the vegetative and reproductive organs of genera given in the theory.

#### **Bacteria and Viruses**

Diseases caused by Bacteria and Viruses in plants, Gram's Staining.

#### **Pteridophytes, Gymnosperms and Paleobotany**

External morphology and internal anatomy of the vegetative and reproductive organs of genera given in the theory.

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

**ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)**

**M. Sc. PLANT BIOLOGY AND PLANT BIOTECHNOLOGY**

**PRACTICAL EXAMINATION**

**TITLE OF THE PAPER: PRACTICAL – I**

**Max Marks- 100**

**PAPER CODE: 10SP18/2C/PR1**

**Practical - 85**

**Record - 10**

**Viva-voce - 5**

**Time- 4 hrs**

1. Cut transverse sections of **A**, **B** and **C**. Give reasons for your identification. **Submit the slides** for valuation. (3X6 = 18 marks)
2. Cut transverse sections of **D** and **E**. Draw labeled sketches. Identify giving reasons. **Submit the slides** for valuation. (2 X 6 =12 marks)
3. Prepare suitable micro-preparations of **F**. Draw labeled sketches. Identify giving reasons. **Submit the preparation** for valuation. (6 marks)
4. Name any two organisms in the given mixture **G**. Draw diagrams, identify giving reasons. (6 marks)
5. Write the protocol **H** for the isolation of fungi from soil / air. (3 marks)
6. Write critical notes on **I, J, K, L, M, N, O & P**. (8 X 4 = 32 marks)
7. Comment on the structure of **Q** and **R**. Mention the geological era and draw the diagram. (2 X 4 = 8 marks)

## ELECTIVE-I: PLANT PATHOLOGY

Teaching hours: 4/ Week  
60/Semester

COURSE CODE-10SP18/1E1/PPA  
Credits: 3  
L-T- P  
2-2- 0

### OBJECTIVES

To enable the student to Understand the

- Principles of plant pathology and defense mechanisms.
- Modern tools in disease diagnosis
- Symptomatology, disease cycle and control measures of few plant diseases.

### UNIT- I

(10Hrs)

History and Principles of Plant Pathology, Scope and Significance of Plant pathology Plant Pathogens – Variation in Plant pathogens – Epidemiology and forecasting of Plant diseases – Host Pathogen Interaction.

### UNIT- II

(15Hrs)

Pathogenesis or Disease development, Environment and nutrition in relation to disease development – Plant Defence mechanism – Molecular tools for diagnosis of disease in relation to Plant Pathology.

### UNIT- III

(15Hrs)

Principles of Plant diseases, Important diseases of crop plants in India (Sheath blight of Rice, Wilt of Tomato, Late blight of Potato, Smut of Sugar cane, Yellow Mosaic Virus in Bhindi). Mycoplasma (Little leaf diseases) – A brief account on Nematodes and Phytoplasma – Abiotic diseases. Plant disease control (physical, chemical and biological), Integrated disease management.

### UNIT- IV

(10Hrs)

Genetics of plant disease: Disease Resistance – Genetics of virulence and resistance, Gene-for-gene concept, Techniques in plant breeding for disease resistance. Genetics of Host – parasite interaction – mutation, heterokaryosis, parasexual recombination.

### UNIT- V

(10Hrs)

Molecular Plant Pathology: Detection of pathogens in host tissues – ELISA, Incorporation of resistant gene Methods- Electroporation and *Agrobacterium* mediated transformation.

## **RECOMMENDED BOOKS**

1. Pathak, Khatri and Pathak. 1996. Fundamentals of Plant Pathology. AgroBios, Jodhpur.
2. Pandey, B.P. 1982. Plant Pathology – Pathogen and Plant disease. S.Chand & Company Pvt. Ltd, New Delhi.
3. Rangaswami G and A. Mahadevan Diseases of Crop plants in India. IV Edition Practice Hall 1999.
4. Bilgrami K.S. and Dube H.C., A Text Book of Modern Pathology Vikas publishing house pvt., Ltd., 1976.
5. Mehrotra R.S. Plant Pathology Tata-Mc Graw Hill Publish, co., Ltd., 1980.

## **REFERENCE BOOKS**

1. Agrios, G.N. Plant pathology, IV Edition, Academic prus 1998.
2. Chatterjee P.B., Plant protection techniques Bharati Bhavan 1997
3. Das Gupta H.K. Principles of Plant pathology Allied Publishers 1988.
4. Singh R.S. Plant Pathogens : The fungi Oxford & IBH Publisher Co.1982.
5. Singh R.S. Plant Diseases Oxford and IBH publishing co., 1983.
6. Walker J.C. Plant Pathology Tata Mc Graw Hill Publishers 1969.
7. Mishra, A., A. Bohra and A. Mishra. 2011. Plant Pathology-Disease and Management. AgroBios, Jodhpur.

## **ONLINE REFERENCE**

[http://oar.icrisat.org/3918/1/12. Integrated\\_Pest\\_Management\\_Options.pdf](http://oar.icrisat.org/3918/1/12. Integrated_Pest_Management_Options.pdf)

<https://books.google.co.in/books?isbn=0203910958>

**Note: No Practical for this paper.**

**ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)**

**CHENNAI-600 008.**

(For candidates admitted during the academic year 2018-2019)

**M. Sc DEGREE EXAMINATION**

**I M. Sc PLANT BIOLOGY AND PLANT BIOTECHNOLOGY**

**ELECTIVE-I: PLANT PATHOLOGY**

**COURSE CODE-10SP18/1E1/PPA**

**QUESTION PAPER TEMPLATE**

**Max Marks: 100**

**Time : 3 hrs**

**Section –A (10x2=20 marks)**

Answer all questions. All questions carry equal marks. Each answer should not exceed 50 words.

(Question number 1-10. 2 Questions from each unit covering all the 5 units)

**Section-B (5x8=40 marks)**

Answer any five questions. All questions carry equal marks. Each answer should not exceed 300 words. [Question number 11- 18. (Eight questions). One Question from each unit, the remaining 3 questions from the bigger units covering all the 5 units]

**Section- C (2x20 =40 marks)**

Answer any two questions. Both questions carry equal marks. Each answer should not exceed 1200 words. (Question number 19-21 (3 questions).

## ELECTIVE-I: BIOPESTICIDE TECHNOLOGY

Teaching hours: 4/ Week  
60/Semester

COURSE CODE-10SP18/1E1/BPT  
Credits: 3  
L-T- P  
2-2- 0

### OBJECTIVES

To study the importance of biopesticides.

To understand the commercialization and efficiency of biopesticides

### UNIT- I

(10Hrs)

Introduction of biopesticides. Advantages for the use of biopesticides.

### UNIT- II

(10Hrs)

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

### UNIT- III

(15Hrs)

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

### UNIT- IV

(10Hrs)

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

### UNIT- V

(15Hrs)

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



## RECOMMENDED BOOKS

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

## REFERENCE BOOKS

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

**Note: No Practical for this paper.**

**ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)**

**CHENNAI-600 008.**

(For candidates admitted during the academic year 2018-2019)

**M. Sc DEGREE EXAMINATION**

**I M. Sc PLANT BIOLOGY AND PLANT BIOTECHNOLOGY**

**ELECTIVE-I: BIOPESTICIDE TECHNOLOGY**

**COURSE CODE-10SP18/1E1/BPT**

**QUESTION PAPER TEMPLATE**

**Max Marks: 100**

**Time : 3 hrs**

**Section –A (10x2=20 marks)**

Answer all questions. All questions carry equal marks. Each answer should not exceed 50 words.

(Question number 1-10. 2 Questions from each unit covering all the 5 units)

**Section-B (5x8=40 marks)**

Answer any five questions. All questions carry equal marks. Each answer should not exceed 300 words. [Question number 11- 18. (Eight questions). One Question from each unit, the remaining 3 questions from the bigger units covering all the 5 units]

**Section- C (2x20 =40 marks)**

Answer any two questions. Both questions carry equal marks. Each answer should not exceed 1200 words. (Question number 19-21 (3 questions).

## **ELECTIVE-II: MICROBIAL TECHNOLOGY**

**Teaching hours: 4/ Week**  
**60/Semester**

**COURSE CODE-10SP18/1E2/MTE**  
**Credits : 3**  
**L-T- P**  
**2-2- 0**

### **OBJECTIVES**

To enable the student to

- Understand the application of fermentation technology and microbes in industry
- Study the Growth kinetics
- Obtain knowledge of microbial products in food industry.

### **UNIT - I: Industrial Microbiology**

**(10Hrs)**

Industrial fermentation - Type of bioreactors - Inoculum development - Scaling up process from shake flask to industrial fermentation - Recovery and purification of intracellular and extracellular products.

### **UNIT - II**

**(10Hrs)**

Microbial production of antibiotics - Penicillin, Streptomycin- Organic acid- lactic acid , Citric acid, Vitamin - B 12 - Amino acid - Lysine - Enzyme - amylase & production of pharmaceutical compounds through microbes.

### **UNIT - III: Environmental and Agricultural Microbiology**

**(10Hrs)**

Microbes in terrestrial, aquatic, microbes in the extreme environments and their adaptations; methods for the determination of microbial numbers, biomass and activities. Significance of microbial activities in the environment Microbial degradation of pesticides, petroleum and hydrocarbons; Microbial inoculants in agricultural; microbes as biological control agents.

### **UNIT - IV: Food Microbiology**

**(15Hrs)**

Brief history of microorganism in food stuffs; source, types and role of microorganisms in spoilage of fruits and vegetables - fresh and processed meats and poultry, miscellaneous foods such as eggs, bakery products, dairy products, beer, wines, and canned foods. Food safety regulations.

## **UNIT - V: Immunology and its application**

**(15Hrs)**

Cells and molecules involved in innate and adaptive immunity, antigens, antigenicity and immunogenicity. B and T cell epitopes, structure and function of antibody molecules. Generation of antibody diversity, monoclonal antibodies, antibody engineering, antigen-antibody interactions.

### **RECOMMENDED BOOKS**

1. Wulf Cruger and Anneliese Crueger, *Biotechnology: A Textbook of Industrial Microbiology*, 2<sup>nd</sup> edition, Panima Publishing Corporation, 2004.
2. A.H. Patel, *Industrial Microbiology*, 1st edition, MacMillan Publication, 2008.
3. Casida Jr, L.E., *Industrial Microbiology*, 1st edition, New Age International (P) Ltd, 2007.
4. K. Sukesh, P K Sivakumar & M.M. Joe, *An Introduction to Industrial Microbiology*, 2010.

### **REFERENCE BOOKS**

1. *Principles of fermentation technology* by Stanbury, P.F Whitaker A. and Hall 1995. Pergaman. Mc Neul and Harvey
2. G. Tortora, B. Funke and C. Case. *Microbiology: An Introduction*. 5th ed. Menlo Park, CA: Bejamin/Cummings, 1995
3. J. Ingraham and C. Ingraham. *Introduction to Microbiology*. Belmont, CA:Wadsworth, 1995.
4. T.D. Brock, M.T. Madison, J. M. Martinko and J. Parker. *Biology of Microorganisms*. 7th ed. Englewood Cliffs, N.J: Prentice-Hall, 1994.

### **ONLINE REFERENCE**

<https://www.omicsonline.org/scholarly/industrial-microbiology-journals-articles-ppts-list.php>

**Note: No Practical for this paper.**

**ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)**

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**M. Sc DEGREE EXAMINATION**

**I M. Sc PLANT BIOLOGY AND PLANT BIOTECHNOLOGY ELECTIVE-II:  
MICROBIAL TECHNOLOGY**

**COURSE CODE-10SP18/1E2/MTE**

**QUESTION PAPER TEMPLATE**

**Max Marks: 100**

**Time : 3 hrs**

**Section –A (10x2=20 marks)**

Answer all questions. All questions carry equal marks. Each answer should not exceed 50 words.

(Question number 1-10. 2 Questions from each unit covering all the 5 units)

**Section-B (5x8=40 marks)**

Answer any five questions. All questions carry equal marks. Each answer should not exceed 300 words. [Question number 11- 18. (Eight questions). One Question from each unit, the remaining 3 questions from the bigger units covering all the 5 units]

**Section- C (2x20 =40 marks)**

Answer any two questions. Both questions carry equal marks. Each answer should not exceed 1200 words. (Question number 19-21 (3 questions).

## **ELECTIVE-II: ALGAL BIOTECHNOLOGY**

**Teaching hours: 4/ Week**  
**60/Semester**

**COURSE CODE-10SP18/1E2/ALB**  
**Credits : 3**  
**L-T- P**  
**2-2- 0**

### **OBJECTIVES**

To enable the student to

- Understand the algal biotechnology.
- Application of algae in the industries.
- Obtain knowledge of algal products in .

### **UNIT – I**

**(10Hrs)**

Objectives of algal biotechnology, Resource potential of algae. Commercial utility of algae, Algal production systems; indoor cultivation methods and Large-scale cultivation of algae. Harvesting algae.

### **UNIT – II**

**(15Hrs)**

Industrial application of algal fuel, algal lipids- transesterification to ester fuel- substitutes for petroleum derived fuel, production of fine chemicals, biofertilizers and hormones, application of seaweed liquid fertilizers. Algae as food for fish, poultry and animals.

### **UNIT – III**

**(10Hrs)**

Therapeutic uses. Remedial compounds, antioxidant, antithrombolytic, anticoagulants, wound healing, skin diseases, antiulcerogenic, antifungal, antibiotics and antitumour, antiviral compounds. Production of pigments and utilization. Role of algae in agriculture and aquaculture. symbiotic algae.

### **UNIT – IV**

**(15Hrs)**

Immobilization of algae: natural compounds of immobilization, methods of immobilization, Recombinant DNA technology in algae. Isolation, fusion and regeneration of protoplasts in macroalgae.

## UNIT – V

(10Hrs)

Role of algae in environmental health; Phycoremediation, Sewage disposal and waste treatment of industrial effluent, algae as indicators in assessing water quality and pollution. Role of algae in nanobiotechnology,

### RECOMMENDED BOOKS

1. Kumar H. D and H. N. Singh.1982. A text Book on Algae. Affiliated East- West Press Pvt. Ltd
2. Morris, I. 1968. An Introduction to the Algae, Hutchinson University Library, London
3. Smith, G. M.1955. Cryptogamic Botany Vol. IMc Graw – Hill Co. New York
4. Smith, S and Reed, D. J.1997. Mycorrhizal mSymbiosis Academic Press.

### REFERENCE BOOKS

5. Baddiley, S. Carey, N.H. Higgins, I.J. and Potter , W.G. 1994 .Microalgae: Biotechnology and Microbiology. Cambride University Press..Cambridge.
6. Becker. E.W. 1994. Micro algae Biotechnology and Microbiology.Cambridge University press.
7. Borowitzka, M.A. and borowizka, L.J. Microalgal Biotechnology. Ignacimuthu, S. 1996. Basic Biotechnology. Tata Mc Graw Hill Publishing Ltd. New Delhi.
8. Trehan, K. 1990. Biotechnology. Naroisia Pub. House. London.
9. Trivedi, P.C. 2001. Algal Biotechnology.. Point publisher, Jaipur.India.
10. Alexopoulos, C. J. And Bold, H. C. Algae and Fungi. The Macmillan Co. London
11. Bold, H. C and Wynne, M. J. 1978.Introduction to the Algae:Structure and Function. Prantice Hall of India New Delhi.
12. Chapman,V. J. 1962. The Algae. Macmillan and Co. Ltd. New York.
13. Dioxn, P. S. 1973. Biology of Rhodophyta. Hafner Press. New York.
14. Dodge, J. E. The Fine Structure of Algal Cells. AP London
15. Fogg., G. E. 1953. The Metabolism of Algae. Methuen & Co. London
16. Fott, B.1959. Studies in Phylogy. Academia Prague
17. Fritsch, F. E.1935. The Structure and Reproduction of Algae, Vol. I.University Press Cambridge
18. Fritsch, F. E.1945. The Structure and Reproduction of Algae, Vol II. University Press Cambridge
19. Pickett\_ Heaps, J. D.1975. Green Algae. Sinauer Associates, Sunderland, Mass
20. Prescott, G. W. 1969.The Algae: A Review. Thomson Nelson & Sons. London

**ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)**

**CHENNAI-600 008.**

(For candidates admitted during the academic year 2018-2019)

**M. Sc DEGREE EXAMINATION**

**I M. Sc PLANT BIOLOGY AND PLANT BIOTECHNOLOGY**

**ELECTIVE-II: ALGAL BIOTECHNOLOGY**

**COURSE CODE-10SP18/1E2/ALB**

**QUESTION PAPER TEMPLATE**

**Max Marks: 100**

**Time : 3 hrs**

**Section –A (10x2=20 marks)**

Answer all questions. All questions carry equal marks. Each answer should not exceed 50 words.

(Question number 1-10. 2 Questions from each unit covering all the 5 units)

**Section-B (5x8=40 marks)**

Answer any five questions. All questions carry equal marks. Each answer should not exceed 300 words. [Question number 11- 18. (Eight questions). One Question from each unit, the remaining 3 questions from the bigger units covering all the 5 units]

**Section- C (2x20 =40 marks)**

Answer any two questions. Both questions carry equal marks. Each answer should not exceed 1200 words. (Question number 19-21 (3 questions)).



## CORE PAPER- IV

### TAXONOMY AND ECONOMIC BOTANY OF ANGIOSPERMS

Teaching hours: 5 / Week  
75/ Semester

COURSE CODE-10SP18/2C/TEB  
Credits: 4  
L-T- P  
3- 2- 0

#### OBJECTIVES:

- Focus on modern trend in classification
- Study the taxonomical and economical aspects of plants

#### UNIT – I

(15Hrs)

Taxonomy and systematics, objectives of plant systematics, hierarchy. Systems of classification – Artificial (Linnaeus), Natural (Bentham & Hooker), Phylogenetic (Takhtajan), Modern (APG). Tools- Flora, Manual, Types of keys and its uses, DNA Bar Coding, Botanical Gardens & Herbaria.

#### UNIT – II

(15Hrs)

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

#### UNIT- III

(15Hrs)

A detailed study of the following families and their interrelationships and phylogeny:

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

15. Combretaceae

**UNIT – IV**

**(15Hrs)**

- 16. Turneraceae
- 17. Passifloraceae
- 18. Aizoaceae
- 19. Apiaceae
- 20. Oleaceae
- 21. Boraginaceae
- 22. Solanaceae
- 23. Bignoniaceae
- 24. Verbenaceae
- 25. Nyctaginaceae
- 26. Casuarinaceae
- 27. Commelinaceae
- 28. Amaryllidaceae
- 29. Arecaceae
- 30. Cyperaceae

**UNIT - V: Economic Botany**

**(15Hrs)**

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

**RECOMMENDED BOOKS**

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

## **REFERENCE BOOKS**

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

## **ONLINE REFERENCE**

[http://edis.ifas.ufl.edu/topic\\_plant\\_families](http://edis.ifas.ufl.edu/topic_plant_families)

**ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)**

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(For candidates admitted during the academic year 2018-2019)

**M. Sc DEGREE EXAMINATION**

**I M. Sc PLANT BIOLOGY AND PLANT BIOTECHNOLOGY**

**CORE PAPER- IV**

**TAXONOMY AND ECONOMIC BOTANY OF ANGIOSPERMS**

**COURSE CODE-10SP18/2C/TEB**

**QUESTION PAPER TEMPLATE**

**Max Marks: 100**

**Time : 3 hrs**

**Section –A (10x2=20 marks)**

Answer all questions. All questions carry equal marks. Each answer should not exceed 50 words.

(Question number 1-10. 2 Questions from each unit covering all the 5 units)

**Section-B (5x8=40 marks)**

Answer any five questions. All questions carry equal marks. Each answer should not exceed 300 words. [Question number 11- 18. (Eight questions). One Question from each unit, the remaining 3 questions from the bigger units covering all the 5 units]

**Section- C (2x20 =40 marks)**

Answer any two questions. Both questions carry equal marks. Each answer should not exceed 1200 words. (Question number 19-21 (3 questions)).

## **CORE PAPER-V**

### **DEVELOPMENTAL BOTANY- ANATOMY, EMBRYOLOGY AND PALYNOLOGY OF ANGIOSPERMS**

**COURSE CODE-10SP18/2C/ AEP**

**Teaching hours: 4 / Week**

**Credits: 4**

**60/Semester**

**L-T- P**

**3- 1- 0**

#### **OBJECTIVES:**

- To study the anatomical, embryological aspects of plants.
- To study the recent advances in palynology

#### **UNIT - I: Anatomy**

**(10Hrs)**

Tissue – Outline, Classification. Organization and theories regarding shoot, root and floral meristems, Vascular cambium - origin, development and types. Cambial activity - normal and anomalous. Cork cambium, Periderm, polyderm, rhytidome, lenticels. Xylem, xylary elements – differentiation. Maceration technique - tracheids, vessels, fibre and parenchyma Patterns of secondary wall thickening. Tyloses; reaction wood, heart wood and sap wood. Growth rings. Phloem - primary and secondary elements - ontogeny-differentiation. Structural variations and characteristics of phloem components. Anomalous thickening in Dicot and Monocot stem.

#### **UNIT - II**

**(15Hrs)**

Secretory cells and tissues; their structure, classification and significance. Types- external and internal secretory structures. Nodal anatomy - uni, tri & multilacunar, Kranz anatomy. Stomata - development and types. Applied plant anatomy in paper and fibre industry.

**UNIT - III: Embryology****(10Hrs)**

Microsporogenesis, Morphology, cytology and physiology of tapetum Microgametogenesis – microspore, division of generative cell, pollen wall morphogenesis and structural variability. Pollen fertility and sterility, Pollen germination, Pollen storage. Ovule-types, Megasporogenesis - Megagametogenesis, Embryosac development and types, ultrastructure of egg, synergids and antipodals.

**UNIT - IV****(15Hrs)**

Fertilization - discharge and movement of sperms. Syngamy and triple fusion; post-fertilization changes. Heterofertilization. (double fertilization). Endosperm - types, endosperm haustoria, Embryogeny -Laws of Embryogeny - Classification – mono and dicot embryos - variations and differences in development, Apomixis. Polyembryony. Embryology in relation to Taxonomy.

**UNIT - V: Palynology****(10Hrs)**

Palynology - aeropalynology - pollen allergy and palynological calendars. Pollen analysis of honey; pollen loads. Paleopalynology - role in coal and oil genesis. Recent advances in palynological studies.

**RECOMMENDED BOOKS**

1. Bhojwani.S.S. and Bhatnagar . S.P. The Embryology Of Angiosperms, Vikas Publications House Private Ltd., 1981.
2. Bhojwani.S.S. and Bhatnagar . S.P., Dantu P.K. The Embryology Of Angiosperms, Vikas Publications House Private Ltd., 2015.
3. Bhojwani.S.S. and Bhatnagar . S.P., The Embryology Of Angiosperms, Vikas Publications House Private Ltd., 2015.
4. Easu. K. 1987. Anatomy of Seedling Plants. Wiley Pub
5. Fahn. A. 2010. Plant Anatomy. Mac Millon
6. Maheswari.P. 1991. Embryology of Angiosperms. Oxford. IBH. Delhi
7. Narayanaswamy. S. 1994. Plant Cell and Tissue Culture. Tata McGraw Hill Ltd. New Delhi
8. Pandey B.P. Plant Anatomy. S. Chand and Co. Pvt Ltd. New Delhi, 2012.Pandey.B.P., Plant Anatomy. S.Chand & Co., Pvt. Ltd. New Delhi. 2002.

9. Singh, Pande, P.C., Jain. D.K. –Anatomy of Seed Plants.
10. Tayal, M.S. –Plant Anatomy.

### **REFERENCE BOOKS**

1. Cronquist. A. .1968 The evolution and Classification of Flowering Plants.
2. Davies . P. H. and Heywood. V. H. 1967. Principles of Angiosperm taxonomy. Oliver and Byod. Edinborough
3. .Davies. G. L Systemic Embryology of Angiosperms,
4. Dixon. A. 1985. Plant Cell Culture- A practical Approach IRL press. Oxford
5. Ertman.G. 1954. An Introduction to Pollen Analysis. Cronica Botanica.
6. Hutchinson. J. 1973. The Families of Flowering Plants. Oxford Uni. Press.
7. Johri. B. M. 1984. Embryology of Angiosperms. Springer Verlaug.
8. Lawrence. G. H. Introduction to Vascular Plants. Oxford. IBH. Delhi.
9. Nair. P. K. K. 1985. Essential of Palynology
10. Carlquist.S. 1961. Comparative Plant Anatomy. Holt Richart
11. Cutter. E. G. Plant Anatomy- Experimental and Interpretation
12. .Gray. P. 1964. Hand Book of Plant Microtechnique.
13. Jenson. W. A. 1962. Botanical Histochemistry. The Benjamin/ Cunnings

### **ONLINE REFERENCE**

[http://self.gutenberg.org/articles/extended\\_maceration](http://self.gutenberg.org/articles/extended_maceration)

<http://www.biologyreference.com/Re-Se/Reproduction-in-Plants.html>

**ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)**

**CHENNAI-600 008.**

(For candidates admitted during the academic year 2018-2019)

**M. Sc DEGREE EXAMINATION**

**I M. Sc., PLANT BIOLOGY AND PLANT BIOTECHNOLOGY**

**CORE PAPER-V**

**DEVELOPMENTAL BOTANY- ANATOMY, EMBRYOLOGY AND PALYNOLOGY  
OF ANGIOSPERMS**

**COURSE CODE-10SP18/2C/ AEP**

**QUESTION PAPER TEMPLATE**

**Max Marks: 100**

**Time : 3 hrs**

**Section –A (10x2=20 marks)**

Answer all questions. All questions carry equal marks. Each answer should not exceed 50 words.

(Question number 1-10. 2 Questions from each unit covering all the 5 units)

**Section-B (5x8=40 marks)**

Answer any five questions. All questions carry equal marks. Each answer should not exceed 300 words. [Question number 11- 18. (Eight questions). One Question from each unit, the remaining 3 questions from the bigger units covering all the 5 units]

**Section- C (2x20 =40 marks)**

Answer any two questions. Both questions carry equal marks. Each answer should not exceed 1200 words. (Question number 19-21 (3 questions).



## CORE PAPER –VI

### ECOLOGY, PHYTOGEOGRAPHY AND EVOLUTION

COURSE CODE-10SP18/2C/ EPE

Teaching hours: 4 / Week

Credits: 3

60/ Semester

L-T- P

3- 1- 0

#### OBJECTIVES:

- To understand ecosystem and environment
- To study the biodiversity and patterns of distribution of plants

#### UNIT - I:

(15Hrs)

**Ecological Principles** : Physical environment /Abiotic environment, biotic environments; their interactions concept of habitat & niche. Diversity of plant life; growth form, life form (Raunkaier's). Productivity and Measurement. Plant Succession – Hydrosere, Xerosere.

**Ecosystem Ecology**: Structure, function, methods of studying vegetation – Transect, Quadrat, Species Area Curve, food chain, food web, energy flow, nutrient cycling (C, N, P, S). Terrestrial ecosystem & aquatic ecosystem. Environmental pollution, effects & control measures.

#### UNIT - II:

(10Hrs)

**Population Ecology**: Population characteristics; Population growth curves; Demography, structure, mortality, natality, age and distribution. Levels of species diversity and its measurements; edges and ecotones.

**UNIT - III:****(15Hrs)**

**Conservation Ecology :** Principles of conservation; Sources and their management strategy with suitable examples (Biosphere reserves etc.) Disaster Management. Global Environmental change. Biodiversity: Status, monitoring and documentation. Endangered plants of India. IUCN category of endangered species.

**UNIT - IV:****(10Hrs)**

**Phytogeography and Remote sensing:** Plant distribution types – continuous, discontinuous, age and area hypothesis. Major Biomes of the world; bio-geographical zones of India; theory of island biogeography; Continental drift; principles of Remote sensing and its applications. Vegetation Mapping through GIS.

**UNIT - V:****(10Hrs)**

**Evolution:** Origin of life, theories of evolution – Darwin, Lamarck and De veries, chemosynthetic theory. Molecular evolution. Variation in nature – sources and analysis of variation. Origin of species – isolation mechanisms.

**RECOMMENDED BOOKS**

1. Ambasht, R. S. (2008). A text book of plant ecology.15<sup>th</sup> Edition. Students & Friends and Co., Varanasi, India.
2. Kumar, H. D. (1997). General Ecology. Vikas Publishing House Pvt. Ltd., New Delhi.
3. Odum, F. E. (1971). Fundamentals of Ecology. W.B. Saunders & Co., New Delhi.
4. Shukla R.S and Chandel P.S (2012) A text book of plant ecology. S Chand
5. Sharma, P.D. (2000) : Ecology & Environment Rastogi Publications, Meerut, India-7=653pp.,
6. Verma P.S and Agarwal V.K (2015) Cell biology, genetics, molecular biology, evolution and ecology S.Chand

**REFERENCE BOOKS**

1. Fahey, T.J. and Knapp, A.K. 2007. Principles and Standards for Measuring Primary Production. Oxford.
2. Grant, W.E. and Swannack, T.M. 2008. Ecological Modeling. Blackwell.

3. Wilkinson, D.M. 2007. Fundamental Processes in Ecology: An Earth system Approach. Oxford.
4. APHA, (1985). Standard methods for the examination of water and waste water. APHA, Washington, DC.
5. Barry, Cox, C and Peter D. Moore (2005). Biogeography: an ecological and evolutionary approach. Blackwell Pub., Co., London.
6. Chapman (1999). Ecology - Principles and applications. Cambridge University Press, Foundation Books, New Delhi.
7. Jones, H. G. (1983). Plants and Microclimate: a qualitative approach to environment plant physiology. Cambridge University Press, London.
8. Koromondy, E. J. (1996). Concepts of ecology. Prentice – Hall of India Pvt. Ltd, New Delhi.
9. Robinson, H. (1978). Biogeography. ECBS & Mac Donald and Evans, London.
10. Crawley, M (2007). Plant ecology. Blackwell scientific Publications.
11. Moore and Chapman, (2007). Methods in plant Ecology. Blackwell Scientific Publications.
12. Russell K. Monson, (2014). Ecology and the Environment. Springer Dordrecht, Heidelberg, New York.
13. Eric R Pianka (2011) Evolutionary Ecology, 7th edition

#### **ONLINE REFERENCE**

<http://www.springer.com/life+sciences/ecology/journal>

<http://guides.lib.ucdavis.edu/ecology>

<http://nptel.ac.in/courses/105108077/module1/lecture1.pdf>

[http://www.ldeo.columbia.edu/res/fac/rsvlab/fundamentals\\_e.pdf](http://www.ldeo.columbia.edu/res/fac/rsvlab/fundamentals_e.pdf)

**ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)**

**CHENNAI-600 008.**

(For candidates admitted during the academic year 2018-2019)

**M. Sc DEGREE EXAMINATION**

**I M. Sc PLANT BIOLOGY AND PLANT BIOTECHNOLOGY**

**CORE PAPER –VI**

**ECOLOGY, PHYTOGEOGRAPHY AND EVOLUTION**

**COURSE CODE-10SP18/2C/ EPE**

**QUESTION PAPER TEMPLATE**

**Max Marks: 100**

**Time : 3 hrs**

**Section –A (10x2=20 marks)**

Answer all questions. All questions carry equal marks. Each answer should not exceed 50 words.

(Question number 1-10. 2 Questions from each unit covering all the 5 units)

**Section-B (5x8=40 marks)**

Answer any five questions. All questions carry equal marks. Each answer should not exceed 300 words. [Question number 11- 18. (Eight questions). One Question from each unit, the remaining 3 questions from the bigger units covering all the 5 units]

**Section- C (2x20 =40 marks)**

Answer any two questions. Both questions carry equal marks. Each answer should not exceed 1200 words. (Question number 19-21 (3 questions).

## **PRACTICAL-II: COVERING THEORY PAPERS III, IV AND V**

**COURSE CODE-10SP18/2C/PR2**

**Teaching hours : 8/ Week**

**Credits : 5**

**120/ Semester**

**L-T- P**

**0-0- 8**

### **Taxonomy and Economic Botany of Angiosperms**

Description of a species, based on herbarium and live specimens of the families mentioned in the theory.

Solving nomenclature problems

Field visits for at least 2-3 days to collect specimens on the spot. Submission of not less than 20 herbarium sheets representing the families studied

### **Ecology and Remote Sensing**

1. Determination of air temperature at different altitudes (Ground Level 50, 100 and 150m).
2. Determination of air temperature at 2 hourly interval starting from 6 am to 6p.m.
3. Determination of the minimum size of quadrat by species area curve.
4. Determination of the quantitative characters of a plant community by random quadrat method (abundance, density, dominance, species diversity, frequency).
5. Determination of the quantitative characters by belt transect method
6. Evaluation of life form classes of the local flora and preparation of biological spectrum of land.
7. Estimation of above ground and below ground biomass employing minimum size of quadrat.
8. Determination of soil moisture content by oven drying method.
9. Determination of water holding capacity.
10. Determination of pH of soil and water by universal indicator(or) pH meter.
11. Mapping of World vegetation
12. Mapping of Indian vegetation.
13. Instruments

## **Anatomy**

Laboratory work on the basis of topics listed under angiosperm anatomy theory. Micrometry in anatomical studies-ocular, stage and camera lucida-types. Techniques in making temporary and permanent microscopic preparations - free hand, peelings, clearing, maceration and wood section. Submission of not less than 5 permanent slides.

## **Embryology and Palynology**

Preparation of dissected whole mounts of embryo. Study of pollen (Acetolysis and nonacetolysis) Collection and Identification of local aerospora. Study from permanent preparation: - Development and structure of anther, Pollen, Ovule, megasporogenesis, embryosac, endosperm and embryo. SEM diagrams of Pollen Grains.

**ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)**

**I M. Sc., PLANT BIOLOGY AND PLANT BIOTECHNOLOGY**

**PRACTICAL EXAMINATION**

**TITLE OF THE PAPER: PRACTICAL –II**

**Max Marks- 100**

**PAPER CODE: 10SP18/2C/PR2**

**Practical- 70**

**Record- 10**

**Herbarium-10**

**Slides - 5**

**Viva-voce- 5**

**Time- 4 hrs**

1. Find the binomial of **A** and **B** using Gamble's flora. (2x3=6)
2. Refer **C** and **D** to their respective families giving reasons. Indicate the taxonomic hierarchy. (2x3=6)
3. Cut L.S of flower and T.S of ovary of the specimen **E**. Construct floral diagram and write the floral formula. **Submit the preparation** for valuation. (4)
4. Cut transverse section of **F** and **submit the slide** for valuation. Draw a labeled sketch and identify giving reasons. (6)
5. Investigate the macerate **G**. Identify the elements and draw diagrams. (4)
6. Identify the nodal type / stomatal type of **H**, draw labeled sketches giving reasons. **Submit the slide** for valuation. (5)
7. Dissect and display any one developmental stage of embryo of **I** giving reasons. **Submit the preparations. Diagrams not necessary.** (4)
8. Write protocol for acetolysis, draw the ornamentation of the pollen grains given in **J**. **Submit the slide** for valuation. (4)
9. Determine the distribution and frequency of vegetation in the given quadrat **K**. Write the procedure, record the data and give your interpretations. (6)
10. Estimate the water holding capacity of soil **L**. (6)
11. Spot at sight – write **genus** and **family name only** for **M** and **N**. (2x2=4)
12. Identify and comment on **O, P, Q, R** and **S**. (5x3=15)

### ELECTIVE-III: HERBAL TECHNOLOGY

COURSE CODE-10SP18/2E3/HTE

Teaching hours: 3 / Week

Credits: 3

45/ Semester

L-T- P

2- 1- 0

#### OBJECTIVES:

To enable the student to Understand

- scope and importance of pharmacognosy
- To understand the nature of phytochemicals
- In-vitro cultivation of medicinal plants

#### UNIT - I

(10Hrs)

Pharmacognosy scope and importance - source - Classification (Taxonomical, Morphological Chemical, Pharmacological); Cultivation, Collection & processing of Crude Drugs. Medicinal & Aromatic Plants-Cultivation and Utilization of Medicinal & Aromatic Plants in India.

#### UNIT - II

(8Hrs)

Phytochemicals through plant tissue culture, Role of Plant tissue culture in enhancing secondary metabolite production (*Withania somnifera*, *Rauwolfia serpentina*, *Catheranthus roseus*, *Andrographis paniculata*, *Dioscorea sp.*) - Elicitation - Biotransformation, Hairy root culture. Factors affecting secondary metabolites production. Biogenesis of Phytopharmaceuticals.

#### UNIT - III

(10Hrs)

**Types of Phytochemicals** - Carbohydrates & derived products; Glycosides (Digitalis, Aloe, Dioscorea.); Tannins (Hydrolysable & Condensed types); Volatile Oils (Clove, Mentha).

#### UNIT - IV

(7Hrs)

**Types of Phytochemicals** - Alkaloids (Taxus, Papaver, Cinchona); Flavonoids; Resins. Application of phytochemicals in phytopharmacueticals, Biocides, Biofungicides, Biopesticides.



## UNIT - V

(10Hrs)

**Analysis of Phytochemicals:** Drug development – preclinical experiments, clinical experiments. Methods of Drug evaluation (Morphological, Microscopic, Physical & Chemical). Preliminary screening, Assay of Drugs - Biological evaluation / assays, Microbiological methods- Chemical Methods of Analysis, Detection of Adulterants: Chemical estimations, Spectrophotometry & Fluorescence analysis. Drug adulteration - Types of adulterants.

### RECOMMENDED BOOKS

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

### REFERENCE BOOKS

1. Natural Products in medicine: A Biosynthetic approach (1997), Wiley. Hornok,L. (ed.) (1992).
2. Pharmacognosy – William Charles Evans, 14th ed. (1989), Harcourt Brace & Company.

### ONLINE REFERENCE

<http://www.gpatonline.com/gpat/book-reference-pharmacognosy>

<http://www.sciencedirect.com/science/journal>

**Note: No Practical for this paper.**

**ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)**

**CHENNAI-600 008.**

(For candidates admitted during the academic year 2018-2019)

**M. Sc DEGREE EXAMINATION**

**I M. Sc PLANT BIOLOGY AND PLANT BIOTECHNOLOGY**

**ELECTIVE-III: HERBAL TECHNOLOGY**

**COURSE CODE-10SP18/2E3/HTE**

**QUESTION PAPER TEMPLATE**

**Max Marks: 100**

**Time : 3 hrs**

**Section –A (10x2=20 marks)**

Answer all questions. All questions carry equal marks. Each answer should not exceed 50 words.

(Question number 1-10. 2 Questions from each unit covering all the 5 units)

**Section-B (5x8=40 marks)**

Answer any five questions. All questions carry equal marks. Each answer should not exceed 300 words. [Question number 11- 18. (Eight questions). One Question from each unit, the remaining 3 questions from the bigger units covering all the 5 units]

**Section- C (2x20 =40 marks)**

Answer any two questions. Both questions carry equal marks. Each answer should not exceed 1200 words. (Question number 19-21 (3 questions).

### **ELECTIVE-III: ETHNOBOTANY**

**COURSE CODE-10SP18/2E3/ETB**

**Teaching hours: 3 / Week**

**Credits: 3**

**45/ Semester**

**L-T- P**

**2- 1- 0**

#### **OBJECTIVES:**

To enable the student to Understand

- scope and importance of ethnobotany
- To understand the basic knowledge and nature of ethnobotanical datas
- To understand the commercial use of traditional knowledge.

#### **UNIT – I**

**(10Hrs)**

Ethnobotany: concepts and definitions. Subdisciplines of ethnobotany. Interdisciplinary approaches. Knowledge of following sociological and anthropological terms: culture, values and norms, institutions, culture diffusion and ethnocentrism. History of Ethnobotany: A brief history of ethnobotanical studies in the world and in India.

#### **UNIT - II**

**(10Hrs)**

Distribution of tribes in India. Basic knowledge of following tribes of Tamil Nadu: Irulas, Kanis, Paliyars and Malayalis.

#### **UNIT – III**

**(7Hrs)**

Sources of ethnobotanical data: Primary - archeological sources and inventories, Secondary - travelogues, folklore and literary sources, herbaria, medicinal texts and official records. Methods in ethnobotanical research. Prior Informed Consent, PRA techniques, interviews and questionnaire methods, choice of resource persons.

## **UNIT – IV**

**(8Hrs)**

Ethnobotanical knowledge and communities: Folk Taxonomy Plants associated with culture and socio-religious activities. Non timber Forest Produce (NTFP) and livelihood Sustainable harvest & value addition

## **UNIT – V**

**(10Hrs)**

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

### **RECOMMENDED BOOKS**

1. JAIN, S.K. 1991. Contributions to Indian Ethnobotany. Scientific Publishers. Jodhpur.
2. JAIN, S.K. 1991. Dictionary of Indian folk medicine and Ethnobotany. Deep Publishers. New Delhi.
3. JAIN, S.K. AND V. MUDGAL. 1999. A Handbook of Ethnobotany. Bishen Singh Mahendra Pal Singh, Dehra dun.
4. RASTOGI, R.P., AND B.N. MEHROTRA. 1993. Compendium of Indian Medicinal Plants. Vol.I & Vol. II. CSIR. Lucknow. Publications and Information Directorate. New Delhi.
5. SINGH, K.S. 1998. India's Communities. Oxford University Press, Delhi. Vols. I –VI.

### **REFERENCE BOOKS**

1. Apte, T. 2006. Intellectual Property Rights, Biodiversity and Traditional Knowledge. Kalpavriksh, Grain & IIED, Pune / New Delhi.
2. BALEE W. L. 2003. Footprints of the Forests. Bishen Singh Mahendar Pal Singh, Dehra Dun, India.
3. COTTON, C. M. 1997. Ethnobotany – Principles and Applications. John Wiley and Sons Limited. New York, USA.

4. CSIR. 1940 - 1976. Wealth of India. A Dictionary of Raw Materials and Industrial Products - Raw Materials. Vol.1-11. CSIR Publication & Information Directorate. New Delhi.
5. CUNNINGHAM, A.B. 1993. Ethics, Ethnobiological Research, and Biodiversity. WWF. International Publication. Switzerland.
6. DAVID, N AND C. KRAMER. 2001. Ethnoarchaeology in Action. Cambridge University Press, New York.
7. Duthfield, G. 2004. Intellectual Property, Biogenetic Resources and Traditional Knowledge. Earthscan, London, UK..
8. JAIN, S.K. 1989. Methods and Approaches in Ethnobotany. Society of Ethnobotanists. Lucknow.
9. KATE, K. T., S. A. LAIRD. 2000. Commercial Use of Biodiversity. Earthscan, London, UK.
10. LAIRD, S.A. 2002. Biodiversity and Traditional knowledge Equitable partnerships in Practice. Earthscan Publications Ltd., London.
11. LEWIS, W.H., AND M.P.F.ELVIN LEWIS. 1976. Medical Botany. Plants Affecting Man's Health. A Wiley Interscience Publication. John Wiley and Sons. New York.
12. MABBERLEY, D.J. 1993. The Plant - Book. Cambridge University Press. Cambridge.
13. MARTIN, G. 1994. Ethnobiology. Chapman & Hall. London.
14. MINISTRY OF ENVIRONMENT AND FORESTS. 1994. Ethnobiology in India. A Status Report. All India Coordinated Research Project on Ethnobiology. Ministry of Environment and Forests. New Delhi.
15. PEI SHENGII, SU YONG-GE, LONG CHUN-LIN, M. KEN AND D.A. POSEY. 1996. The Challenges of Ethnobiology in the 21st Century. Kunming Institute of Botany. China.
16. RAMAKRISHNAN, P.S., R. BOOJH, K. G. SAXENA et al. 2005. One Sun Two World an Ecological Journey. Oxford & IBH. New Delhi, India.
17. SCHULTES, R.E., AND S.V. REIS. (Eds.). 1995. Ethnobotany. Evolution of a discipline. Chapman & Hall. London.
18. SIMPSON,B.B., AND M.C. OGORZALY. 1986. Economic Botany. Plants in Our World. McGraw Hill Company. New York.
19. SOFOWORA, A. 1982. Medicinal Plant and Traditional Medicine in Africa. John Wiley and Sons Limited. New York, USA.
20. SUBRAMANIAM, S.V., AND V.R. MADHAVAN, (Eds.). 1983. Heritage of the Tamil Siddha Medicine. International Institute of Tamil Studies. Madras.
21. SUDARSHAN, S.R., A.N.Y. REDDY, B. GOWDA. 1993. Oshadhi Koshha (Encyclopaedia of India Medicinal Plants). Vol.I. Kalpatharu Research Academy. Bangalore.
22. UNDP. 1994. Conserving Indigenous Knowledge. Integrating Two Systems of Innovation. Rural Advancement Foundation. Commissioned by UNDP.
23. WONG, J.L.G., K. THORNBUR AND N. BAKER. 2001. Non-wood forest products. Resource assessment of non-wood forest products. Experience and biometric principles. Food and Agriculture Organization, (FAO), Rome.

**Note: No Practical for this paper.**

**ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)**

**CHENNAI- 600 008.**

(For candidates admitted during the academic year 2018-2019)

**M. Sc DEGREE EXAMINATION**

**I M. Sc PLANT BIOLOGY AND PLANT BIOTECHNOLOGY**

**ELECTIVE-III: ETHNOBOTANY**

**COURSE CODE-10SP18/2E3/ETB**

**QUESTION PAPER TEMPLATE**

**Max Marks: 100**

**Time : 3 hrs**

**Section –A (10x2=20 marks)**

Answer all questions. All questions carry equal marks. Each answer should not exceed 50 words.

(Question number 1-10. 2 Questions from each unit covering all the 5 units)

**Section-B (5x8=40 marks)**

Answer any five questions. All questions carry equal marks. Each answer should not exceed 300 words. [Question number 11- 18. (Eight questions). One Question from each unit, the remaining 3 questions from the bigger units covering all the 5 units]

**Section- C (2x20 =40 marks)**

Answer any two questions. Both questions carry equal marks. Each answer should not exceed 1200 words. (Question number 19-21 (3 questions).

**EXTRA DISCIPLINARY-I**  
**ENTREPRENEURIAL BOTANY**  
**(offered to other Department students)**

**COURSE CODE-10SP18/2E/EBO**

**Teaching hours: 4/ Week**

**Credits: 3**

**60/ Semester**

**L-T- P**

**2- 2- 0**

**OBJECTIVES:**

To enable the student to Understand

- scope and importance of pharmacognosy
- To understand the nature of phytochemicals
- In-vitro cultivation of medicinal plants

**UNIT - I**

**(10Hrs)**

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

**UNIT - II**

**(10Hrs)**

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

**UNIT – III**

**(15Hrs)**

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

## **UNIT - IV**

**(15Hrs)**

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

## **UNIT – V**

**(10Hrs)**

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

### **RECOMMENDED BOOKS**

1. Manibhushan Rao, K 1991 Text book of Horticulture.MacMillan India private Limited New Delhi.
2. Prasad S and Kumar 1999 Principles of Horticulture. Agrobotanica.Bikander India.
3. B.C. Suman, V. Sharma, B. Suman, V.P. Sharma Mushroom Cultivation in India. 2007. Daya pub house.Delhi.
4. Gurcharan Singh Randhawa, Amitabha Mukhopadhyay. Floriculture in India.1986.Allied Publishers.Ltd.Bombay.
5. Bhupendra Singh Khatkar .Food Science and Technology 2007. Daya pub house.Delhi.

### **REFERENCE BOOKS**

- 1, Brig,Harmander Singh 1991. Mushroom- The art of cultivaitaion. Sterling Pubnlshers.
2. Mathew IP and Karikari 1994 Horticulture; Principles and practice MacMillan Press Limited New Delhi
3. Marshall Woodrow.G 1999 Gardening in India, Biotech Books New Delhi.
4. Mary Violet Christy A.( 2014) Vermitechnology ,MJP Publisher.
5. R.P.Srivastava, Sanjeev Kumar (2013) Fruit and Vegetable Preservation : Principles and Practices ( 3rd Edition )
6. Kumar N (Pb 2016) Introduction To Horticulture 7Ed . Oxford & IBH Publishing Company Pvt. Limited,

### **ONLINE REFERENCE**



[http://www.namyco.org/mushroom\\_cultivation\\_reference.php](http://www.namyco.org/mushroom_cultivation_reference.php)

<https://www.imedpub.com/articles/food-spoilage-microorganisms-and-their-prevention.pdf>

<https://www.ideals.illinois.edu/bitstream/handle/2142/28446/canningfruitsveg>

**ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)**

**CHENNAI-600 008.**

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**M. Sc DEGREE EXAMINATION**

**I M. Sc PLANT BIOLOGY AND PLANT BIOTECHNOLOGY**

**EXTRA DISCIPLINARY-I**

**ENTREPRENEURIAL BOTANY (offered to other Department students)**

**COURSE CODE-10SP18/2E/EBO**

**QUESTION PAPER TEMPLATE**

**Max Marks: 100**

**Time : 3 hrs**

**Section –A (5x8=40 marks)**

Answer any five questions. All questions carry equal marks. Each answer should not exceed 400 words. (Question number 1- 8. (eight questions). One Question from each unit, the remaining 3 questions from the bigger units covering all the 5 units)

**Section- B (3x20=60 marks)**

Answer any three questions. All questions carry equal marks. Each answer should not exceed 1500 words. (Question number 9-13 ( five questions) . One Question only from each unit, covering all the 5 units).

**SEMESTER-III**  
**CORE PAPER- VIII**

**CELL BIOLOGY GENETICS AND PLANT BREEDING**

**COURSE CODE-10SP18/3C/CGP**

**Teaching hours: 5 / Week**

**Credits: 4**

**75/ Semester**

**L-T- P**

**3- 2- 0**

**OBJECTIVES:**

To enable the student to

- Study the recent techniques in cell biology
- Obtain knowledge on identification of karyotyping of chromosomes

**UNIT I**

**(15Hrs)**

Membrane structure and function, Structure of model membrane, mechanism of sorting and regulation of intracellular transport, electrical properties of membranes.

Structural organization and function of intracellular organelles cell wall, nucleus, mitochondria, Golgi bodies, lysosomes, endoplasmic reticulum, peroxisomes and chloroplast, Endosymbiont theory, Structure & function of cytoskeleton and its role in motility.

**UNIT II**

**(15Hrs)**

Cell division and cell cycle:

Mitosis and meiosis, their regulation, steps in cell cycle, regulation and control of cell cycle. Genetic rearrangements in progenitor cells, oncogenes, tumor suppressor genes, cancer and the cell cycle, virus-induced cancer, metastasis, apoptosis, therapeutic interventions of uncontrolled cell growth.

Chromosomes - morphology, fine structure - telomere-types: lamp brush, polytene, isochromosomes - heterochromatin and euchromatin, chromosome identification - banding techniques - chromosomal aberrations, transposons.

### **Unit- III**

**(15Hrs)**

Cell signaling:

Hormones and their receptors, cell surface receptor, signaling through G- Protein coupled receptors, signal transduction pathways, second messengers, regulation of signaling pathways, bacterial and plant two-component systems, light signaling in plants, bacterial chemotaxis and quorum sensing.

Microbial Genetics:

Methods of Genetic transfers – transformation, conjugation, transduction and sex-duction, mapping genes by interrupted mating.

### **Unit – IV**

**(15Hrs)**

Mendelian principles : Dominance, segregation, independent assortment. Concept of Gene : Allele, multiple alleles, pseudoallele, Extensions of Mendelian principles : Co-dominance, incomplete dominance, gene interactions, pleiotropy, genomic imprinting. Linkage and crossing over, sex linkage and sex influenced characters. Gene mapping methods: Linkage maps, tetrad analysis mapping with molecular markers, mapping by using somatic cell hybrids, development of mapping population in plants.

### **UNIT – V**

**(15Hrs)**

Extra chromosomal inheritance: Inheritance of mitochondrial and chloroplast genes, maternal inheritance. Human genetics: Pedigree analysis, lod score for linkage testing, Karyotypes, genetic disorders. Quantitative genetics: Polygenic inheritance, heritability and its measurements. Plant breeding: Methods of crop improvement – selection (pure line, mass and clonal), hybridization – pedigree, bulk, backcross. Multilines, multilineal hybrids, heterosis – types, causes, mutation breeding and disease resistance, crop improvement and seed certification.

## RECOMMENDED BOOKS

1. Chahal, G.S. and Gosal, S.S. Principles and Procedures of Plant Breeding Biotechnological and Conventional Approaches, Narosa Publishing House, New Delhi.
2. Chaudhari, H.K. 1984. Elementary Principles of Plant Breeding.
3. Chaudhry R.K. A text Book of Plant Breeding.
4. Darbeshwar Roy, 2000. Plant Breeding: Analysis and Exploitation of variation, Narosa Publishing House, New Delhi.
5. Rangaswami.R.A. A Text book of Agricultural Statistics., 1995.
6. Roy.S.C. & K. De. Cell Biology New Central Book Agency (P) Ltd Calcutta, 2011.
7. Shukla, R.S. and Chandel P.S. Cytogenetics, Evolution and Plant Breeding , 2004.
8. Singh, P. 2001. Essentials of Plant Breeding, Kalyani Publishers, Hyderabad
9. Verma P.S & V.K. Agarwal, Cytology, S. Chand & Co New Delhi, 2006.
10. Verma P.S.A and V.K. Agarwal. Cell Biology, Genetics, Molecular Biology, Evolution and Ecology. S.Chand & Co. Pvt. Ltd., 2005.

## REFERENCE BOOKS

1. Brown and Berke: Text Book of Cytology, Blackstains Sons & Co.
2. Brachet and Mirsky (ed.): The Cell, Academic Press, Vols. 16.
3. Darlington, C.D. : Recent Advances in Cytology, Blackstains Sons & Co.
4. Lewin, B. 2000. Genes VII, Oxford University Press, USA.
5. DeRobertis, E.D.P. and De Robertis, E.M.F. 2001. Cell and Molecular Biology, Lippineott Williams & Wilkins, Bombay.
6. Sharma, A.K. and Sharma, A. 1980. Chromosome Techniques. Theory and Practice, Butterworth.
7. Stebbins, J.L. Chromosomal Evolution in Higher Plants, Edward Arnold Publ., London.
8. Roy, S.C. and Kumar, K.D.C. 1977. Cell Biology, New Central Book Agency, Calcutta.
9. Wolfe, S.L. 1993. Molecular and Cellular Biology, Wordsworth Publ. Co., California, USA..
10. Singleton, W.R. 1963. Elementary Genetics.
11. Gardner, E.J. 1972. Principles of Genetics.
12. Levin B. 2015. Genes XI
13. Stansfield, W.D. 1969. Theory and problems of Genetics.
14. Stick Berger, M. W. 1976. Genetics.
15. Sinnott, E.W. Dunn, L.E. and Dobzhansky, T. 1973. Principles of Genetics.
16. Hays, K.K. Immer, F.R. and Smith D.C. 1985. Methods of Plant Breeding.
17. Kenneth, J and Frey. 1980. Plant Breeding.
18. Gustafson, J.P. 1984. Gene manipulation In Plant Breeding and Evolution.
19. Ahluwaalia, K. B. 1996. Genetics.
20. Genetics, Winter,P.C., Hickey,G.I. and Fletcher, H.L., Viva Books 2002
21. Klug, Concepts of Genetics, Pearson Education
22. Genes VII, Benjamin Lewin, OUP
23. Genetics a Molecular Approach, 2nd Ed. Brown, T.A., Chapman and Hall, 1992

24. Burnham, C.R. 1962. Discussions in Cytogenetics, Burgess Publishing Comp. Minnesota.
25. Khush,G.S. 1973. Cytogenetics of aneuploids, Academic Press, New York.
26. Sybenga, J. 1975. Meiotic configurations. Springer Verlag, Berlin Heidel Berg.
27. Lewin, B. 2004. Gene VIII, Prentice Hall.
28. Russel, P.J. 1998. Genetics (5 th edition), The Benjamin / Cummings Publishing Company, Inc., USA.
29. Strickberger, Genetics, Prentice Hall.
30. Russel, P.J. 1998. Genetics. The Benjamin/Cunnings Publishing Co., Inc., USA.
31. Khush, G.S. 1973. Cytogenetics of Aneuploids, Academic Press, London..

### **ONLINE REFERENCE**

<http://www.cellsignal.com/contents/science/cst-pathways/science-pathways>

<http://www.ncbi.nlm.nih.gov/books>

**ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)**

**CHENNAI- 600 008.**

(For candidates admitted during the academic year 2018-2019)

**M. Sc DEGREE EXAMINATION**

**II M. Sc PLANT BIOLOGY AND PLANT BIOTECHNOLOGY**

**CORE PAPER- VIII**

**CELL BIOLOGY GENETICS AND PLANT BREEDING**

**COURSE CODE-10SP18/3C/CGP**

**QUESTION PAPER TEMPLATE**

**Max Marks: 100**

**Time : 3 hrs**

**Section –A (10x2=20 marks)**

Answer all questions. All questions carry equal marks. Each answer should not exceed 50 words.

(Question number 1-10. 2 Questions from each unit covering all the 5 units)

**Section -B (5x8=40 marks)**

Answer any five questions. All questions carry equal marks. Each answer should not exceed 300 words. [Question number 11- 18. (Eight questions). One Question from each unit, the remaining 3 questions from the bigger units covering all the 5 units]

**Section - C (2x20 =40 marks)**

Answer any two questions. Both questions carry equal marks. Each answer should not exceed 1200 words. (Question number 19-21 (3 questions).

## **CORE PAPER-IX**

### **PLANT MOLECULAR BIOLOGY**

**COURSE CODE-10SP18/3C/ PMB**

**Teaching hours: 4 / Week**

**Credits: 4**

**60/ Semester**

**L-T- P**

**3- 1- 0**

#### **OBJECTIVES:**

To enable the student to

- Understand the molecular aspects of DNA and RNA
- Obtain knowledge on Techniques and applications of DNA

#### **UNIT- I**

**(10Hrs)**

Nucleic acids - Base pairing and variations in base composition. Types and forms of DNA. Chargaff's rule - DNA size - fragility - melting curves - denaturation - renaturation - circular and superhelical DNA - topoisomerase - special base - Repeated sequence - DNA sequencing

#### **UNIT II**

**(10Hrs)**

DNA replication - basic rule of replication – DNA replication in prokaryotes – enzymology- DNA topoisomerase - DNA polymerase - ligase, helicase Termination of DNA replication - Replication of eukaryotic chromosomes- Eukaryotic DNA polymerase- DNA repair mechanism- DNA methylation- DNA gyrase.

#### **UNIT- III**

**(15Hrs)**

Transcription - Enzymology - RNA polymerase - classes of RNA molecules - transcription in Prokaryotes and Eukaryotes - splicing mechanisms - Reverse transcriptions. Inhibitors of nucleic acid biosynthesis.



## UNIT- IV

(15Hrs)

Protein synthesis and processing : (Ribosome, formation of initiation complex, initiation factors and their regulation, elongation and elongation factors, termination, genetic code, aminoacylation of tRNA, tRNA – identity, aminoacyl tRNA synthetase, and translational proof-reading, translational inhibitors, Post-translational modification of proteins). Genetic code – characters – codons and anticodons – wobble hypothesis.

## UNIT V

(10Hrs)

Gene regulation - Operon concept - Lac repressor - c-AMP, Catabolic repression - *ara* operon and *trp* operons - Gene expression in eukaryotes. Role of chromatin in gene expression and gene silencing.

## RECOMMENDED BOOKS

1. David Friefielder. Molecular Biology. Narosa Publishers House, 1987. Delhi, 2007.
2. Dubey R.C. Advanced biotechnology, S.Chand & Co., Ltd., New Delhi, 2014.
3. GeralKarp. Cell andMolecular biology 6<sup>th</sup> (Ed).2009.
4. Ignacimuthu S. 2015. Basic Bio-technology, Tata Mc Graw Hill, Publishing Co., Ltd., New
5. Kumar H.D. A text book of Biotechnology, East West Affiliated Press Ltd., New Delhi,1993.
6. P.K.Gupta. Molecular biology and Genetic Engineering. 2008.Rastogi pub , New Delhi.
7. Veer Bala Rastogi. Fundamentals of molecular biology. revised 2010.Ane books pub.
8. Verma P.S.A and V.K. Agarwal. Cell Biology, Genetics, Molecular Biology, Evolution and Ecology. S.Chand & Co. Pvt. Ltd., 2004.

## REFERENCE BOOKS

1. Alberts, B., Bray, D., Lewis, J. Raff, M., Roberts, K. and Watson, J.D. 1989. Molecular Biology of the cell, Garland Publishing Inc., New York.
2. Lodish, H., Berk, A., Zipursky, S.L., Matsudaira, P., Baltimore, D. and Darnell, J. 2000. Molecular Cell Biology, W.H. Freeman and Co., New York, USA.
3. Richard, M., Twyman and Wisden, W. 1999. Advanced Molecular Biology, Viva Books Pvt. Ltd.
4. Turner, P.C., Mclennan,A.G., Bates, A.D. and White, M.R.H. 2001. Instant notes on molecular biology.
5. Snustad Peter, D. Michael J. Simmons. Principles of Genetics, John Wiley Sons.
6. Robert H. Tamarin. Principles of Genetics, Tata McGraw Hill Company.
7. Benjamin Lewin . Genes VIII, Prentice Hall.

## ONLINE REFERENCE

<https://www.citethisforme.com/.../dna.../how-to-cite-a-online-image->  
[https://en.wikipedia.org/wiki/Protein\\_synthesis\\_inhibitor](https://en.wikipedia.org/wiki/Protein_synthesis_inhibitor)

**ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)**

**CHENNAI-600 008.**

(For candidates admitted during the academic year 2018-2019)

**M. Sc DEGREE EXAMINATION**

**II M. Sc PLANT BIOLOGY AND PLANT BIOTECHNOLOGY**

**CORE PAPER-IX**

**PLANT MOLECULAR BIOLOGY**

**COURSE CODE-10SP18/3C/ PMB**

**QUESTION PAPER TEMPLATE**

**Max Marks: 100**

**Time : 3 hrs**

**Section –A (10x2=20 marks)**

Answer all questions. All questions carry equal marks. Each answer should not exceed 50 words.

(Question number 1-10. 2 Questions from each unit covering all the 5 units)

**Section-B (5x8=40 marks)**

Answer any five questions. All questions carry equal marks. Each answer should not exceed 300 words. [Question number 11- 18. (Eight questions). One Question from each unit, the remaining 3 questions from the bigger units covering all the 5 units]

**Section- C (2x20 =40 marks)**

Answer any two questions. Both questions carry equal marks. Each answer should not exceed 1200 words. (Question number 19-21 (3 questions).

## **CORE PAPER-X**

### **PLANT BIOTECHNOLOGY**

**COURSE CODE-10SP18/3C/PBI**

**Teaching hours: 4 / Week**

**Credits: 3**

**60/ Semester**

**L-T- P**

**3- 1- 0**

#### **Objectives**

- To study the plant tissue culture techniques
- Application of Tissue Culture in agriculture, horticulture.

#### **UNIT – I**

**(15Hrs)**

Recombinant DNA technology – Tools of recombinant DNA: restriction endonucleases and other enzymes; vectors - plasmid – pBR322, pUC18, Ti plasmid, bacteriophage – M13, lambda phage, phagemids, cosmids – pLFR5, pJB8, BAC and YAC Vectors - choice of vectors - gene cloning principles and techniques- construction of genomics, cDNA libraries. Herbicide resistance – resistance against glyphosate, resistance against pests and insects – *Bacillus thuringiensis* – Bt genes endotoxins.

#### **UNIT – II**

**(10Hrs)**

Regulation and release of Genetically modified organism in India- Recombinant DNA guidelines, Regulation of GM food – Status of development of GM food in India. IPR, PGR – importance.

#### **UNIT- III**

**(15Hrs)**

Laboratory Organisation – Design of different laboratories and management. Methodologies – Aseptic techniques – methods of sterilization – basic procedure for Aseptic transfer – Incubation of culture – Composition of Culture Media – MS Medium – B5 Medium.

General Techniques of Micropropagation, Initiation of Culture, Multiplication, Rooting, Hardening. Callus Culture – establishment – Organisation – Embryogenesis. Somaclonal & Gametoclonal variation, Uses in crop improvement.

#### **UNIT – IV**

**(10Hrs)**

Shoot TIP / Meristem Culture for Virus free plants – Chemotherapy – Thermootherapy – Virus indexing. Anther culture – Production of Haploids – Utilization of Haploids in Agriculture. Protoplast Culture – Protoplast isolation, purification, viability test – culture – regeneration. Somatic Hybridization – Protoplast fusion techniques – Chemical fusion – Electrofusion selection of fusion products. Synthetic Seeds – Practical applications. Cryopreservation & gene bank.

#### **UNIT – V**

**(10Hrs)**

Approaches and factors affecting the production of secondary metabolites, production of pharmaceutically important drugs – alkaloids – food additives and insecticides in *in vitro* system. Application of Tissue Culture – Techniques in Agriculture, Horticulture & Forestry.

#### **RECOMMENDED BOOKS**

1. Bhojwani, S.S. and Razdan, M.K. 1996. Plant Tissue Culture: Theory and Practice revised edition. Elsevier Science Publishers, New York, USA.
2. Bojwani, S.S. 1990. Plant Tissue Culture: Applications and Limitations, Elsevier Science Publisher, New York, USA.
3. Dubey R.C. Advanced biotechnology, S.Chand & Co., Ltd., New Delhi, 2014.
4. Khasim, S.M. 2002. Botanical Microtechnique: Principles and Practice, Capital Publishing Company, New Delhi.
5. Kumar H.D. A text book of Biotechnology, East West Affiliated Press Ltd., New Delhi, 1993.

## REFERENCE BOOKS

1. Trigiano, R.N., and D.J. Gray (eds.). 2000. Plant tissue culture concepts and laboratory exercises. CRC Press. (Textbook). 2nd Edition.
2. Kyte, M., and Kleyn, J. 1996. Plant from test tubes. Timber Press. Auge, R. et al., 1995. In vitro culture and its applications in horticulture. Science Publishers, Inc.
3. Crispeels, M.J. and D. E. Sadava. 2003. Plants, genes and agriculture. Jones and Bartlett Publishers.
4. Gamborg, O.L. and G. C. Phillips (eds). 1995. Plant cell, tissue and organ culture. Springer Lab Manual.
5. Potrykus, I, and G. Spangenberg (eds.). 1995. Gene transfer to plants. Springer Lab Manual.
6. Jones, H. 1996. Plant gene transfer and expression protocols. Methods in molecular biology . 49. Humana Press.
7. Collins, H.A. and Edwards, S. 1998. Plant Cell Culture, Bios Scientific Publishers, Oxford, UK.
8. Hall, R.D. (Ed.) 1999. Plant Tissue Culture: Techniques and Experiments, Academic Press, New York.
9. Press, New York.
10. Kartha, K.K. 1985. Cyropreservation of plant cells and organs. CRC Press, Boca Raton, Florida.
11. Vasil, I.K. and Thorpe, T.A. 1994. Plant Cell and Tissue Culture, Kluwer Academic Press, The Netherlands.

**ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)**

**CHENNAI-600 008.**

(For candidates admitted during the academic year 2018-2019)

**M. Sc DEGREE EXAMINATION**

**II M. Sc PLANT BIOLOGY AND PLANT BIOTECHNOLOGY**

**CORE PAPER-X**

**PLANT BIOTECHNOLOGY**

**COURSE CODE-10SP18/3C/PBI**

**QUESTION PAPER TEMPLATE**

**Max Marks: 100**

**Time : 3 hrs**

**Section –A (10x2=20 marks)**

Answer all questions. All questions carry equal marks. Each answer should not exceed 50 words.

(Question number 1-10. 2 Questions from each unit covering all the 5 units)

**Section-B (5x8=40 marks)**

Answer any five questions. All questions carry equal marks. Each answer should not exceed 300 words. [Question number 11- 18. (Eight questions). One Question from each unit, the remaining 3 questions from the bigger units covering all the 5 units]

**Section- C (2x20 =40 marks)**

Answer any two questions. Both questions carry equal marks. Each answer should not exceed 1200 words. (Question number 19-21 (3 questions).

## **PRACTICAL III : COVERING CORE PAPERS VI, VII and VIII**

**COURSE CODE-10SP18/4C/PR3**

**Teaching hours: 8/ Week**

**Credits: 5**

**120/ Semester**

**L-T- P**

**0-0- 8**

### **CELL BIOLOGY**

1. Study of dividing cells – squash
2. Calculate the mitotic index of onion root tip cells
3. Smear techniques
4. Study of induced aberrations in onion root tips employing chemicals and plant extracts.
5. Calculation of aberration percentage of chemical treated onion root tip cells
6. Induction of polyploidy using colchicines
7. Study of sub cellular organelles from electron micrographs
8. Nuclear stains
9. Pre fixatives
10. Demonstration of Salivary gland chromosomes

### **GENETICS**

11. Genetics problem based on the theory
12. Chromosome mapping
13. Calculation of variation pattern in fruits/leaves/ seeds - standard deviation standard error  
– Based on the data given.
14. Chi square test
15. Students “t” Test

### **PLANT MOLECULAR BIOLOGY**

16. Isolation of Genomic DNA
17. Isolation of RNA
18. Electrophoresis of nucleic acids (know protocols)
19. Preparation of competent *E. Coli* cells
20. Isolation of plasmid DNA
21. Restriction analysis of DNA
22. Southern blotting
23. RFLP techniques
24. PCR techniques

Cot curve, DNA melting curve, tertiary structure of protein, tRNA, recognition site for Hind III, Eco RI, Bam H1, PUC Plasmid, PCR flow chart, SDS, Southern blotting, X-ray diffraction protein DNA, Ethidium bromide, Lac Operon. Simple problems based on the theory syllabus.

## **PLANT CELL AND TISSUE CULTURE**

25. Tissue culture laboratory design
26. Sterilization
27. Inoculation of explant
28. Media preparation
29. Callus Culture
30. Organ Culture
31. Plant regeneration- Anther culture
32. Synthetic Seed Preparation.

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



**ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)**

**M. Sc. PLANT BIOLOGY AND PLANT BIOTECHNOLOGY**

**PRACTICAL EXAMINATION**

**TITLE OF THE PAPER: PRACTICAL –III**

**Max Marks- 100**

**PAPER CODE: 10SP18/4C/PR3**

**Practical- 85**

**Record- 10**

**Viva-voce- 5**

**Time- 4 hrs**

1. Make a suitable squash preparation of **A**. Display any two stages of cell division. Draw labeled sketches and identify giving reason. (10)
2. Make a suitable squash preparation of **B** and show any one chromosomal aberration and draw diagram. (4)
3. Make a suitable smear preparation of **C** and show any one stage of cell division. Draw diagram and identify giving reason. (6)
4. Solve the genetics problems **D1** and **D2**. (4+4=8)
5. Write the protocol of the experiment **E** provided to you. (4)
6. From the given plant material **F**, find the mean and calculate the standard deviation with reference to length of the sample. (6)
7. Estimate the amount of DNA in the given sample **G**. (6)
8. Solve the Molecular biology problem **H1** and **H2**. (4 +4= 8)
9. Prepare and Inoculate the given explant **I**, provided to you and write the protocol for the experiment and submit the preparation. (8)
10. Prepare synthetic seeds of given sample **J** by immobilization method. (5)
11. Solve the tissue culture problem – **K**. (4)
12. Identify and comment on **L, M, N** and **O**. (4x4= 16)

## **ELECTIVE- IV BIOSTATISTICS**

**COURSE CODE-10SP18/3E4/BIS**

**Teaching hours: 3 / Week**

**Credits: 3**

**45/ Semester**

**L-T- P**

**2- 1- 0**

### **OBJECTIVES:**

To enable the student to

- To obtain knowledge on biostatistics
- To study the computer application in biology

### **UNIT - I**

**(7Hrs)**

Introduction to Biostatistics, sample collection and representation of Data - Primary and Secondary - Classification and tabulation of Data – Diagrams, graphs and presentation.

### **UNIT – II**

**(8Hrs)**

Analysis of quantitative characters and Measures of central tendency of mean, median, mode. Measures of dispersion – types, standard deviation and standard error, ANOVA.

### **UNIT - III**

**(10Hrs)**

Probability; basic principles - types - Rules of probability - addition and multiplication rules.

Patterns of probability distribution; binomial - Poisson and normal - Tests of significance; Chi - square test for goodness of Fit; Null hypothesis, level of Significance - Degrees of Freedom.

## **UNIT – IV**

**(10Hrs)**

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

## **UNIT – V**

**(10Hrs)**

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

## **RECOMMENDED BOOKS**

1. Gurumani, N. (2005) Biostatistics, 2<sup>nd</sup> edn. MJP publications, India.
2. Pillai, R.S.N. and Bagawathi, V. (1989), Statistics. Theory and practice (For B.Com. and B.A. (Eco) classes) S.Chand & Co. Ltd. New Delhi.
3. Pillai, R.S.N. and Bagawathi, V. (1987) Practical Statistics (For B.Com. and B.A., Students) S.Chand & Co. (Pvt.) Ltd., New York.
4. Mahajan, B.K. (1984). Methods in Biostatistics for Medical students and Research works. Smt. Indu Mahajan, New Delhi.

## **REFERENCE BOOKS**

1. Milton, J.s. (1992) Statistical method in Biological and Health Sciences. McGraw Hill Inc., New York.
2. Scheffler, W.C. (1968) Statistics for biological sciences, Addison- Wesley Publication Co., London.
3. Snedecor, G.W and Cochran, W.G. (1967) Statistical Methods. Oxford & IBH Publication co., New Delhi.
4. Spiegel, M.R. (1981) Theory and Problems of statistics, Schaum's Outline series McGraw-Hill International Book Co., Singapore.
5. Stansfield, W.D. (1986) Theory and problems of genetics (including 600 problems). Schaum's outline series. McGraw Hill ) Book Co. New York.
6. Sobl. R.R. and Rohif, F.J. (1969) Biometry. The principles and Practice and Statistics in Biological Research. W.H. Freeman and Co., San Francisco.

## **ONLINE REFERENCE**

[http://guides.library.ucla.edu/public\\_health/biostatistics](http://guides.library.ucla.edu/public_health/biostatistics)

[www.blackwellreference.com](http://www.blackwellreference.com)

**ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)**

**CHENNAI-600 008.**

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**M. Sc DEGREE EXAMINATION**

**II M. Sc PLANT BIOLOGY AND PLANT BIOTECHNOLOGY**

**ELECTIVE- IV BIOSTATISTICS**

**COURSE CODE-10SP18/3E4/BIS**

**QUESTION PAPER TEMPLATE**

**Max Marks: 100**

**Time : 3 hrs**

**Section –A (10x2=20 marks)**

Answer all questions. All questions carry equal marks. Each answer should not exceed 50 words.

(Question number 1-10. 2 Questions from each unit covering all the 5 units)

**Section-B (5x8=40 marks)**

Answer any five questions. All questions carry equal marks. Each answer should not exceed 300 words. [Question number 11- 18. (Eight questions). One Question from each unit, the remaining 3 questions from the bigger units covering all the 5 units]

**Section- C (2x20 =40 marks)**

Answer any two questions. Both questions carry equal marks. Each answer should not exceed 1200 words. (Question number 19-21 (3 questions).

## ELECTIVE- IV WOOD TECHNOLOGY

COURSE CODE-10SP18/3E4/WOT

Teaching hours: 3 / Week

Credits: 3

45/ Semester

L-T- P

2- 1- 0

### OBJECTIVES:

To enable the student to

- To obtain knowledge on wood.
- To study the chemical and mechanical property as well as wood products.

#### Unit – I

(10 Hrs)

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

#### Unit – II

(10 Hrs)

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

#### Unit – III

(7 Hrs)

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

#### Unit – IV

(8 Hrs)

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

**Unit – V****(10 Hrs)**

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

**REFERENCES**

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

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**M. Sc DEGREE EXAMINATION**

**II M. Sc PLANT BIOLOGY AND PLANT BIOTECHNOLOGY**

**ELECTIVE- IV WOOD TECHNOLOGY**

**COURSE CODE-10SP18/3E4/WOT**

**QUESTION PAPER TEMPLATE**

**Max Marks: 100**

**Time : 3 hrs**

**Section –A (10x2=20 marks)**

Answer all questions. All questions carry equal marks. Each answer should not exceed 50 words.

(Question number 1-10. 2 Questions from each unit covering all the 5 units)

**Section-B (5x8=40 marks)**

Answer any five questions. All questions carry equal marks. Each answer should not exceed 300 words. [Question number 11- 18. (Eight questions). One Question from each unit, the remaining 3 questions from the bigger units covering all the 5 units]

**Section- C (2x20 =40 marks)**

Answer any two questions. Both questions carry equal marks. Each answer should not exceed 1200 words. (Question number 19-21 (3 questions).

**EXTRA DISCIPLINARY-II**  
**MEDICINAL BOTANY AND DIETETICS**  
(offered to other Department students)

**COURSE CODE-10SP18/3E/MBD**

**Teaching hours: 4/ Week**

**Credits: 3**

**60/ Semester**

**L-T- P**

**3- 1- 0**

**OBJECTIVES:**

To enable the student to Understand

- scope and importance of pharmacognosy
- To understand the nature of phytochemicals

**UNIT – I**

**(10Hrs)**

Biological source, geographical distribution, physic chemical analysis of the following medicinal plants: *Tinospora cordifolia* (root), *Acorus calamus* (rhizome), *Costus* (leaf), *Terminalia chebula* (fruit), *Plantago ovata* (seed), *Holarrhena antidysenterica* (bark),

**UNIT - II**

**(8Hrs)**

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

**UNIT - III**

**(7Hrs)**

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



## **UNIT - IV**

**(10Hrs)**

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

## **UNIT - V**

**(10Hrs)**

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

## **RECOMMENDED BOOKS**

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

## **REFERENCE BOOKS**

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

## **ONLINE REFERENCE**

[www.gamlaa.com/categories/Medicinal-Plants](http://www.gamlaa.com/categories/Medicinal-Plants)

<http://www.ecornell.com/certificates/plant-based-nutrition/certificate-in-plant-based-nutrition/>

<http://carlg.org/englakandeorter.html>

**ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)**

**CHENNAI-600 008.**

(For candidates admitted during the academic year 2018-2019)

**M. Sc DEGREE EXAMINATION**

**II M. Sc PLANT BIOLOGY AND PLANT BIOTECHNOLOGY**

**EXTRA DISCIPLINARY-II**

**MEDICINAL BOTANY AND DIETETICS (offered to other Department students)**

**COURSE CODE-10SP18/3E/MBD**

**QUESTION PAPER TEMPLATE**

**Max Marks: 100**

**Time: 3 hrs**

**Section-A (5x8=40 Marks)**

Answer any five questions. All questions carry equal marks. Each answer should not exceed 400 words. (Question number 1- 8. (eight questions). One Question from each unit, the remaining 3 questions from the bigger units covering all the 5 units )

**Section-B (3x20=60 Marks)**

Answer any three questions. All questions carry equal marks. Each answer should not exceed 1500 words. (Question number 9-13 ( 5 questions) . One Question only from each unit, covering all the 5 units).

## **SOFT SKILL - III**

### **COMPUTING FOR BIOLOGICAL RESEARCH**

**COURSE CODE-10SP15/3S/CBR**

**Teaching hours: 2/ Week**

**Credits: 2**

**30/ Semester**

**L-T- P**

**2- 0- 0**

#### **UNIT – I**

**(6 Hrs)**

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

#### **UNIT – II**

**(6 Hrs)**

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

#### **UNIT – III**

**(6 Hrs)**

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

#### **UNIT – IV**

**(6 Hrs)**

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

#### **UNIT-V**

**(6 Hrs)**

Biological Databases – SRS - Pub Med – NCBI – EMBL-EBI – GenBank – DDBJ - UniProt/SwissProt - TrEMBL- PIR- PDB – MMDB – SCOP - CATH.

#### **REFERENCE BOOKS**

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

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**I M. Sc PLANT BIOLOGY AND PLANT BIOTECHNOLOGY**

**SOFT SKILL - III**

**COMPUTING FOR BIOLOGICAL RESEARCH**

**COURSE CODE-10SP15/3S/CBR**

**QUESTION PAPER TEMPLATE**

**Max Marks: 50**

**Time : 2 hrs**

**Section –A (5x2=10 marks)**

Answer all questions. All questions carry equal marks. Each answer should not exceed 50 words.

(Question number 1 -5. 1 Question from each unit covering all the 5 units)

**Section-B (4x5=20 marks)**

Answer any four questions out of six. All questions carry equal marks. Each answer should not exceed 300 words. [Question number 6 - 11. (six questions). One Question from each unit, the remaining 1 question from the bigger unit covering all the 5 units]

**Section- C (1x20 =20 marks)**

Answer any one question out of two. The answer should not exceed 1500 words. (Question number 12 – 13 (2 questions)).

**CORE PAPER -XII**  
**PLANT PHYSIOLOGY**

**COURSE CODE-10SP18/4C/ PPH**

**Teaching hours: 5 / Week**

**Credits: 3**

**75/ Semester**

**L-T- P**

**3- 2- 0**

**OBJECTIVES**

To enable the student to understand the

- significance of photosynthesis and respiration
- Water relation and stress physiology
- Structure and properties of Bio-molecules and enzymes

**UNIT - I**

**(15Hrs)**

Water relation in plants – properties of water, water potential, mechanism of water absorption – active – passive transport, apoplast & symplast concept. Solute transport and photo assimilate translocation – uptake, transport and translocation of ions, solutes and macromolecules from soil, through cells, across membranes, through xylem and phloem; stomatal mechanism- anti transparent – ascent of sap

**UNIT - II**

**(15Hrs)**

Photosynthesis – Light harvesting complexes; mechanisms of electron transport; photoprotective mechanisms; CO<sub>2</sub> fixation – C<sub>3</sub>, C<sub>4</sub> and CAM pathways. Respiration and photorespiration - Citric acid cycle; plant mitochondrial electron transport and ATP synthesis; alternate oxidase; photorespiratory pathway.

### **UNIT – III**

**(15Hrs)**

Mineral nutrients – Role of Macro and Micro nutrients, Nitrogen cycle and fixation, Nitrogen metabolism – Nitrogen and ammonium assimilation; amino acid biosynthesis. Secondary metabolites – Biosynthesis of terpenes, phenols and alkaloids and their roles.

### **UNIT - IV**

**(15Hrs)**

Plant hormones – Biosynthesis, storage, breakdown and transport; physiological effects and mechanisms of action of auxins, gibberellins, cytokinins and abscisic acid. Sensory photobiology – structure, function and mechanisms of action of phytochromes, cryptochromes and phototropins; photoperiodism, biological clocks and biological rhythm – circadian.

### **UNIT – V**

**(15Hrs)**

Movement – nastic and tropic movements. Seed dormancy – causes and methods to break seed dormancy – physiology of seed germination – abscission – and senescence. Stress physiology – Responses of plants to biotic (pathogen and insects) and abiotic (water, temperature and salt) stresses.

### **RECOMMENDED BOOKS**

1. Datta. S. C. 1989. Plant Physiology. Central Book Depot. Allahabad.
2. Hall. D. V. K. K. Rao. Photosynthesis. Arnold London
3. Jain, VK. 2006. Fundamentals of Plant Physiology, S.Chand&Company Ltd.,
4. Salisbury. F. B., C. W. Ross. 1992 Plant Physiology. Wassworth Pub. Co. Belmont
5. Verma, SK. 2006. A Textbook of Plant Physiology, S.K.Chand & Co., New Delhi

### **REFERENCE BOOKS**

1. Bidwell. R. G. S. 1979. Plant Physiology. Macmillon Delhi.
2. Gauch. H. G. 1972 Inorganic Plant Nutrition. Hutchinson & Dowd. New York.
3. Govindji. 1982. Photosynthesis. AP. New York
4. Jacob. W. P. 1979. Plant Hormones and Plant Development. Cambridge University Press. Cambridge
5. Khan. A. A. 1982. The Physiology and Biochemistry of Seed development, Dormancy and Germination. Elsevier. Amsterdam
6. Ting. I. P. 1982. Plant Physiology. Addison Wesley Pb. Philippines

7. Michealis. I. And J. C. Torry. 1956. Plant in Action W. H. Freeman
8. Lea, P. J. and R. C. Leegood. 1993. Plant Biochemistry and Molecular Biology, John Wiley & Sons. New York.
9. Gregory, R. P. F. 1989. Biochemistry of Photosynthesis Wiley Chichester
10. Sage, R. and R. K. Monson (eds). 1999. The Biology of C4 Plants AP New York.
11. Dixon, R. O. D. and C. T. Wheller 1986. Nitrogen Fixation in Plants Blackie. Glasgow.
12. Postgate. J. 1987. Nitrogen Fixation 2nd Edition Cassel, London
13. Stacey,G., R. H. Burris and Evans, H. J. 1992. Biological Nitrogen Fixation. Chapman and Hall, New York
14. Mann, J. 1987, Secondary Metabolism Clarendron Press, Oxford
15. Bonner, J. and J. E. Varner. 1979.Plant Physiology. Macmillon Delhi
16. Robert Horton, H. L. A. Moran, R. S. Ochs, J. D. Rawn and K. G. Scrimgeour. 1996. . Principles of Biochemistry. Printice hall International. NJ.
17. Fersht. A. 1985. Enzyme Structure and Metabolism. W. H. Freeman New York
  
18. Lewin. B.1994. Genes. V. Oxford University Press. New York
19. Ferrier, R. J. and Collind, R. M. 1995. Monassaharides Wiley, New York.
20. Moore, T. S. (ed).1993. Lipid Metabolism in Plants. CRC Press. Boca Raton
21. Murphy, D. J (ed) 1994. Designer Oil Crops. VCH Press. Germany
22. Dey, P. M. J. B. Harborne (eds)1997 Methods in Plant Biochemistry, Academic Press London
23. Hopkins, W.G. 1995. Introduction to Plant Physiology, John Wiley & Sons, Inc., New York, USA.
24. Nobel, P.S. 1999. Physiochemical and Environmental Plant Physiology, Academic Press, San Diego, USA.
25. Taiz and Zeiger, 1998. Plant Physiology (2 nd ed.)

## **ONLINE REFERENCE**

[http://hsc.csu.edu.au/agriculture/production/3359/plant\\_hormones.htm](http://hsc.csu.edu.au/agriculture/production/3359/plant_hormones.htm)

<https://www.advancednutrientsonline.com/>

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**M. Sc DEGREE EXAMINATION**

**II M. Sc PLANT BIOLOGY AND PLANT BIOTECHNOLOGY**

**CORE PAPER –XII**

**PLANT PHYSIOLOGY**

**COURSE CODE-10SP18/4C/ PPH**

**QUESTION PAPER TEMPLATE**

**Max Marks: 100**

**Time : 3 hrs**

**Section –A (10x2=20 marks)**

Answer all questions. All questions carry equal marks. Each answer should not exceed 50 words.

(Question number 1-10. 2 Questions from each unit covering all the 5 units)

**Section-B (5x8=40 marks)**

Answer any five questions. All questions carry equal marks. Each answer should not exceed 300 words. [Question number 11- 18. (Eight questions). One Question from each unit, the remaining 3 questions from the bigger units covering all the 5 units]

**Section- C (2x20 =40 marks)**

Answer any two questions. Both questions carry equal marks. Each answer should not exceed 1200 words. (Question number 19-21 (3 questions).



## **CORE PAPER -XIII**

### **PLANT BIOCHEMISTRY AND BIOPHYSICS**

**COURSE CODE-10SP18/4C/ PBB**

**Teaching hours: 6 / Week**

**Credits: 4**

**90/ Semester**

**L-T- P**

**3- 3- 0**

#### **OBJECTIVES**

- To study the structure and importance of Biomolecules
- To study the properties and application of enzymes

#### **UNIT – I**

**(20Hrs)**

Atomic structure; chemical bonds- ionic bond, covalent bond, coordination bond, hydrogen bond; radioactivity; hydrogen ion concentration (pH), buffers. Biomolecules: Carbohydrates – properties of mono, oligo and polysaccharides. Structure and functions of trioses, tetroses, pentoses, hexoses, maltose, sucrose, starch and pectin, glycosidic linkage, glycoproteins, isomerism and mutarotation.

#### **UNIT – II**

**(15Hrs)**

Biomolecules: Amino acids and proteins, ionic forms of aminoacids, general reactions of aminoacid metabolism. zwitterion, isoelectric pH, optical isomers of amino acids, physical properties of amino acids. Formation of peptide bond – peptides- structure of polypeptides - primary, secondary, tertiary and quaternary protein structure - super secondary structures. Ramachandran plot - denaturation of proteins. Protein sequencing.

#### **UNIT – III**

**(20Hrs)**

Biomolecules: Lipids- Classification, structure and properties - Fatty acids- saturated and unsaturated fatty acids - phospholipids, glycolipids, steroids. – Biosynthesis and Oxidation of fatty acid - Glyoxalate pathway – Gluconeogenesis.

#### **UNIT – IV**

**(15Hrs)**

Enzymes- Properties- apoenzyme, Cofactors, metallic activators coenzymes. Nomenclature, Classification - Enzyme kinetics – Concept of active sites, Michaelis-Menton constant - mechanism of enzyme action- enzyme inhibitors- allosteric control of enzymes. General principles of extraction and purification of enzymes – Enzyme immobilization. Application of enzymes in industry and medicine.

#### **UNIT – V**

**(20Hrs)**

Bioenergetics - Laws of thermodynamics - enthalpy, entropy and free energy. Exergonic and endergonic reactions. Redox potential. Structure and hydrolysis of high energy compound – ATP, Application of first and second law of thermodynamics in biological systems.

#### **RECOMMENDED BOOKS**

1. Agarwal O.P. Chemistry of Organic products. Volume 1, Goel Publishing house, 2014.
2. Dinesh puri. Text book of medical biochemistry .2006. Elsevier pub.
3. Gurdeep R. Chatwal, Organic Chemistry of Natural Products Volume 2, Himalaya Publishing House, 1997.
4. Jain.J.L. Fundamentals of Biochemistry, Vijaya Printers, Chennai, 2016
5. Mathew George, Lincy Joseph.Textbook of Pharmaceutical Chemistry.VivaBooks Pvt.Ltd. 2009
6. Pankaja Naik .Essentials of Biochemistry 2012. Jaypee pub.

#### **REFERENCE BOOKS**

1. Principles of Biochemistry by A.L.Lehninger, D.L.Nelson & M.M.Cox. (2012) Worth Publishers, New York.
2. Biochemistry by L.Stryer (2015) Freeman & Co, New York.
3. Biochemistry by G. Zubay (1988) Macmillan Publishing Co, New York.
4. The vital force: A study of Bioenergetics by F.M.Harold (1986) Freeman & Co, New York.
5. Andrews, R. Leach. Molecular Modeling: Principles and Applications.
6. Leonard, Banaszak. Foundation of Structural Biology.
7. Voet and Voet, 1992. Biochemistry, John Wiley & Sons, Inc., New York, USA.
- 8.

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**M. Sc DEGREE EXAMINATION**

**II M. Sc PLANT BIOLOGY AND PLANT BIOTECHNOLOGY**

**CORE PAPER -XIII**

**PLANT BIOCHEMISTRY AND BIOPHYSICS**

**COURSE CODE-10SP18/4C/ PBB**

**QUESTION PAPER TEMPLATE**

**Max Marks: 100**

**Time : 3 hrs**

**Section –A (10x2=20 marks)**

Answer all questions. All questions carry equal marks. Each answer should not exceed 50 words.

(Question number 1-10. 2 Questions from each unit covering all the 5 units)

**Section-B (5x8=40 marks)**

Answer any five questions. All questions carry equal marks. Each answer should not exceed 300 words. [Question number 11- 18. (Eight questions). One Question from each unit, the remaining 3 questions from the bigger units covering all the 5 units]

**Section- C (2x20 =40 marks)**

Answer any two questions. Both questions carry equal marks. Each answer should not exceed 1200 words. (Question number 19-21 (3 questions).

## **PRACTICAL -IV: COVERING CORE PAPERS IX and X**

**COURSE CODE-10SP18/4C/PR4**

**Teaching hours: 8/ Week**

**Credits: 5**

**120/ Semester**

**L-T- P**

**0-0- 8**

### **PLANT PHYSIOLOGY**

1. Extraction and separation of photosynthetic pigments of C<sub>3</sub> and C<sub>4</sub> plants by paper chromatographic method.
2. Extraction and separation of photosynthetic pigments of C<sub>3</sub> and C<sub>4</sub> plants by thin layer chromatographic (TLC) method.
3. Extraction and separation of photosynthetic pigments of C<sub>3</sub> and C<sub>4</sub> plants by Column chromatographic method.
4. Extraction and separation of photosynthetic pigments by Chemical method.
5. Estimation of Chlorophyll a, Chlorophyll b and Total chlorophyll by Arnon's method.
6. Estimation of Carotenoids by using colorimeter.
7. Determination of absorption spectra of Chlorophyll a and Chlorophyll b by using colorimeter.
8. Determination of water potential by Plasmolytic method
9. Deficit (DPD) by weighing method.
10. Determination of effect of Chemicals on membrane permeability (Colorimetrically)
11. Determination of effect of Temperature on membrane permeability (Colorimetrically)
12. Effect of varying intensities of light on the rate of photosynthesis of an aquatic plant by using Wilmott's Bubble Counter
13. Effect -of varying wave lengths of light (Or Quality of light)on the rate of photosynthesis of an aquatic plant by using Wilmot's Bubble Counter.
14. Effect of varying concentrations of CO<sub>2</sub> on the rate of photosynthesis of an aquatic plant by using Wilmot's Bubble Counter.

### **(DEMONSTRATION EXPERIMENTS PLANT PHYSIOLOGY)**

1. Dye reduction test (Hill's Reaction)
2. Estimation of total nitrogen by Kjeldhal method.
3. Bio- assay of 2,4-D.
4. Bioassay of kinetin.

## **PLANT BIOCHEMISTRY**

1. Basic Biochemistry - Preparation of different types of solutions
2. Principles of Photometry - Colorimeter and Spectrophotometer- principles and Applications.
3. To find complimentary colour for different coloured solutions by using colorimeter.
4. Preparation of standard graph for potassium dichromate ( $K_2Cr_2O_7$ ) by using colorimeter (OR) Verification of Beer- Lambert Law by using colorimeter.
5. Principles of pH meter and application
6. Determination of pH of lemon juice and detergent powder by using pH meter.
7. Determination of neutralization point of acid- base mixture by titration method using pH meter.
8. Estimation of glucose by anthrone reagent method colorimetrically.
9. Estimation of aminoacids by ninhydrin method colorimetrically.
10. Estimation of proteins (Lowry's method and Bradford method ).
11. Extraction and separation of known and unknown amino-acids by using Paper Chromatographic method.
12. Assay of the enzyme Catalase
13. Assay of the enzyme Peroxidase

## **(DEMONSTRATION EXPERIMENTS PLANT BIOCHEMISTRY AND BIOPHYSICS)**

1. Dialysis
2. Warburg manometer
3. Preparation of Buffers
4. Polyacrylamide Gel Electrophoresis (PAGE and SDS PAGE)

Simple problems based on theory syllabus.

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

**ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)**

**M. Sc. PLANT BIOLOGY AND PLANT BIOTECHNOLOGY**

**PRACTICAL EXAMINATION**

**TITLE OF THE PAPER: PRACTICAL –IV**

Max Marks- 100

**PAPER CODE: 10SP18/4C/PR4**

Practical- 85

Record- 10

Viva-voce- 5

Time- 4 hrs

1. Determine the water potential of the given plant material **A** by plasmolytic method. (10)
2. Conduct the experiment **B** assigned to you. Record your observation, analyze and interpret the results. (13)
3. Verify Beer- Lambert's Law with the given sample **C** by using colorimeter. Record your observation and interpret the results. (10)
4. Conduct the experiment **D** assigned to you. Record your observation, analyze and interpret the results. (13)
5. Write the protocol for the experiment **E** assigned to you. (6)
6. Write the principle for the given instrument **F**. (5)
7. Solve the Biochemistry Problems **G1, G2, G3** and **G4**. (3+3+3+3=12)
8. Identify and comment on **H, I, J** and **K**. (4×4=16)

## **ELECTIVE- V**

### **BIOINSTRUMENTATION AND METHODOLOGY**

**COURSE CODE-10SP18/4E5/BME**

**Teaching hours: 4 / Week**

**Credits: 3**

**60/ Semester**

**L-T- P**

**2- 2- 0**

#### **OBJECTIVES**

- To understand the principle and techniques of gene cloning
- To study the importance of transgenic plants
- Importance of Green nanotechnology and its applications

#### **UNIT – I**

**(10Hrs)**

Microtomy – Rotary microtome – Fixatives, Dehydration, Paraffin sectioning. Stains, Micrometry, Centrifugation – Types. Chromatography – Paper Chromatography – Thin layer Chromatography – Column Chromatography – Gas Chromatography – Liquid Chromatography.

#### **UNIT – II**

**(10Hrs)**

Microscopy – Principle, Types of microscopes – Applications, Electron microscopes – Scanning and Transmission microscopes, Different Fixation and staining techniques for EM. Freeze – etch and Freeze fracture methods for EM.

#### **UNIT – III**

**(15Hrs)**

Spectroscopic techniques – Principles and Applications – Visible and ultraviolet (UV) spectroscopy, Infra-red spectrophotometry, Nuclear-magnetic Resonance (NMR) spectrometry, Mass spectrometry. PCR, PAGE, Southern and Northern blotting, RFLP, RAPD, AFLP based DNA fingerprinting

## **UNIT – IV**

**(10Hrs)**

Nanotechnology- tools, techniques, advantages. Nanoparticles - characterization, production. Nanobiosensors, DNA nanotechnology, Biomedical Applications - disease diagnosis, gene therapy and drug delivery.

## **UNIT – V**

**(15Hrs)**

Writing the research report – The components of research report – Title – Authors and address, abstract – summary – synopsis – key words – introduction – review of literature – materials and methods – results – discussion – acknowledgements – General introduction and General discussion.

## **RECOMMENDED BOOKS**

1. Recombinant DNA and biotechnology. A guide for teachers. ASM Press.
2. Manasi Karkare 2008 . Nanotechnology: Fundamentals and Applications.IK Pub.
3. Jeremy Ramsden 2011. Nanotechnology: An Introduction. Elsever Publication
4. Mahesh, A. B. Vedamurthy 2003. Biotechnology-4 : Including Recombinant DNA Technology, Environmental Biotechnology and Animal cell culture. New age Int.Pub.
5. Gurumani.N. Research Methodology for Biological Sciences. MJP .2006
6. Karp.G. Cell And Molecular Biology. John Wiley And Sons , New York. 2002.
7. Patania.V.B. Spectroscopy.Campus Books.2002.
8. Veerakumari.L Bioinstrumentation. MJP. Publishers, Chennai Publishers, Chennai.2006.
9. Recombinant DNA and biotechnology. A guide for teachers. ASM Press.
10. Manasi Karkare 2008 . Nanotechnology: Fundamentals and Applications.IK Pub.
11. Jeremy Ramsden 2011. Nanotechnology: An Introduction. Elsever Publication
12. Mahesh, A. B. Vedamurthy 2003. Biotechnology-4 : Including Recombinant DNA Technology, Environmental Biotechnology and Animal cell culture. New age Int.Pub.
13. Gurumani.N. Research Methodology for Biological Sciences. MJP .2006
14. Karp.G. Cell And Molecular Biology. John Wiley And Sons , New York. 2002.
15. Patania.V.B. Spectroscopy.Campus Books.2002.
16. Veerakumari.L Bioinstrumentation. MJP. Publishers, Chennai Publishers, Chennai.2006.



## REFERENCE BOOKS

1. Trigiano, R.N., and D.J. Gray (eds.). 2000. Plant tissue culture concepts and laboratory exercises. CRC Press. (Textbook).
2. Kyte, M., and Kleyn, J. 1996. Plant from test tubes. Timber Press. Auge, R. et al., 1995.
3. *In vitro* culture and its applications in horticulture. Science Publishers, Inc. Crispeels, M.J. and D. E. Sadava. 2003.
4. Plants, genes and agriculture. Jones and Bartlett Publishers. Gamborg, O.L. and G. C. Phillips (eds). 1995.
5. Plant cell, tissue and organ culture. Springer Lab Manual. Potrykus, I, and G. Spangenberg (eds.). 1995.
6. Gene transfer to plants. Springer Lab Manual. Jones, H. 1996. Plant gene transfer and expression protocols. Methods in molecular biology . 49. Humana Press. Kreuzer, H, and A. Massey. 1996.
7. Mick Wilson, Kamali Kannangara, Geoff Smith - 2002 Nanotechnology: Basic Science and Emerging Technologies. Chapman and Hall.
8. Trigiano, R.N., and D.J. Gray (eds.). 2000. Plant tissue culture concepts and laboratory exercises. CRC Press. (Textbook).
9. Kyte, M., and Kleyn, J. 1996. Plant from test tubes. Timber Press. Auge, R. et al., 1995.
10. *In vitro* culture and its applications in horticulture. Science Publishers, Inc. Crispeels, M.J. and D. E. Sadava. 2003.
11. Plants, genes and agriculture. Jones and Bartlett Publishers. Gamborg, O.L. and G. C. Phillips (eds). 1995.
12. Plant cell, tissue and organ culture. Springer Lab Manual. Potrykus, I, and G. Spangenberg (eds.). 1995.
13. Gene transfer to plants. Springer Lab Manual. Jones, H. 1996. Plant gene transfer and expression protocols. Methods in molecular biolog . 49. Humana Press. Kreuzer, H, and A. Massey. 1996.
14. Mick Wilson, Kamali Kannangara, Geoff Smith - 2002 Nanotechnology: Basic Science and Emerging Technologies. Chapman and Hall .

## ONLINE REFERENCE

<http://www.britannica.com/science/recombinant-DNA-technology>

[ebooks.cambridge.org/chapter.jsf?bid=CBO9781139168205&cid](http://ebooks.cambridge.org/chapter.jsf?bid=CBO9781139168205&cid).

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**II M. Sc PLANT BIOLOGY AND PLANT BIOTECHNOLOGY**

**ELECTIVE- V**

**BIOINSTRUMENTATION AND METHODOLOGY**

**COURSE CODE-10SP18/4E5/BME**

**QUESTION PAPER TEMPLATE**

**Max Marks: 100**

**Time : 3 hrs**

**Section –A (10x2=20 marks)**

Answer all questions. All questions carry equal marks. Each answer should not exceed 50 words.

(Question number 1-10. 2 Questions from each unit covering all the 5 units)

**Section-B (5x8=40 marks)**

Answer any five questions. All questions carry equal marks. Each answer should not exceed 300 words. [Question number 11- 18. (Eight questions). One Question from each unit, the remaining 3 questions from the bigger units covering all the 5 units]

**Section- C (2x20 =40 marks)**

Answer any two questions. Both questions carry equal marks. Each answer should not exceed 1200 words. (Question number 19-21 (3 questions).

**ELECTIVE- V**  
**NANOBIOTECHNOLOGY**

**COURSE CODE-10SP18/4E5/NBT**

**Teaching hours: 4 / Week**

**Credits: 3**

**60/ Semester**

**L-T- P**

**2- 2- 0**

**OBJECTIVES**

- To understand the principle and techniques of nanotechnology
- Importance of Green nanotechnology and its applications

**UNIT – I**

**(10Hrs)**

*Introduction*

History of Nanotechnology, Difference between Nanoscience and Nanotechnology, Green nanotechnology, Bottom up and top down approaches.

**UNIT - II**

**(10Hrs)**

*Biological Nano-Objects*

Structural and Functional Regulation of DNA: Geometry, Topology and Methylation : Geometry of the DNA Double Helix - The Z Conformation of DNA.- Supercoiled DNA - Methylation of DNA, Protein–Lipid Assembly and Biomimetic Nanostructure.

**UNIT - III**

**(10Hrs)**

*Biological Membranes*

Biological Membranes - Lipid Membranes: Structure and Properties - Models and Methods for Characterising Membranes - Protein–Lipid Assembly - Applications of Biomimetic Membranes

## **UNIT – IV**

**(15Hrs)**

### *Methods of Nanobiotechnology*

Optical tools – Nanoforce and imaging – Surface methods – Mass spectrometry – Electrical Characterization and Dynamics of Transport – Microfluidics : Concepts and Applications to the Life Sciences.

## **UNIT – V**

**(15Hrs)**

### *Applications of Nanobiotechnology*

Real Time PCR – Biosensors : From the Glucose electrode to the Biochip – DNA Microarrays – Protein Microarrays – Cell Biochips – Lab on a chip – Polyelectrolyte multilayers – Biointegrating materials – Pharmaceutical applications of nanoparticles carriers.

## **REFERENCE BOOKS**

1. Industrial Pharmaceutical Biotechnology, Heinrich Klefenz, Wiley-Vch Publication, Germany, 2002.
2. Pharmaceutical Biotechnology, Daan Crommelin, Robert D Sindelar, 2002, Tailor and Francis Publications, Newyork, 2002.
3. Hand book of Pharmaceutical Biotechnology, Jay P Rho, Stan G Louie, 2003, Pharmaceutical products press, Newyork, 2003
4. Theory and practice of industrial pharmacy, Lachman L Lieberman, HA, Kanig, J, 1986, 3rd edition, Varghese publishing & Co, New Delhi, 2000.
5. Remington's Pharamaceutial sciences, Joseph Price Remington , 18th edtion, Mack publishing & Co., Easton, 1980.

**ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)**

**CHENNAI-600 008.**

(For candidates admitted during the academic year 2018-2019)

**M. Sc DEGREE EXAMINATION**

**II M. Sc PLANT BIOLOGY AND PLANT BIOTECHNOLOGY**

**ELECTIVE- V**

**NANOBIOTECHNOLOGY**

**COURSE CODE-10SP18/4E5/NBT**

**QUESTION PAPER TEMPLATE**

**Max Marks: 100**

**Time : 3 hrs**

**Section –A (10x2=20 marks)**

Answer all questions. All questions carry equal marks. Each answer should not exceed 50 words.

(Question number 1-10. 2 Questions from each unit covering all the 5 units)

**Section-B (5x8=40 marks)**

Answer any five questions. All questions carry equal marks. Each answer should not exceed 300 words. [Question number 11- 18. (Eight questions). One Question from each unit, the remaining 3 questions from the bigger units covering all the 5 units]

**Section- C (2x20 =40 marks)**

Answer any two questions. Both questions carry equal marks. Each answer should not exceed 1200 words. (Question number 19-21 (3 questions).

**SOFT SKILL - IV**  
**BIOINFORMATICS**

**COURSE CODE-10SP15/4S/BIN**

**Teaching hours: 2/ Week**

**Credits: 2**

**30/ Semester**

**L-T- P**

**2- 0- 0**

**UNIT – I**

**(6 Hrs)**

Introduction to Bioinformatics – Definitions. Proteomics. Genomics. Applications of Bioinformatics

**UNIT – II**

**(6 Hrs)**

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

**UNIT – III**

**(6 Hrs)**

Bioinformatics-Taxonomic classification- Operational taxonomic unit. Methods of phylogenetic analysis – Phenetic method and Cladistic method of analysis - Molecular phylogeny.

**UNIT – IV**

**(6 Hrs)**

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

**UNIT – V**

**(6 Hrs)**

Techniques in Bioinformatics- FASTA, BLAST, Multiple Sequence Analysis- Open Reading Frame.

## REFERENCE BOOKS

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

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**M. Sc DEGREE EXAMINATION**

**I M. Sc PLANT BIOLOGY AND PLANT BIOTECHNOLOGY**

**SOFT SKILL - IV**

**BIOINFORMATICS**

**COURSE CODE-10SP15/4S/BIN**

**QUESTION PAPER TEMPLATE**

**Max Marks: 50**

**Time : 2 hrs**

**Section –A (5x2=10 marks)**

Answer all questions. All questions carry equal marks. Each answer should not exceed 50 words.

(Question number 1 -5. 1 Question from each unit covering all the 5 units)

**Section-B (4x5=20 marks)**

Answer any four questions out of six. All questions carry equal marks. Each answer should not exceed 300 words. [Question number 6 - 11. (six questions). One Question from each unit, the remaining 1 question from the bigger unit covering all the 5 units]

**Section- C (1x20 =20 marks)**

Answer any one question out of two. The answer should not exceed 1500 words. (Question number 12 – 13 (2 questions)).