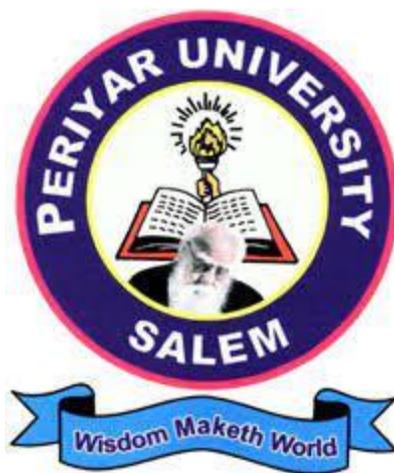


**PERIYAR UNIVERSITY**  
**PERIYAR PALAKALINAGAR**  
**SALEM -636011**



**DEGREE OF MASTER OF SCIENCE**  
**CHOICE BASED CREDIT SYSTEM**  
**SYLLABUS FOR M.Sc ., BOTANY**  
**(FOR THE STUDENTS ADMITTED FROM THE ACADEMIC YEAR 2021-2022 ONWARDS)**

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**PERIYAR UNIVERSITY, SALEM - 636 011**

**M. Sc., Botany - Choice Based Credit System**

**Regulations and Syllabus**

**(Effective from the Academic year 2021 - 2022 onwards)**

**AIM**

1. Aims at providing skills in critical thinking and evaluation of information.
2. To instill knowledge across wide areas of plant science.
3. Help to understand the evolution of land plants from simple ancestors
4. Providing an opportunity to familiarize with life cycles and mode of reproduction in different Plant groups.
5. As the course includes units from related branches like Biochemistry, Biophysics, Microbiology, Biotechnology, Nano biotechnology an opportunity is provided to understand the relationship between Botany and other related branches
6. Appreciating the importance of Ecology of population and communities, the dynamics of Ecosystem, the Biosphere, and future of the Biosphere
7. Identifying different flowering plants based on their characters.
8. The topics included in different units of different papers aim to enable the Students develop technical skills and innovative approaches in Botanical and Related branches.

**SCOPE**

- This course considers the patterns of plant diversity and the processes that generate and maintain plant diversity. It is an interdisciplinary approach in which major groups of plants are overviewed in holistic manner
- This course also considers the Biology of plants. Different branches of Botany are given due importance as they deserve. Practicals are framed with an aim to improve skills in microscope, observation, drawing, and laboratory exercise. During field trips the students are exposed to basic ecological principles and interactions
- Students who complete this course will have a better understanding of the types and sources of plants by diversity and the role of human and non-human factors in plant diversity. Students will better understand plants and their importance in the Biosphere as life sustaining components.
- Students who complete this course can pursue research. As topics from relevant courses are included there is a scope for the student to have opportunity for employment in state and central governments. Also the student has a scope for self employment

## **REGULATIONS OF PG COURSES IN BOTANY OFFERED IN THE AFFILIATED COLLEGES**

### **1. Condition for admission**

A candidate who has passed Br. V in Botany or Br. V (a) Botany Vocational - Biotechnology or any of the above degree of any other University accepted by the syndicate as equivalent, thereto subject to such condition as may be prescribed therefore shall be permitted to appear examination and qualify for M. Sc. degree in Botany at this University after a course of study of two academic years.

### **2. Duration of the course**

The course for the degree of Master of Science shall consist of two academic years divided into four semesters. Each Semester consists of 90 working days. Practical examinations will be at the end of even semesters

### **3. Passing minimum**

#### **3 (a) THEORY**

University Examination (EA)	Internal Assessment (CIA)
<b>75 marks</b>	<b>25 marks</b>

#### **Classification of Internal Assessment Structure**

##### **Marks**

<b>Test</b>	10 Marks
<b>Seminar</b>	05 Marks
<b>Assignment</b>	05 Marks
<b>Attendance</b>	05 Marks
<hr/> <b>Total Marks</b>	<hr/> <b>25 Marks</b>

<b>Passing minimum (CIA) 50%</b>	-	12 Marks
<b>Passing minimum (EA) 50%</b>	-	38 Marks
<b>Total Passing minimum</b>	-	<b>50 Marks</b>

### 3 (b) PRACTICAL

University Examination (EA)	Internal Assessment (CIA)
<b>60 marks</b>	<b>40 marks</b>

#### Classification of Internal Assessment Structure

##### Marks

Submission	-	10 marks
Test	-	10 marks
Attendance	-	10 marks
Continues assessment in Practical class	-	10 marks
		-----
<b>Total marks</b>		<b>40 marks</b>
		-----
Passing minimum (CIA) 50%	-	20 Marks
Passing minimum (EA) 50%	-	30 Marks
Total Passing minimum	-	<b>50 Marks</b>

**3(c).** The candidate shall be declared to have passed the examination if the candidates secure not less than 38 marks out of 75 marks in the University examination in each theory paper and 12 marks out of 25 marks in the Internal Assessment and in total not less than 50 marks.

**3(d).** For the practical paper 30 marks out of 60 marks in the University examination and the record notebook taken together and 20 marks out of 40 marks in the Internal Assessment and in total 50 marks. There is no passing minimum for the record notebook. However submission of a record notebook is a must.

**3(e).** For the project work and viva-voce a candidate should secure 50% of the marks for pass. The candidate should compulsorily attend the Viva-voce examination to secure a pass in that paper.

Internal Assessment (CIA)	40 Marks
Dissertation	40 Marks
Viva voce	20 Marks
<b>Total marks</b>	<b>100 Marks</b>

Passing minimum (CIA) 50% - 20 Marks

Passing minimum (Dissertation) 50% - 20 Marks

Passing minimum (Viva voce) 50% - 10 Marks

Total passing minimum = 50 Marks

(Dissertation evaluation and Viva-voce to be conducted by an External Examiner (Appointed by University) and an Internal examiner).

#### 4. Internship training (Non credits course)

**4(a).**The Students should undergo a compulsory minimum 10 days internship program during the II semester vacation to any Botany related industry like herbal medicine processing unit / mushroom culture unit / Algal cultivation / Bio fertilizer / vermin-compost unit / Horticulture center / plant tissue culture unit etc . At the end of the program, students should submit the report

**4(b).**For the internship training a candidate should secure 50% of the marks for passing. The candidate should compulsorily submit and report an oral presentation to secure pass in that paper.

<b>Maximum mark</b>	<b>50 mark</b>
Submission of Report	40 marks
Oral presentation	10 marks

Passing minimum – 25 marks

#### 5. Classification of successful candidates

**5(a).**Candidates who secures not less than 60% of the aggregate marks in the whole Examination shall be declared to have passed the examination in First class.

**5(b).**All other successful candidates shall be declared to have passed in the Second class.

Candidates who obtain 75% of the marks in the aggregate shall be deemed to have passed the examination in First Class with Distinction provided they pass all the examinations prescribed for the course at the first appearance.

**5(c).**Candidates who pass all the examinations prescribed for the course in the first Instance and with in a period of two academic years from the year of admission to the course only are eligible for University Ranking

#### **6. Maximum duration for the completion of the PG Programme**

The maximum duration for completion of the PG Programme shall not exceed eight semesters.

#### **7. Commencement of this regulation**

These regulations shall take effect from the academic year 2021 -2022, i.e., for students who are to be admitted to the first year of the course during the academic year 2021-2022 and thereafter.

#### **8. Transitory provision**

Candidates who were admitted to the PG course of study before 2021 shall be permitted to appear for the examinations under these regulations for a period of three years i.e., up to and inclusive of the examinations of April/May 2024. Thereafter, they will be permitted to appear for the examination only under the regulation then in force

**PERIYAR UNIVERSITY, SALEM -636011**  
**M.Sc., Botany – Choice Based Credit System**  
**(Academic year 2021-2022 onwards)**  
**Course structure**

SEM	CODE	COURSE TITLE	Credits	Hrs	MARKS		
					CIA	EA	Total
<b>I</b>	Core course –I	<b>Biodiversity of plants - I</b> (Algae, Fungi, Lichens and Bryophytes)	5	6	25	75	100
	Core course –II	<b>Biodiversity of plants - II</b> (Pteridophytes, Gymnosperms and Paleobotany)	5	6	25	75	100
	Core course –III	Taxonomy of angiosperms and Economic botany (Practical Assessment and credits carried to Core Course –VIII, 3 hrs)	5	5	25	75	100
	Core course -IV	<b>Practical – I</b> Algae, Fungi, Lichen, Bryophytes, Pteridophytes, Gymnosperms Paleobotany) (Core Course I practical – 3 hrs) (Core Course II practical - 3 hrs)	4	6	40	60	100
	Elective course -I	Ethnobotany	4	4	25	75	100
		<b>Total</b>	<b>23</b>	<b>30</b>	<b>140</b>	<b>360</b>	<b>500</b>
<b>II</b>	Core course –V	Microbiology and Plant Pathology	4	5	25	75	100
	Core course –VI	Anatomy of Angiosperms, Plant Microtechniques and Embryology of Angiosperms	5	5	25	75	100
	Core course –VII	Cell biology, Genetics and Molecular biology	5	5	25	75	100
	Core course –VIII	<b>Practical - II</b> Taxonomy of Angiosperms and Economic Botany, Microbiology and Plant Pathology)	4	3	40	60	100
	Core course IX	<b>Practical – III</b> Anatomy of Angiosperms, Plant Microtechniques and Embryology of Angiosperms, Cell biology and Genetics and Molecular biology (Core Course VI Practical - 3 hrs) (Core Course VII Practical - 3hrs)	4	6	40	60	100
	*EDC	Extra disciplinary course (other than Botany major subject)	4	4	25	75	100
	Non credits course I	Human rights		2	25	75	100
	Non credits course II	Internship training (During second semester vacation)	Minimum 10 days		<b>50</b>	<b>50</b>	
		<b>Total</b>	<b>26</b>	<b>30</b>	<b>180</b>	<b>420</b>	<b>600</b>

<b>III</b>	Core course -X	Plant Physiology and Biophysics	5	6	25	75	100
	Core course –XI	Biochemistry and Nano biotechnology	4	6	25	75	100
	Core course -XII	<b>Practical - IV</b> Plant physiology, Biophysics, Biochemistry and Nano biotechnology) ( Core Course X Practical – 3 hrs ) (Core Course XI Practical – 3hrs )	4	6	40	60	100
	Elective course -II	Horticulture and forestry	4	6	25	75	100
	Elective course - III	Plant Biotechnology and Genetic engineering	4	6	25	75	100
		<b>Total</b>	<b>21</b>	<b>30</b>	<b>140</b>	<b>360</b>	<b>500</b>
<b>IV</b>	Core course -XIII	Ecology, Conservation biology and Phytogeography	4	6	25	75	100
	Core course –XIV	Bio instrumentation, Research methodology, Biostatistics and Bioinformatics	4	6	25	75	100
	Core course -XV	<b>Practical - V</b> Ecology, conservation biology and Phytogeography, Bio instrumentation, Research methodology, Biostatistics and Bioinformatics (Core Course XIII Practical- 3hrs) (Core Course XIV Practical - 3hrs )	4	6	40	60	100
	Core course -XVI	Project and Dissertation	4	6	40	60	100
	Elective course –IV	Phyto chemistry and drug development	4	6	25	75	100
		<b>Total</b>	<b>20</b>	<b>30</b>	<b>155</b>	<b>345</b>	<b>500</b>
		<b>Grand Total</b>	<b>90</b>	<b>120</b>	<b>615</b>	<b>1485</b>	<b>2100</b>
<b>*Extra disciplinary course (other than Botany Major Students)</b>							
	EDC Paper –I	Horticulture	4	4	25	75	100
	EDC Paper –II	Herbal Botany	4	4	25	75	100

**Note: Non credits course marks not include for percentage**

**FIRST SEMESTER**  
**CORE COURSE - I**  
**BIODIVERSITY OF PLANTS – I**  
**(ALGAE, FUNGI, LICHENS AND BRYOPHYTES)**

**COURSE OBJECTIVE**

- To study the classification, character feature, distribution and reproductive cycle of Algae, fungi, lichens and bryophytes
- To study the ecological and economic importance of Algae, fungi, lichens and bryophytes

**COURSE OUTCOMES**

- Comprehend the General features, classifications, biology and distribution and evolution of different algal forms with their ecology and ecological importance with their counterpart lichen
- Recognize characteristic features, classification and commercial importance of fungi and their interactions
- Connect the link between algae with their terrestrial counterpart bryophytes through studying the features, ecology and variations of gametophytes and sporophytes and their evolutionary significance.

**UNIT I - Classification and Structure of algae****15hrs**

Introduction and history of phycology. Algology in India (Contributions of eminent Indian Algologists . Habit and habitat of algae, Classification of algae (F.E.Fritsch 1935, 1945, Bold & Wynne 1978) - Criteria used for algae classification. Ultra structure of Prokaryotic and eukaryotic algae cells – structure of cell wall , protoplasm, flagella-types and organization, eye spots, plastids types and organization, pigments types, pyrenoids, nucleus, Reserve foods material reproduction and life cycle pattern of Algae.

**UNIT II - General character, systematic studies and economic important of algae 20hrs**

Salient features, reproduction and Life cycle pattern of Cyanophyceae, Chlorophyceae, Xanthophyceae, Chrysophyceae, Dinophyceae, Chloromonadinaeae, Euglenophyceae, Charophyceae, Bacillariophyceae, Phaeophyceae, Rhodophyceae. Fossil algae. Phylogeny and Evolutionary trend in algae, origin and evolution of sex in algae. Economic importance of Algae: Algae as food, fodder, biofertilizer, medicine, industrial uses, and other useful products. Harmful effects of algae. Toxicity and parasitism, red tides. Bio -fouling of marine vessels, Importance in municipal water supplies: algae bloom. Use of Algae in experimental studies.

**UNIT III - Fungi****25hrs**

Classification of fungi (J. Alexopoulos and C.W.Mims 1979) - Range of structure, distribution, Reproduction, phylogeny and interrelationship of Mastigomycotina, Zygomycotina, Ascomycotina, Basidiomycotina and Deuteromycotina – Spore dispersal mechanism in fungi - Heterothallism and para sexuality in fungi – Sex hormones and

pheromones in Fungi - Mycorrhizae and AM fungi, Fossil fungi , Economic importance of fungi.

#### **UNIT IV - Lichens**

**10hrs**

Introduction to lichen - Classification of Lichens - Occurrence and interrelationship of Phycobionts and Mycobionts, Structure and reproduction in lichens – Lichens as indicator of pollution – Role of lichens in soil formation, Economic importance of lichens

#### **UNIT V - Bryophytes**

**20hrs**

Bryophytes: General feature, Classification of Bryophytes (Watson 1971), Distribution, Structures, Reproduction and Life cycle of Marchantiales, Jungermanniales, Anthocerotales and Polytrichales – Comparative study of gametophytes and Sporophytes of major classes. Spore dispersal mechanisms, germination pattern spore - Economic importance with special reference to Chemical constituents, Bryophytes as indicator of Pollution, Succession of bryophytes. Evolutionary trends in Sporophytes and gametophytes of bryophytes. Fossil bryophytes

#### **Text books for Algae**

1. Sharma, O.P. (2011). Diversity of microbes & Cryptogams – Algae, Tata McGraw Hill Education Private Limited, New Delhi
2. Kumar, H.D. (1985). Introductory Phycology - East West Press, New Delhi.
3. Kumar, H.D and Singh, H.N. (1982). A textbook of Algae. Affiliated East West Press, New Delhi.
4. Sambamurty, A.V.S.S. (2005). Textbook of Algae, I K International Publishing House.
5. Vashishta, B.R. *et al.* (2008). Botany for Degree Students - Algae. S. Chand and Co. New Delhi.

#### **Reference books**

1. Bold, H.C and Wyne M.J. (1978). Introduction to algae – Structure & reproduction Prentice hall, New Jersey
2. Chapman, V.J and Chapman. (1973). The algae – ELBS & MacMillan, London
3. Fritsch, F.E. (1935). The Structure & Reproduction of The Algae (Vol - 1 & 2) Cambridge University Press, England
4. Round, F.E. (1982). The Ecology of algae, Cambridge University press, London
5. Lee, R.E. (2008). Phycology - IV Edition, Cambridge University Press, New Delhi
6. Venkataraman G.S *et al.*, (1974). Algae form and Function – Today and Tomorrow Publishers, New Delhi.

### **FUNGI**

#### **Text books**

1. Sharma, O.P. (2011). Fungi and allied microbes The McGraw –Hill companies, New Delhi
2. Alexopoulos, C.J and Mims, C.W. (1979). Introductory Mycology, Wiley Eastern ltd., New Delhi
3. Dube, H.C. (1990). An Introduction of Fungi. Vikas Publication House Ltd, New Delhi
4. Dube, H.C (1983). Introduction of Modern Mycology. Blackwell Science Publication. Oxford
5. Sharma, P.D (2003). The Fungi. Rastogi Publications, Meerut

## **Reference Books**

1. Burnett, J.H. (1971). The fundamentals of Mycology. ELBS Publication, London
2. Bessey, E.A (1979). Morphology and Taxonomy of fungi, Vikas publishing House Pvt. Ltd , New Delhi.
3. Mehrotra R.S and Aneja K.R. (1990). An Introduction to Mycology, New Age International Pub, New Delhi
4. Sundararajan, S. (2004). Practical manual of fungi, Anmol publications Pvt. Ltd, New Delhi.

## **LICHENS**

### **Text & Reference Books**

1. Muthukumar S and Tarar, J.L. (2006). Lichen Flora of Central India, Eastern book Corporation, New Delhi.
2. Awasthi, D.D. (2000). A Handbook of Lichens Vedams eBooks (P) Ltd. New Delhi.
3. Hale, M.E. (1983). The Biology of Lichens. Edward Arnold, London
4. Nash, T.H (1996). Lichen Biology. Cambridge University Press, London

## **BRYOPHYTES**

### **Text Books**

1. Rashid, A. (1998). An introduction to bryophyte. Vikas Publishing Co. New Delhi.
2. Vashishta, Sinha A.K and Adarsh Kumar. (2011). Bryophytes, S. Chand & Company ltd., New Delhi.
3. Sharma O.P (2020). Bryophyta. Third edition, McGraw Hill Education (India) Pvt. Ltd.

### **Reference books**

1. Cavers, F. (1971). The interrelationship of Bryophyta, Dawsons of Pall Mall, London.
2. Chopra, R N. (1998). Topics in Bryology, Allied Published Ltd, Mumbai
3. Chopra, R.N and Kumar P.K. (1988). Biology of Bryophytes, John Wiley, New York
4. Graham, L.E. (1993). Origin of land Plants. John Wiley, New York
5. Prem Puri, P. (1990). Bryophytes: Morphology, Growth and Differentiation.
6. Smith, A.J.E. (1982). Bryophyte Ecology. Chapman and Hall. London
7. Watson E.V. (1968). British Mosses and Liverworts, Hutchinson and Co., London
8. Watson, E.V. (1970). Structure and life of Bryophytes. Hutchinson and Co, London
9. Parihar, N.S. (1972). An Introduction to Embryophyta - I: Bryophyta. Central Book, Depot, Allahabad.

**FIRST SEMESTER****CORE COURSE - II****BIODIVERSITY OF PLANTS – II****(PTERIDOPHYTES, GYMNOSPERMS AND PALEOBOTANY)****Course objective:**

- To study the lower vascular plants and their characteristics
- To understand the character and salient features of fossil and living forms Pteridophytes and gymnosperms
- To study the concept of fossil and fossilization

**Outcome of the course**

- Knowledge on the classification and life cycle of Pteridophytes and Gymnosperms
- Understand phylogeny and evolutionary trends of Pteridophytes and Gymnosperms
- Knowledge on salient features' of fossil forms of Pteridophytes and Gymnosperms
- Familiar with morphology, anatomy, reproduction, phylogeny and Economic importance of living Pteridophytes and Gymnosperms
- Learn the concept of paleobotany and the economic importance of fossil plants.

**UNIT I - Pteridophytes****25 hrs**

Classification of Pteridophytes (Remier. 1954), Comparative morphology, anatomy, reproductive biology and evolutionary studies of the following groups: *Psilopsida*, *Lycopsida*, *Sphenopsida* and *Pteropsida*. Fossil Pteridophytes– *Rhynia*, *Sphenophyllum*, *Lepidocarpon*, *Cladoxylon*, *Pentoxylon*, *Botryopteris*

**UNIT II - Evolutionary Approach in Pteridophytes****10 hrs**

Phylogenetic trends in Pteridophytes - Evolution of Stele, Sorus – Origin of sporangium - Heterospory and seed habit –Alternation of generation – Affinities of various classes of Pteridophytes, Apogamy and Apospory in Pteridophytes, Economic importance of Pteridophytes

**UNIT III – Evolutionary Approach in Gymnosperm & extinct gymnosperms****20 hrs**

General character, classification of gymnosperms (Sporne, K.R. 1956). Origin and Evolution of gymnosperms with special reference to Progymnosperms, Devonian pre ovules and origin of seed. Salient feature, morphology, anatomy, reproductive structure and Phylogeny of extinct gymnosperms order – *Pteridospermales*, *Bennettiales*, *Pentoxylales*, *Cycadales*, *Cordaitales*, *Coniferales*.

**UNIT- IV–Living gymnosperm & Economic important****20 hrs**

Comparative study of vegetative, anatomical and reproductive characteristics of extant order of *Cycadaceae*, *Ginkgoales*, *coniferales*, *Gnetales*. Economic importance of gymnosperms Affinities with Angiosperms and Pteridophytes, Global distribution of gymnosperms with special reference to Indian plants.

## UNIT IV - Paleobotany

15 hrs

Concept of Paleobotany - Geological time scale- contribution of Birbal Sahni– Technique for paleobotanical studies. Fossilization process, Types of fossils, the fossil records: systematic reconstruction and nomenclature of fossil plants, Determination of Age of Fossils, Fundamentals of Paleo Floristics, Palaeogeography and Palaeoclimatology. Role fossil in oil exploration, Paleopalynology

### PTERIDOPHYTES

#### Text books

1. Vashishta, P.C, Sinha and Anilkumar (2010). Pteridophytes, S. Chand & company Ltd, New Delhi
2. Sharma.O.P. (1990). Textbook of Pteridophyta, MacMillan India Ltd., New Delhi
3. Smith, G.M. (1955). Cryptogamic Botany Vol. II, Tata Mcgraw Hill Publishing Co., Ltd., New Delhi.
4. Rasheed, A. (1999). An Introduction to Pteridophyta, Vikas Publishing Co., New Delhi.
5. Vashishta.P.C. (1990). Pteridophyta, S. Chand & Co. Ltd, New Delhi
6. Johri, R.M. Sneh Lata and Sandhya Sharma, (2004). A Textbook of Pteridophyta. Vedams Books (P) Ltd., New Delhi

#### Reference books

1. Eames, A.J. (1936). Morphology of Vascular Plants - Lower groups, Tata Mcgraw Hill Publishing company Ltd., New Delhi.
2. Sporne, K.R. (1972). The Morphology of Pteridophytes, B.I. Publications, Madras
3. Sporne, KR. (1970). The morphology of Pteridophytes (The structure of Ferns and Allied Plants), Hutchinson University, London.
4. Bower. F.O (1939). The Ferns (Vol. I,II,III), Today & tomorrow's Printers, New Delhi

### GYMNOSPERMS

#### Text books

1. Sharma, O.P. (2017). Gymnosperms, 4<sup>th</sup> Edition, Pragati Prakashan, Meerut, India
2. Bhatnagar and Moitra, (1996). Gymnosperms. New age International Publishers, New Delhi
3. Johri, R.M, Lata S, Tyagi, K. (2005). A text book of Gymnosperms , Dominate pub and Distributor, New Delhi
4. Biswas, C. and Johri, B.M. (2004). The Gymnosperms. Narosa Publishing House, New Delhi.
5. Vashista P.C. (1990). Gymnosperms,S. Chand & Co. Ltd., New Delhi

#### Reference books

1. Bierhost, D.W. (1971). Morphology of Vascular plants. McMillan Company, New York.
2. Chamberlain, C.J. (1934). Gymnosperms: Structure and Evolution. Chicago (Reprinted 1950) New York.
3. Delveloryas, T. (1962). Morphology and evolution of fossil plants.
4. Doyle, W.T. (1970). Non Vascular Plants: Form and function. Belmont, California.
5. Foster and Gifford, J.R. (1962). Comparative Morphology of Vascular Plants. Allied Pacific Pvt. Ltd., Bombay.

## **PALEOBOTANY**

1. Atchley, W.R & Woodnuff, D.S. (1981). Evolution and speciation, Cambridge University Press, Cambridge.
2. Kimura, M. (1983). The natural theory of molecular evolution, Cambridge University Press, Cambridge.
3. Arora, M.P. (1990). Evolutionary biology, Himalaya Publication House, Delhi.
4. Arnold, C.A (1947).An Introduction to Paleobotany, McGraw Hill Book Company Inc. New York & London
5. Kirkaldy, J.E. (1963). The study of Fossils. Hutchinson Educational, London
6. Stewart W.N Palaeobotany and evolution of plants. Cambridge University Press, New York.
7. Stewart, W.N and Rothwell, G.W. (2013). Palaeobotany and the evolution of plants. 2 ed. Cambridge University Press, Ltd, New Delhi
8. Edith L. Taylor, Thomas N. Taylor and Michael Krings (2009). Palaeobotany: The Biology and Evolution of Fossil Plants. Academic Press

**FIRST SEMESTER**  
**CORE COURSE –III**  
**TAXONOMY OF ANGIOSPERMS AND ECONOMIC BOTANY**

**Course objective**

- To understand the basic nomenclature criteria of plant taxonomy
- To develop a skill to identify the plants and recognize the major plant families and their representative species using Regional Floras.
- To familiarize the important families of angiosperms
- To know about the economic importance of selected families

**Course outcome**

- Understand the different classification in plant systematic
- Familiar with plant nomenclature and rules
- Knowledge on molecular tool in taxonomy
- Do research and also get hands-on training in herbarium taxonomy through the process of preserving the plant specimens for herbarium which is a biological tool and store house of plants for taxonomic research.
- Examine the recent developments in the field of plant systematic and reflect upon the learning programs related to net based applications which will make the students amused towards the subject.

**UNIT I - Scope and Sources of Systematics**

**20 Hrs**

Classification of angiosperm: A brief historical account on the classification of Angiosperms up to the present day – Principles - Classification of angiosperms, Linnaeus, Bentham and Hooker, Engler and Prantl, Bessy, Takhtajan, Angiosperm phylogeny group (APG)-IV – Merits and demerits. Phenetics - Cladistics - Concepts of Taxonomic hierarchy – Species concept – Systematic Evidence: Morphology, anatomy, Palynology, Embryology, Cytology, Chemotaxonomy, Numerical taxonomy, Sero taxonomy and Molecular taxonomy – DNA barcoding – Molecular markers in taxonomy – Computer applications in plant systematic

**UNIT II - Botanical Nomenclature**

**20 Hrs**

Nomenclature and taxonomic techniques: Binomial nomenclature – Principles of ICN – Typification - Principles of priority - Author citation – Retention, rejection and changing of names - Synonyms - Effective and valid publication – Monographs, Icones, Journal, Periodicals, Floras, Electronic flora and Manuals - Plant Identification: Herbarium preparation and data information - Taxonomic keys- indented key, Bracketed key, written description, specimen comparison - Botanical gardens, Botanical Survey of India (BSI) Unified biological nomenclature – Draft Biocode, Phylocode

**Arrangement of the families in UNIT III & IV according to the classification of APG IV (2016)**

### **UNIT III - Systematic study of Basal angiosperms, Magnoliids & Eudicots** 10 hrs

Study of Systematic Position, salient features, description, distribution of economic importance of the following families, **Basal angiosperm** - Nymphaeaceae, **Magnoliids** : Magnoliaceae, Aristolochiaceae. **Monocots**: Araceae, Orchidaceae, Commelinaceae, zingiberaceae, Cyperaceae, **Eudicots**: Menispermaceae, **Superrosids**: Crassulaceae.

### **UNIT IV - Systematic study of Rosids & Asterids families** 15 Hrs

Study of Systematic Position, salient features, description, distribution of economic importance of the following families - **Rosids**: Combretaceae, Lythraceae, Casuarinaceae, Moraceae, Rosaceae, Meliaceae, Sapindaceae. **Superasterids**: Nyctaginaceae, Polygonaceae, Portulacaceae, **Asterids**: Sapotaceae, Boraginaceae, Rubiaceae, Bignoniaceae, Pedaliaceae, Convolvulaceae

### **UNIT V - Economic botany** 10 Hrs

General account on economic value, cultivation and utilization of selected crop plants : Cereals (Wheat) – Pulses (black gram) – Sugar yielding plants (Sugar beet) – Spices and condiments (Cardamom, Cinnamon) - Fiber (Jute), Timber (Teak and red sanders wood), Resin and Gums (Asafoetida and Gum Arabic) – Essential oils (lemongrass and eucalyptus Beverages (coffee and tea) – oil yielding plants (Sun flower, gingelly) - drug yielding plant (Cinchona, Withania and Gloriosa)

#### **Text books**

1. Lawrence, G.H.M. (1995). The Taxonomy of vascular Plants (Vol I-IV), Central Book, Dept, Allahabad
2. Heywood V.H. (1967). Plant Taxonomy, Edward Arnold, London.
3. Jeffery C. (1982). An introduction to Plant Taxonomy, J & A Churchill Ltd., London
4. Mathew, K.M. (1983). The Flora of Tamil Nadu Carnatic, The Rapinat Herbarium, Trichy.
5. Sivaraajan, V.V. (1989). Introduction to Principle of Plant Taxonomy, Oxford and IBH, New Delhi.
6. Pandey, BP. (2017). Taxonomy of Angiosperms, S. Chand & Co., New Delhi.
7. Singh, V. and Jain, K.K. (1989). Taxonomy of Angiosperms, Rastogi, Meerut.
8. Vashista, PC. (1990). Taxonomy of Angiosperms, S. Chand & Co., New Delhi.
9. Sharma, OP. (2017). Plant taxonomy, McGraw Hill Publishers.
10. Sambamurthy, A.V.S.S and Subramaniam, N.S. (2016). A text book of Modern Botany, CBS publishers.
11. Gurcharan Singh. (2020). Plant systematic – Theory and Practices 4<sup>th</sup> Edition, Oxford & IBH, Publishing co. Pvt. Ltd, New Delhi.
12. Gurcharan Singh. (2015). Plant systematic –Theory and Practices 3<sup>rd</sup> Edition, Oxford & IBH, Publishing co. Pvt. Ltd, New Delhi.

#### **Reference books**

1. APG IV (2016). An Update of the Angiosperm Phylogeny Group Classification for the Orders and Families of Flowering Plants. Botanical Journal of the Linnean Society, 181, 1-20.

2. Hutchinson, J. (1973). *The Families of Flowering plants*, Oxford Univ.press, London.
3. Gamble, J.S, Fisher, L.E.F. (1967). *The Flora of The presidency of madras (Vol-III)* BSI, Calcutta.
4. Davis, P.H and Heywood, V.M. (1965). *Principles of Angiosperm Taxonomy*, Oliver and Boyd Edinburgh.
5. Kress J.W, Wurdack, K.J., E.A.C., Zimmer, L.A., Weight and Janzen D.H. (2005). Use of DNA barcodes to identify flowering plants. *Proc. Natl. Acad. Sci*, 102-374.
6. Stoeckle, M. (2003). Taxonomy, DNA and the bard code of life. *Biosci*, 53: 796-797.
7. Simpson, M.G. (2006). *Plant systematic*, Elsevier Academic Press, USA.
8. Takhtajan, AL. (1969). *Flowering Plants – Origin and dispersal – Oliver & Boyed*.
9. Takhtajan, A.L. (1991). *Evolutionary trends in flowering plants*, Bishen Singh Mahendra Pal Singh, DehraDun.

## FIRST SEMESTER

### CORE COURSE IV

#### PRACTICAL –I (Covering Course I & II)

#### (ALGAE, FUNGI, LICHENS, BRYOPHYTES, PTERIDOPHYTES, GYMNOSPERMS AND PALEOBOTANY)

**Study of the Morphology and Anatomy of the vegetative and Reproductive parts of the following**

#### **I. Algae**

- a) Cyanobacteria : *Gloeocapsa, Spirulina, Nostoc, Scytonema*
- b) Chlorophyceae : *Dunanellella, Pandorina, Cladophora, Spirogyra, Codium,*
- c) Xanthophyceae : *Vaucheria*
- d) Charophyceae : *Nitella*
- e) Bacillariophyceae : *Cyclotella, Navicula (Diatoms)*
- f) Phaeophyceae : *Padina, Turbinaria*
- g) Rhodophyceae : *Batrchospermum, Gracilaria*

#### **II. Fungi**

- a) Myxomycotina : *Plasmodiophora*
- b) Mastigomycotina : *Saprolegenia, Phytophthora*
- c) Zygomycotina : *Pilobolus, Rhizopus*
- d) Ascomycotina : *Neurospora, Tapharina, Pencillum, Xylaria*
- e) Basidiomycotina : *Agaricus, Pleuerotus, Lycoperdon,*
- f) Deuteromycotina : *Cercospora, Fusarium, Colletotrichum*

#### **III. Lichens**

- a) Parmeliaceae : *Usnea, Parmelia*

#### **IV. Bryophytes**

- a) Marchantiales : *Marchantia, Lunularia*
- b) Jungermaniales : *Porella*
- c) Anthocerotales : *Anthoceros, Notothylus*
- d) Sphangales : *Sphagnum*
- e) Polytrichales : *Polytrichum, Pogonatum*

## VI. Pteridophytes

- a) Psilopsida : *Psilotum*
- b) Lycopsida : *Selaginella, Isoetes*
- c) Sphenopsida : *Equisetum*
- d) Pteridopsida : *Ophioglossum, Osmunda, Gleichenia, Azolla*
- e) Fossil Pteridophytes : *Rhynia, Sphenophyllum, Lepidocarpon, Cladoxylon, Pentoxylon, Botryopteris*

## VII. Gymnosperms

- a. Cycadaceae : *Cycas sp*
- b. Ginkgoales : *Gingobiloba*
- c. Coniferales : *Araucaria, Podocarpus, Taxus, Ephedra*
- d. Gnetales : *Gnetum*
- e. Fossil Gymnosperms : *Lyginopteris, Lagenostoma, Cordaites*

### Note

- A) Submission of 15 herbarium sheets from Algae / Fungi / lichens / Bryophytes / Pteridophytes / Gymnosperms
- B) Field trip to hill stations and Coastal area for a minimum period of Five days for the collection of herbarium specimens and to observe and study the lower plants in their natural habitat.
- C) Certified record work done in the laboratory during practical classes.

**FIRST SEMESTER**  
**ELECTIVE COURSE - I**  
**ETHNOBOTANY**

**Course objective**

- To study the history and importance ethnic knowledge on the uses of herbal plant
- To study the details and life style of ethnic group of Tamil Nadu
- To understand the importance and methods of ethnobotanical survey
- To know the commercial significance of traditional knowledge and benefit sharing mechanisms

**Course outcomes**

- Understand the concept of ethnobotany and the lifestyle and traditional Practices of plants by Indian tribals.
- Highlight the role of Non-Timber Forest products for livelihood of tribal people of India.
- Assess the various investigation methods to collect ethnobotanical knowledge from ethnic community
- Apply methods to transform ethnobotanical knowledge into value added products.

**UNIT I - Concept of Ethnobotany****15hrs**

History of Ethnobotany– Definition, scope and objectives, Ethnobotany studies in the world and in India – interdisciplinary approaches, knowledge of following sociological and anthropological terms of culture, values and norm, institution, culture diffusion and ethnocentrism.

**UNIT II - Ethnic community in India****10hrs**

Distribution of ethnic groups in India – basic knowledge of following Ethnic groups in Tamil Nadu (Irulas, Kanis, Paliyars, Badagas, Kurumbres, Thodas and Malayali) –lifestyle and traditional practices of the above ethnic group.

**UNIT III - Botanical knowledge and practice****10 hrs**

Ethnobotanical knowledge and communities – Folk taxonomy – plants associated with culture and socio- religious activities. Non – timber forest products (NTFP) and livelihood – Sustainable harvest and value addition.

**UNIT IV - Documentation Methods****15hrs**

Source of Ethnobotanical data: Primary-Archeological source and inventories. Secondary– Travelogues, folklore and literary source, herbaria, Medicinal text and official records. Method in Ethnobotanical research – Prior informed consent –PRA techniques – Interviews and questionnaire methods – choice of resource persons.

**UNIT V – Bio prospecting and Knowledge Sharing****10hrs**

Bioprospecting and commercial use of traditional knowledge, developing research partnership codes of ethics and research guidelines, equitable research relationship, traditional knowledge (TK) in Relation to Intellectual property Right and Bio piracy. Equitable benefit sharing models of the world – problems in equitable benefit sharing.

**Text books:**

1. Gokhale, S.B., Kokate, C.K and Gokhale, A. (2016). Pharmacognosy of traditional drugs, nirali prakashan, 1 /e.
2. Jain, S.K. (2010). Manual of ethnobotany. Scientific publishers, New Delhi
3. Singh, V. (2009). Ethnobotany and Medicinal Plants of India and Nepal (Vol. 3). Scientific Publishers. New Delhi
4. Gringauz (2012). Introduction to Medicinal Chemistry: How Drugs Act & Why? Wiley India Pvt, Ltd., Noida
5. Joshi, S.G. (2018). Medicinal Plants. Oxford & IBH Publishing C., Pvt., Ltd., New Delhi.
6. Kumar, N. (2018). A Textbook of Pharmacognosy. Aitbs Publishers, India
7. Premendra Singh (2013). Medicinal Plants: Conservation, Cultivation and Utilization. Daya Publishing House, New Delhi.

**Reference Books**

1. Albuquerque, U.P., Ramos, M.A., Júnior, W.S.F., and De Medeiros, P.M. (2017). Ethnobotany for beginners. Springer International Publishing, US.
2. Balick, M.J., and Cox, P.A. (1996). Plants, people, and culture: the science of ethnobotany. Scientific American Library, US
3. Qadry, J.S. (2014). A textbook of Pharmacognosy Theory and Practicals. 17<sup>th</sup> ed. CBS Publishers & Distributors, New Delhi.
4. Prajapati, N.D., Purohit, S.S, Sharma, A.K, Tarun Kumar, (2006). A Handbook of Medicinal Plants: A Complete Source Book. Vedic Books Sales Rank.

**SECOND SEMESTER****CORE COURSE - V****MICROBIOLOGY AND PLANT PATHOLOGY****Course objective**

- To teach the basic information and general feature of bacteria and viruses
- To study the bacteria cultivation and identification method
- To study the fundamental of microbial genetics
- Highlight the role of microorganisms in human welfare.
- To study the details of plant pathogenic microbes and disease management

**Course outcome:**

- Basic knowledge on bacteria and viruses
- Fundamental understanding the microbial genetics
- Knowledge on eco friendly microbes and their uses
- Knowledge on plant disease and their impact on various crop plants
- Understanding on biological and chemical methods of plant disease management

**UNIT I - General microbiology and Bacteria****20 hrs**

History, Scope and branches of microbiology – General characteristics of bacteria - classification of bacteria (Bergey, 1923) – Structure and organization bacterial cell, Gram positive and Gram negative bacterial cell wall, Motility, flagella and pili –Growth and Nutrition, growth curve, kinetics of growth , sterilization and disinfection methods and their quality control. Types of culture media and applications – preservation of microbial culture. Types of staining – simple, differential. Special and spore staining, Economic importance of Extremophiles.

**UNIT II - Viruses****10 hrs**

History of Viruses – Classification (Harrison *et al.*, 1971) Structure and chemical composition of double strand DNA viruses, Double strand RNA viruses, Cauliflower mosaic virus – Tobacco mosaic viruses. Bacteriophage – Classification, Morphology, Structure and reproduction, isolation and purification of plant viruses, - Emerging viral disease, SARS coronavirus disease, Ebola virus disease and chikungunya.

**UNIT III - Microbial genetics****15 hrs**

Organization of Bacterial genome, Plasmids and extra chromosomal material – Conjugation - the F-factor, Hfr strains, F' strain– transformation; competence, mechanisms of transformation, Transduction–generalized transduction, specialized transduction. Recombination and mechanisms - Transposable elements – classes, evolutionary significance of transposable elements. Genomics and Proteomics.

**UNITIV - Applied microbiology****15 hrs**

**Food microbiology:** The role of microorganism in food – spoilage of fruits, vegetables, meats, poultry, egg, bakery products, dairy products and canned foods – food borne

disease - detection of foodborne pathogen, controlling food spoilage pathogen, food preservation. **Industrial microbiology:** Microbes in industrial process - Structure, function, Fermentation techniques – Microbiology of fermented foods – cheese production, Alcoholic beverages. Antibiotic, Vitamins, citric acid, organic acid, amino acid, and single cell protein – factor affecting fermentation process. **Agriculture microbiology** - Microbial inoculants in agriculture, Bio-fertilizer, Bio-control agents- Bio-pesticides, Biodegradation of Chemical pesticides – Sewage treatment

#### **UNIT V- Plant pathology**

**15 hrs**

Introduction to plant pathology – disease – concept, component and causes, classification of disease, brief account on general symptoms of Plant disease – modes of Infection and dissemination, defense mechanisms in plants, phytoalexin, pathogen related protein, Systemic Acquired Resistance (SAR) - Plant diseases forecasting – Plant disease management – plant quarantine, chemical, cultural and biological control, Bioformulation, integrated disease management. Important disease of crop plant in India, bacterial blight of Paddy, Bunchy top of Banana, Late blight potato, little leaf of brinjal

#### **BACTERIA & PLANT PATHOLOGY**

##### **Text books**

1. Pelczar, H.J., Chan, C.S. and Kreig, N.R. (1996). Microbiology concepts and applications. McGraw Hill Inc
2. Dubey, R.C, Maheswari, D.K. (2013). A Textbook of Microbiology, 4/e S. Chand & company, New Delhi
3. Powar, C.B. and Dagniwala, H.F. (2010). General Microbiology.2/E , Himalaya Publishing House, Bombay
4. Freifelder, D. (1990). Microbial genetics. 2/e, Narosa Publishing House, New Delhi.
5. Bilgrami, K.S. and Dube H.C. (1990). A text book of Modern Plant Pathology – Vikas Publishing House (P) Ltd., New Delhi.
6. Sharma, P.D. (1992). Microbiology – Rastogi & Co., Meerut
7. Dube, H.C. (2014). Modern Plant Pathology, Agrobios (India) Behind Nasrani Cinema Chopasani Road, Jodhpur.

##### **Reference Books**

1. Stainer, R.Y., Adelberg, E.A and Ingram, J.L. (1978). General Microbiology, MacMillan & Co, London.
2. Prescott, Harley and Klein S. (2008). Microbiology 7<sup>th</sup> edition, McGraw hill international Edition, New York
3. Alexander, (1978). Introduction to soil Microbiology, Wiley Eastern Private Ltd., New Delhi.
4. Carpenter, P.L. (1977). Microbiology, W.B. Saunders Co., London.
5. Darglos, J. (1975). Bacteriophages. Chapman & Hall Ltd., London.
6. Ketchum, P.A. (1988). Microbiology: Concepts and application, John Wiley and Sons, New York.

7. Mandahar, C.L. (1978). An Introduction to Plant Viruses. S. Chand & Co., New Delhi.
8. Mehrotra R.S. and Ashoka Agarwal. (2003). Plant Pathology. TATA McGraw-Hill Publishing Co., Ltd., New Delhi.
9. Rangasami, G. (1972). Diseases of Crop Plants in India. Prentice Hall India (Pvt.) Ltd., New Delhi.
10. Singh, R.S. (1980). Plant Diseases. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
11. Subba Rao, N.S. (1977). Soil Microorganisms and Plant growth. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
12. Gardner E.J, Simmons M.J. and Snustad D.P. (2010) Principle of Genetics (VIII Edition), WSE India Pvt. Ltd , New Delhi
13. Gunasekaran, P. (1995). Laboratory manual in Microbiology, New age (P) Ltd Publisher.

## **VIRUSES**

### **Text Books**

1. Cooper, J.J. (1995). Viruses and the environment (2nd edition) Chapman & Hall London.
2. Nayudu, M.V. (2008). Plant viruses, Tata McGraw-Hill Education, New Delhi
3. Smith, K.M. (1974). Viruses, Cambridge University Press.

**SECOND SEMESTER****CORE COURSE –VI****ANATOMY OF ANGIOSPERMS, PLANT MICROTECHNIQUES AND EMBRYOLOGY OF ANGIOSPERMS****Course objective**

- To study the structure and functional development of cells , tissues and organs
- Trace the development of male and female gametophyte in angiosperm plants
- To know the tools and techniques used in Anatomical studies
- To study the male and female gametophyte development in angiosperm plants
- Understand the incompatibility barriers and evolve methods to overcome
- Highlight the physiological role of endosperm in the morphogenesis of embryo.

**Course outcome**

- Learn the structures, functions and roles of apical, lateral meristems in monocot and dicot plant growth
- Study the function and organization of woody stems derived from secondary growth in dicot and monocot plants
- Learn the micro techniques skills to observes the anatomical structure plant
- Understand the development process of tissue form spermatogenesis, organogenesis to embryo formation

**UNIT I- Anatomy of angiosperms****20 hrs**

Meristems – characters, classification, various concepts of Apical organization of shoot and root apices - Vascular cambium – origin, types, structure and etiology – origin, structure, development and ontogeny of xylem and Phloem .wood anatomy – variation in wood structure – tyloses, Sap and heart wood – compression and tension wood. Shoot and root transition – Nodal anatomy, Anomalous secondary growth in dicots and Monocots.

**UNIT II****15 hrs**

Leaf ontogeny – initiation, Apical, intercalary, marginal and adaxial growth, plate meristem and development of vascular plasto chronic index, transfer cell – structure, development and function. Classical concept of flower: floral anatomy and its role in classification, plant galls. Types, structure and development, role of polarity in cell differentiation and symmetry, role of sucrose in vascular differentiation.

**UNIT III - Micro techniques****15 hrs**

Microscopy - Principle and application, Light microscope, Bright field, Dark field, Phase contrast microscopy – Fluorescence Microscope, Electron microscope (TEM & SEM) – Microtome's - types –Principles and operating mechanisms, Maceration, Squashes, Smears, Whole mount and clearing techniques. Fixation and fixatives, dehydration, clearing,

infiltration, Embedding, Block making and sectioning. Stains and staining techniques, Camera Lucida – types, Principles and their uses.

**UNIT IV- Embryology of angiosperms** **15hrs**

Microsporangium - Microsporogenesis, Microspores - morphology - ultrastructure - Microgametogenesis – pollen wall development, Pollen - Stigma - Incompatibility -Methods to overcome incompatibility - Megasporangium - Megagametogenesis - Female gametophyte - Monosporic - Bisporic and Tetrasporic - Nutrition of embryo sac and fertilization.

**UNIT V - Post pollination events** **10hrs**

Endosperm - Types - Endosperm haustoria - Cytology and physiology of endosperms, functions of endosperms - Embryo development in Dicot and Monocot, Nutrition of embryo - Polyembryony - Causes, Apomixis - Causes, Apospory - Their role in plant improvement programs and seed development.

**ANATOMY OF ANGIOSPERMS**

**Text Book**

1. Pandey, B.P. (2015). Plant Anatomy, S. Chand Publ. New Delhi.
2. Vashista, P.C (1984). Plant Anatomy, Pradeep Publication , Jalandhar
3. Pijush Roy, (2010). Plant Anatomy, New central Book Agency, Pvt. Lit, New Delhi.
4. Singh, V, Pande, P.C. & Jain D.K. (1987). Anatomy of seed plants – Rastogi Publications, Meerut.

**Reference books**

1. Cutter, E.G. (1970). Plant Anatomy: Experimental and interpretation. Edward, Arnold Pub. Ltd., London.
2. Cutter, E.G. (1971). Plant Anatomy, Edward Arnold Pub. Ltd., London.
3. Cutter, E.G. (1978). Plant Anatomy, Experimental and Interpretation. Edward Arnold Pub.Ltd., London
4. Esau, K. (1960). Plant Anatomy, Wiley Eastern Private Ltd., New Delhi.
5. Esau, K. (1977). Anatomy of seed plants. Wiley Eastern Publication, New Delhi.
6. Fahn, A. (1989). Plant Anatomy. Macmillan Publication (P) Ltd, Singapore.

**EMBRYOLOGY**

**Text Book**

1. Bhatnagar, S.P, Dantu, P.K, Bhojwani SS. (2014). The Embryology of Angiosperms 6<sup>th</sup> Edition Vikas Publishing House. Delhi
2. Bhojwani, S.S. and Bhatnagar, S.P. (2011). The Embryology of Angiosperms, 5<sup>th</sup> Edition, Vikas Publishing House. Delhi.
3. Pandey, A.K. (2000). Introduction to Embryology of Angiosperms 1<sup>st</sup> Edition: CBS; New Delhi

4. Maheswari, P. (1976). An introduction to the Embryology of Angiosperms. TATA McGraw-Hill Publishing Co., Ltd., New Delhi.

#### **Reference books**

1. Austin, (1968). Fertilization. Prentice Hall of India, New Delhi.
2. Davis, G.L. (1966). Systematic Embryology of the Angiosperms.
3. Dwivedi, J.N. (1988). Embryology of Angiosperms. Rastogi & Co., Meerut.
4. Johri, B.M. (1984). Experimental Embryology of Vascular plants
5. Rahavan, V. (1976). Experimental Embryogenesis in Vascular plants, Academic Press, London
6. Shivanna, K.R. and B.M. Johri. (1985). The Angiosperm pollen structure and functions. Wiley- Eastern Ltd.
7. Sporne, K.R. (1972). The Evolution of pollen types in Dicotyledons. New Phytol.71:181-185.

#### **MICROTECHNIQUES**

##### **Text Books**

1. Marimuthu, R. (2011). Microscopy and Microtechnique. MJP publishers Chennai.
2. Patki, L.R, Bhalchandra, B.L. and Jeevaji, I.H. (1987). An introduction to Microtechnique, S.Chand and company (Pvt) Ltd, New Delhi.

##### **Reference Books**

1. Johansen, D.A. (1940). Plant Microtechnique, TATA McGraw Hill Book Co., Ins., New Delhi.
2. Peter Gray, (1964). Handbook of Basic Microtechnique. McGraw hill publication, New York
3. Steven Ruzin, (2005). Plant Microtechnique and Microscopy. Oxford University press, London

**SECOND SEMESTER**  
**CORE COURSE – VII**  
**CELLBIOLOGY, GENETICS AND MOLECULAR BIOLOGY**

**Course objectives**

- Enable to learn various cell structures and functions of prokaryotes and eukaryotes and understand the salient features and functions of cellular organelles
- To study the fundamental principles of Genetics and understand the structure, function and changes in the genetic materials
- Learn the different principles of plant breeding and the application of molecular genetics techniques in crop improvement

**Course out come**

- Recognize the general features and organization of Ultra structure of cell wall and cell organelles in prokaryotes and eukaryotes
- Understand the organization and function of organelle genome
- Knowledge on the fundamental principles of Genetics.
- Understanding the principles and significant of plant breeding for crop improvement

**CELL BIOLOGY**

**UNIT I - General features of Cells 15 hrs**

Cell structure, organization of prokaryotic and Eukaryotic cell, cell theory, ultrastructure and molecular organization of cell wall, Plasma membrane, Nucleus, mitochondria, lysosomes, Ribosome , Endoplasmic reticulum, plastids, vacuoles, molecular basis for cell - wall mediated signaling mechanism. Endocytosis and exocytosis, Cell division and cell cycle: Mitosis and meiosis, their regulation, steps in cell cycle, and control of cell cycle

**UNIT II - Genome organization and function 15 hrs**

Organization of nuclear genome: DNA as genetic material – prokaryotic and eukaryotic DNA- chromatin – chromosomes - Gene, C -value paradox – transposons – evolution of DNA - Replication of DNA (Structure – types – melting curve – types of replication – enzymes in replication – formation of replication fork – synthesis of daughter strands – repair mechanisms). Organelle Genome: endosymbiotic theory – organization in chloroplast and mitochondria – synthesis and assembly of RUBISCO – interaction with nuclear genome.

**UNIT III - Principal of genetics 15 hrs**

Mendelian genetics - Mendel's Law of inheritance, non mendelian inheritance, Chromosomal basis of inheritance, Gene interactions - complementary genes, Lethal genes, Epistasis, Quantitative inheritance, Gene Linkage and crossing over- Kinds of linkage, types of crossing over mechanism. Sex determination in plants, theories of sex determination. Sex

linked characters. Multiple alleles and pseudo alleles. Cytoplasmic inheritance organelle heredity with reference to chloroplast and mitochondrial mutants –male sterility in plants

#### **UNIT IV –Population genetics and plant breeding** **15 hrs**

Population Genetics –Gene pool, Gene Frequencies, Mutation, Selection, Migration, genetic drift, Hardy –Weinberg law . Gene Mutation - Molecular basis of Mutation, Mutagenic agents and their mode of action. Biochemical mutants in bacteria and *Neurospora*. Plant Breeding -Plant Breeding systems, methods, selection in self and cross pollinated crops, male sterility, self-incompatibility, heterosis and hybrid vigor, Role of polyploidy in plant improvement. Applications of tissue culture techniques in plant breeding.

#### **UNIT V- Molecular Biology** **15 hrs**

Transcription in prokaryotes and eukaryotes (RNA synthesis – enzymology – signaling) – mechanics of initiation, elongation, termination – post–transcriptional modification and RNA splicing - regulation of gene expression (lac and trp operons of *E. coli*) – RNA interference (TGS and PTGS)- Translation (genetic code – redundancy and elucidation of base composition – tRNA charging – initiation, elongation and termination) – posttranslational modification – coupled transcription and translation. Molecular Chaperons - Heat shock proteins.

### **CELL BIOLOGY**

#### **Text books**

1. Ajoy Paul, (2009). Text book of cell and Molecular biology, Books and allied (P) Ltd., Kolkata.
2. Kumar, H.D. (2000). Molecular biology, Vikas Publishing House Pvt., Ltd., New Delhi.
3. Singh, B.D. (2015). Plant breeding, Principles and Methods, Kalyani Publications.
4. Verma P.S. and Agarwal V.K. (2007). Cell biology, Genetics, Molecular biology and Evolution, S. Chand and Company Ltd., New Delhi.
5. David Freifelder (1958). Essentials of Molecular Biology, Narosa Publishing House, New Delhi.

#### **Reference Books**

1. Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Robers, Peter Walter (2002). Molecular biology of the cell (IV<sup>th</sup> Edition). Garland Science, Taylor and Francis group, New York.
2. Cooper, G.M., Hausman, R.E. (2013). The cell : A Molecular Approach 6<sup>th</sup> Edition ASM Press & Sunderland, Washington, D.C, Sinauer Associates, MA.
3. De Robertis and De Robertis (1998). Cell and Molecular Biology, B.I. Waverly Pvt. Ltd., New Delhi.
4. Karp, G (2018).Cell and Molecular biology, Concepts and experiments, 6<sup>th</sup> edition John Wiley & Sons, Inc.
5. Lewin, (2017). Gene XII, Jones and Bartlett Pub.
6. Lodish, et al., (2000), Molecular and cell biology, W.H. Freeman & Co, New York.
7. Strickberger, M.W. (2010). Genetics (3<sup>rd</sup> Edi.) PHI Learning Pvt., Ltd.,
8. Stansfield, W.D, Colome J.S and Cano R.J. (2010). Molecular biology and cell biology, TATA McGraw Hill Education Pvt Ltd, India

**SECOND SEMESTER****CORE COURSE –VIII****Practical –II (Covering course III & V)****(TAXONOMY OF ANGIOSPERMS AND ECONOMIC BOTANY,  
MICROBIOLOGY AND PLANT PATHOLOGY)****TAXONOMY**

1. Identification of Specimen at family, generic and specific level belonging to the following families based on APG IV 2016 classification

**Basal angiosperm** - Nymphaeaceae, **Magnoliids:** Magnoliaceae, Aristolochiaceae. **Monocots:** Araceae, Orchidaceae, Commelinaceae, Zingiberaceae, Cyperaceae, **Eudicots:** Menispermaceae, **Superrosids:** Crassulaceae, **Rosids:** Combretaceae, Lythraceae, Casuarinaceae, Moraceae, Rosaceae, Meliaceae, Sapindaceae. **Superasterids:** Nyctaginaceae, Polygonaceae, Portulacaceae, **Asterids:** Sapotaceae, Boraginaceae, Rubiaceae, Bignoniaceae, Pedaliaceae, Convolvulaceae

- Familiarity with the use of Flora
  - Identify the families mentioned in the syllabus by noting their vegetative and floral character
  - Preparation of Dichotomous key using locally available plants.
2. Study of economically important plants and parts, Wheat , Black gram, Sugar beet, Cardamom, Cinnamon, Jute, Teak, Asafoetida and Gum Arabic, lemon grass, coffee, Sun flower, Cinchona
    - A field trip of not less than four days to a place of luxuriant vegetation to study
    - The flora and to study the different types of vegetation.
    - Submission of a tour report and 25 herbarium sheets (Specimens collected from Tour Collection / locally available plants during the internal practical Examination.
    - Certified record work done in the laboratory during practical classes

**MICROBIOLOGY**

1. Preparation of Nutrient media and sterilization technique
2. Preparation cleaning solution
3. Inoculation techniques for growth of bacterial population
4. Serial dilution and plating techniques
5. Isolation and identification of bacteria from spoiled food
6. Staining methods: Preparation of smears for stains, simple staining, negative staining and Gram staining.

7. Spoilage of milk by microorganisms (Methylene Blue Dye Reduction Test)
8. Photographs of bacteria colony / TMV Viruses, Cauliflower Mosaic virus, Bacteriophage, covid - 19 virus.

### **Demonstration**

1. Preparation of Spawn for cultivation of edible Mushroom
2. Media preparation and Culturing of Blue green algae
3. Isolation and Seed preparation of *Rhizobium*, *Azotobacter*
4. Culturing of phosphate solubilizing bacteria or *Azospirillum*
5. Production of citric acid using *Aspergillus niger* – Solid state fermentation and Submerged fermentation.

### **PLANT PATHOLOGY**

Study of the disease symptoms, causal organism, transmission and control Measures of the following plant diseases.

1. Bacterial blight of Paddy
2. Bunchy top of Banana
3. Late blight of potato
4. Little leaf of brinjal

Collection and preservation of specimens from infected plants. Submit 5 herbarium sheets/ live specimens along with a report

## SECOND SEMESTER

### CORE COURSE - IX

#### PRACTICAL – III (Covering Course VI & VII)

#### (ANATOMY OF ANGIOSPERMS, PLANT MICROTECHNIQUES AND EMBRYOLOGY OF ANGIOSPERMS, CELL BIOLOGY, GENETICS AND MOLECULAR BIOLOGY)

#### ANATOMY, MICRO TECHNIQUES AND EMBRYOLOGY

Preparation of hand sections, replicas of surface maceration and clearing

1. Temporary and permanent mounting of whole specimens and Sections using different types of mountants
2. To observe the different types of meristem
3. To observe xylem and phloem elements
4. Study of leaf anatomy-structure, stomata, trichomes, types of stomata.
5. Study the anomalous features in *Aristolochia*, *Bignonia*, *Dracaena*.
6. Examination of vascular cambium and study of its activity
7. Examination of Structural and identification of Wood of some common Indian and *Pterocarpus*

#### MICROTECHNIQUES

1. Students are expected to be thorough with the following techniques.
  - (a) Preparation of semi permanent slides
  - (b) Preparation of permanent slides.
  - (c) Preparation of whole mounts.
  - (d) Maceration.
  - (e) Preparation of fixatives (FAA, Carnoy's Fluid).
  - (f) Preparation of dehydration series (Alcohol, Acetone, TBA).
  - (g) Preparation of paraffin blocks.
  - (h) Preparation of serial sections with Microtomy
2. Candidates should prepare and submit 10 permanent slides in which the following categories should be included;
  1. Free hand sections (single/double stained).
  2. Serial sections (single/double stained).
  3. Wood sections and whole mounts
3. Micrometry: Calibrate the ocular micrometer stage micrometer on a light microscope and measure the size of an object (e.g., diameter of spore/pollen grains/ width of algal filaments/xylem/phloem)
4. Demonstrate the drawing tool Camera Lucida

#### EMBRYOLOGY

1. Observation of pollen types pollen germination
2. Section of Anther (observation of different stages)

3. Study on ovary, ovules and their modification.
4. Isolation of plant embryos , embryonic tissues and Endosperm

## **CELL BIOLOGY, GENETICS AND MOLECULAR BIOLOGY**

### **CELL BIOLOGY**

1. To observe the plant cell structure with onion peel out
2. Microscopic views of cell organelles in plant cell Chloroplast (Hydrilla leaf), Nucleus (Onion peel out)
3. Squash and Smear techniques (Mitosis in onion root tips; Meiosis in Rheo/ onion flower buds).
2. Separation of giant chromosomes (Chironomus larvae).
3. Isolation of plant organelles by centrifugation techniques (Demonstration).

### **GENETICS**

1. Problem solving a dihybrid phenotypic, Genotypic and test cross ratios (Mendelian hypothesis).
2. Incomplete dominance in plants.
3. Mendelian Modified ratios (Complementary, supplementary, Epistasis and Polygenic inheritance).
4. Multiple alleles in plants, blood group inheritance in humans.
5. Chromosome mapping from three point test cross.
6. Calculate gene and genotype frequency by Hardy Weinberg law.
7. Isolation of auxotrophs by UV mutagenesis (Demonstration).
8. Techniques in plant hybridization (Demonstration).

### **MOLECULAR BIOLOGY**

1. Isolation of DNA from Plant Materials (Onion, Papaya) (Demonstration).
2. Isolation of RNA from plant Materials (CTAB protocol) Demonstration).
3. Regulation of gene expression (with the help of Models / Charts / Book diagram).
4. RFLP genetic Mapping (Demonstration).

**THIRD SEMESTER**  
**CORE COURSE - X**  
**PLANT PHYSIOLOGY AND BIOPHYSICS**

**Course objectives**

- To acquire the knowledge on the functional aspects of plants
- To understand the biophysical and biochemical process of plants
- To study the metabolism of plants
- To learn the plant growth regulation
- To know the adaptive mechanism of plants in adverse environment conditions

**Course outcome**

- Knowledge on the functional aspect of plants
- Understanding on the biophysical and biochemical process and their significant for plant growth
- Knowledge on the metabolism of plants
- Knowledge on the role of plant growth regulator for plant growth and development
- Understanding on the adaptive mechanism of plants in adverse environment condition

**UNIT I - Plant water relations and mineral nutrition****20 hrs**

Water relations of plants: physical and chemical properties of water – Imbibitions, diffusion, osmosis, component of water potential. Transpiration and evapotranspiration - Stomatal structure and function – mechanism of stomatal opening and closing. Absorption of water by root - Apoplast and symplast concept – water transport through the xylem. Mineral nutrients and deficiency symptoms, mineral ion uptake. Various mechanisms of solute transport. Organization conducting tissue, source sink relation – phloem loading and unloading – theories translocation

**UNIT II - Photosynthesis****15 hrs**

Photosynthesis: Fine structure of photosynthetic machinery – Light harvesting protein complex –light absorption and photosynthetic electron transport, Emerson enhancement effect and cyclic, non-cyclic and pseudo cyclic photophosphorylation. Oxygen Evolving Complex (OEC), photosynthetic carbon reduction cycles (PCR cycles): C<sub>3</sub>, C<sub>4</sub> and CAM pathway and their distinguishing feature, photorespiration and its significance. Structure and function of Rubisco and PEP Carboxylase.

**UNIT III – Respiration and nitrogen metabolism****20 hrs**

Respiration – Aerobic and anaerobic respiration, Glycolysis, TCA cycle, mitochondrial electron transport and oxidative phosphorylation, chemiosmotic proton circuit, ATPase complex, mechanisms ATP synthesis, electron transport inhibitors and uncouplers, cyanide resistant respiration, Respiratory quotient, pentose phosphate pathway. Nitrogen fixation: Sources of Nitrogen, Types – Physical and Biological nitrogen fixation - Biochemistry of

Nitrogen fixation – Nitrogenase, nif gene, Assimilation of nitrate and ammonium ion - NR, NIR, GDH, GS/GOGAT pathways. Integration of nitrogen and carbohydrate metabolisms.

**UNIT IV- Plant growth substances & Stress physiology** **20 hrs**

Plant growth substance: Chemical structure, physiological effects and mechanism of action of auxin, gibberellins, cytokinins, ethylene and abscisic acid. Photomorphogenesis – phytochrome mediated responses –physiology of flowering and fruit ripening, dormancy of seeds, causes and method of breaking dormancy, types and mechanism of senescence, physiology of seed germination. Stress physiology: Concepts – water-drought, flooding and salt, ionizing and non-ionizing radiation stress temperature-heat, frost-adaptive mechanism to various stress –stress responsive protein – anti-oxidative mechanisms.

**UNIT V - Bio Physics** **15 hrs**

Bioenergetics: Energy, laws of thermodynamics, Enthalpy, entropy and free energy free energy changes of chemical reaction. Oxidation - redox reactions in biological systems and its importance, oxidation-reduction potential -Redox couple, redox potential, standard redox potential. ATP bioenergetics, NADP/NADPH redox couple bioenergetics, mitochondrial and chloroplast bioenergetics. Photobiology: Dual nature of light, characteristics of solar radiation, solar energy - Efficiency of atoms – Absorption spectrum, action spectrum and emission spectrum in molecules states. Energy states, de -excitation .Light emission – fluorescence, Phosphorescence and Bioluminescence.

**Text Books**

1. Devlin, RM, (2017). Outline of Plant Physiology. Medtech; 1/ed
2. Jain, V.K. (2017). Fundamentals of Plant Physiology. S Chand & Co Ltd, New Delhi
2. Noggle, G.R, Fritz, G.J. (2013). Introductory plant physiology (2/ed ) PHI learning, Pvt, Ltd, Delhi
3. Pandey, S.N. and Sinha, B.K. (2005). Plant Physiology, (4/ed) Vikas Publication House Pvt. Ltd, New Delhi.
4. Salil Bose, S. (1982). Elementary Biophysics. Vijaya Printers, Madurai.
5. Verma, V. (2008). Text book of plant Physiology, Ane's student edition, New Delhi
6. Raman, K. (1996). Transport phenomenon in plants. Narosa Publications.

**Reference books**

1. Beevers, L. (1976). Nitrogen metabolism in plants. William & Sons Ltd. London.
2. Bray, C.M. (1983). Nitrogen Metabolism in Plants, Longman.
3. Kramer, P.J. (1969). Plant and soil water relationship, A Modern Synthesis.
4. Salisbury, F.B and Ross, C.W. (1986). Plant Physiology. Third edition, CBS Publishers and Distributors, New Delhi
5. Bidwell, R.G.S. (1974). Plant physiology, Mac Million Publisher, Boston
6. Taiz, L., Zeiger, E., Moller, I.M. and Murphy, A. (2015). Plant Physiology and Development 6th Edition. Sinauer Associates, Sunderland, CT.
7. Davies, P.J. (2010). Plant Hormones: Biosynthesis, Signal Transduction, Action. 3<sup>rd</sup> ed. Springer, Dordrecht
8. Hopkins, W.G. (2006). Photosynthesis and Respiration. Chelsea House Publishers, NY.
9. Lawlor D.W. (2001). Photosynthesis 3/ed., Viva Books Pvt. Ltd.

**THIRD SEMESTER**  
**CORE COURSE - XI**  
**BIOCHEMISTRY AND NANOBIO TECHNOLOGY**

**Course objectives**

- Learn structural and functional properties of carbohydrates, proteins , lipids and nucleic acid
- Learn the biosynthetic pathway of carbohydrates, amino acid, lipids and secondary metabolites
- Learn the functional role secondary metabolite
- Study about the mechanism of enzyme action and inhibition.
- To learn the basics of Nanoscience and Nanobiotechnology.

**Course outcomes**

- Understanding on the structure and properties of plant biomolecular.
- Understand the biosynthetic pathway of primary and secondary metabolites
- Knowledge on plant enzymes and their role.
- Knowledge on characterization of nanoparticles and nanomaterials.
- To learn nano biotechnological applications in Agriculture, Medicine and environment.

**UNIT I - Basics of chemistry****15 hrs**

Atomic structure: Chemical bonds – ionic bond, covalent bond, metallic bond. Weak interaction - hydrogen bond, hydrogen bond in biological system - hydrophobic bond- van der waals interaction. Water – structure, properties, ionization of water. Acid and bases. pH concept – buffer, Molarity, Molality and Normality.

**UNIT II - Carbohydrates****20 hrs**

Classification of Carbohydrate - Structure, Physico - chemical properties and biological significance of Monosaccharides, Oligosaccharides and Polysaccharides. Structure and function of glycoprotein. Gluconeogenesis, Glycogen Metabolism. Nucleic acids: Structure of nitrogenous bases; Structure and function of nucleotides; Types of nucleic acids – Biosynthesis of Nucleotide – De novo synthesis and salvage pathway – Nucleotide degradation

**UNIT III - Lipids and Secondary Metabolites****20 hrs**

**Lipids:** Structure, classification and properties, biosynthesis of Membrane lipids, Biosynthesis of major fatty acids, Fatty acid oxidation and energy production. Biological significance of lipids. Vitamins – types and biological function. Secondary metabolism in plants: Structure, classification and properties of Alkaloids, Terpenoids, Flavonoids, Tannins, Phenols and their biochemical importance. Shikimic acid pathway and mevalonic acid pathway.

#### **UNIT IV - Amino acid, Protein and Enzyme**

**20 hrs**

Amino acids – classification and peptide bonds, Ramachandran Plot, properties of Amino acid - Amino acid metabolism, Urea cycle, one carbon reaction, non protein amino acids, amines and their role in cell function. Proteins: classification, structure – primary, secondary, tertiary and quaternary, properties of protein. Enzymes - general feature, naming and classification - Factors affecting enzyme activities. Enzyme kinetics - Michaelis and Menten equation,  $V_{max}$  and Michaelis constant – Line weaver Burk plot. Enzyme inhibition, Mechanism of enzyme action, isoenzymes

#### **UNIT V- Nanobiotechnology**

**15 hrs**

Nanoscience - Background, Nanoparticles, Quantum dots, Nanotubes and Nanowires, Biosensors and their applications. Fundamentals of bionanoparticles - production, size, surface area. Techniques to analyse bionanomaterials - Electron microscopy - (SEM) (TEM), AFM, FTIR, X-ray diffraction (XRD). Nanocarriers for drug delivery - Polymeric NP, Micelles, Liposome. Nanocapsules. Nanomedicine. Biopharmaceuticals. Applications of Nanoparticles in Agriculture, Environment and Medicine. Impact of Nanoscience and Nanotechnology on society.

### **BIOCHEMISTRY**

#### **Text Books**

1. Rastogi, S.C. (2003). Outlines of Biochemistry. CBS Publishers & Distributors, New Delhi
2. Mahadevan, A and Sridhar, R. (1986) Methods in Physiological plant Pathology, Sivakami Publications, Madras
3. Jain, J.L., Jain, S. and Jain, N. (2016), Fundamentals of Biochemistry, Chand Publishing, New Delhi
4. Conn, E.E., Stumpf, Bruening G and Doi RH. (2016). Outlines of Biochemistry 5/Ed, Wiley India Pvt. Ltd (Student edition)
5. Satyanarayana, U. and Chakrapani, U. (2013). Biochemistry Elsevier India Pvt., Ltd, and Books Allied Pvt., Ltd., New Delhi.
6. Purohit, S.S. (2010). Biochemistry – Fundamental and application , Student edition Jodhpur
7. Rajan, S and Selvichristy, R. (2017). Biochemistry – An exam companion, Anjanaa Bookhouse, Publisher and Distributors, Chennai.

#### **Reference books**

1. Buchanan, B.B., Grissem, W. and Jones, R.L. (2000). Biochemistry and Molecular biology of plants, 5<sup>th</sup> edition, Wiley-Blackwell.
2. Lehninger, A.C. (2005). Principles of Biochemistry, 4<sup>th</sup> Edition, W.H. Freeman, New York.
3. Stryer, L. (1988). Biochemistry, WH Freeman & Co., NY.
4. Apps *et al.*, (1992). Biochemistry, ELBS.
5. Caret *et al.*, (1993). Inorganic, Organic and Biological Chemistry, WMC Brown Pub. USA.

6. Nelson, D.L and Cox, M.M. (2005). Lehninger Principle of Biochemistry, W.H. freeman and company, New York
7. Rawn, D. (1989). Biochemistry, Neil Patterson.
8. Zuley G.L. (1998). Biochemistry, Wm. C. Brown Publishers USA.
9. Voet, D. and Voet, J.G. (2004). Biochemistry. 3<sup>rd</sup> edition, Johnwiley and Sons, Inc.
10. Heldt, H.W. (2005). Plant Biochemistry. 3<sup>rd</sup> edition, Elsevier Academic Press.

## **NANO BIOTECHNOLOGY**

### **Text Books:**

1. Pradeep, T. (2007). NANO: The Essentials – Understanding Nanoscience and Nanotechnology, TATA McGraw – Hill Education.
2. Charles, P.P and Frank, J.O. (2012). Introduction to Nanotechnology, Wiley India.

### **Reference Books**

1. Abdelhamid Elaissari, (2008). Colloidal Nanoparticles in Biotechnology, John Wiley & Sons, Inc., Hoboken, New Jersey.
2. Brechignac, C., Houdy, P and Lahmani, M. (2007). Nanomaterials and Nanochemistry. Springer, New York.
3. Kewal, K. and Jain, M.D. (2008). The Handbook of Nanomedicine, Humana Press, USA

## **THIRD SEMESTER**

### **CORE COURSE - XII**

### **PRACTICAL – IV (Covering Course X & XI)**

## **PLANT PHYSIOLOGY, BIOPHYSICS, BIOCHEMISTRY AND NANO BIOTECHNOLOGY**

### **I. PLANT PHYSIOLOGY & BIOPHYSICS**

1. Determination of water potential (Shardakov's method)
2. Determination of solute potential
3. Extraction and estimation of chlorophylls a, b, and carotenoids in C<sub>3</sub> and C<sub>4</sub> Plant
4. Experiment to study the rate of Hill activity of isolated chloroplast by Dye
5. Reduction method
6. Determination of Stomatal Frequency and stomatal index.
7. Estimation of total acidity in CAM plants
8. Estimation of Leg- hemoglobin content
9. Estimation of starch by perchloric method.
10. Estimation of nitrogen by Nessler's method
11. Estimation of proline and phenols in plant tissues under different environmental and physiological conditions

### **II. DEMONSTRATION**

1. Demonstration of Apparent photosynthesis
2. Estimation of Photosystem II activity C<sub>3</sub>,and C<sub>4</sub> anatomy, C<sub>4</sub> subtype
3. Experiment to compare the rate of absorption with the rate of transpiration:
4. Demonstration on aerobic respiration
5. In vivo assay of NR, NiR.
6. Estimation of IAA

### **III. BIOCHEMISTRY & NANO BIOTECHNOLOGY**

1. Preparation of phosphate and citrate buffers.
2. Estimation of DNA by Diphenylamine method.
3. Estimation of reducing sugars by the DNS method (Dinitrosali cyclic acid).
4. Estimation of Carbohydrate by Anthrone method.
5. Estimation of proteins by Lowry's method.
6. Estimation of total phenols.
7. Assay of catalase and peroxidase.
8. Estimation of amino acids by ninhydrin method.

### **DEMONSTRATION**

1. Estimation of oil in oil seed by soxhlet extraction.
2. Preparation of silver nanoparticles.

**THIRD SEMESTER**  
**ELECTIVE COURSE - II**  
**HORTICULTURE AND FORESTRY**

**Course objectives**

- To understand the basic concept of horticulture
- To learn the various methods of plant propagation and management
- To understand the arts of floriculture and landscape gardening
- To know the arts of fruit crop and vegetable crop cultivation
- Enable the students to understand the importance of forests.
- To learn forestry and forest laws

**Course outcome**

- Understand the importance and division of horticulture
- Demonstrate the propagation, growth, and maintenance of plants in horticulture systems.
- To know the art of indoor gardening
- Apply horticultural skills and knowledge to explore career opportunities in the horticulture industry.
- Understand the importance of forestry for social, ecological, economic, cultural and environmental purposes
- Apply the regeneration methods of forests

**HORTICULTURE****UNIT - I Basics of Horticulture****20 hrs**

History, Scope and Importance of Horticulture. Divisions of Horticulture – Plant growth environment – soil and nutritional needs – organic manures and substrate – Farmyard manure, compost, Leaf mould, oil cake, Meat meals, Blood meal, Horn and Hoof meal - Liquid Manure, Peat Moss. Bio-fertilizers and Plant growth regulators in root initiation, flowering, fruit setting and development. Water Irrigation -types- sprinkler irrigation, trickle irrigation- surface, furrow, surge, pitcher.

**UNIT II – Plant propagation method & Nursery management****15 hrs**

Plant Propagation: Natural method: propagation through Seed and Vegetative structure - Artificial method: Cutting, Budding, Grafting and Layering. Stock–scion relationship – Micropropagation . Nursery techniques – Preparation of soil bed – method of digging – bed size, types, spacing, and rotation. Green house, Glass house, Poly house - construction and related equipment.

**UNIT III - Aesthetics of Horticulture****15 hrs**

Gardens types – formal, informal and kitchen – principle and design, landscaping. Aftercare of plants: weeding, Pruning, Top dressing and Topiary. Lawn making, Floriculture - cut flowers, harvesting and marketing. Terrarium culture, Vegetable and fruit gardens, Hedge Plants, Hydroponics, Bonsai and Bonsai techniques. Flower Arrangement - Containers and

requirements for flower arrangements -free style, Shallow and Mass arrangement - Japanese – Ikebana - Bouquet and garland making - Dry flower arrangement.

## **FORESTRY**

### **UNIT IV - General introduction to Forests**

**20 hrs**

Forests - Definition - Forest Types of India and their distribution according to Champion and Seth's classification. Forest Topography and stratification. Strategy and objectives of social and agroforestry. Silvi culture - concept, scope and practices. Forest resources and utilization -major and Non-timber forest products of India and their importance in rural and industrial economy. Identification of timber plants based on vegetative features, seedlings, leaves, bark branching pattern architectural models of trees .Forest laws and policies - Indian Forest Policy of 1894, 1952 and 1988. Recent Policies and Acts – Tribal Bill, 2007, Biodiversity Bill, 2002, National Agroforestry Policy 2014

### **UNIT V - Forest protection and Menstruation**

**20 hrs**

Principles of forest protection- factors affecting forest health , outbreak of diseases and insect attack, droughts and floods, anthropogenic activities, pollution, biotic pressures, urbanization and industrial expansion - Forest fires, Fire protection methods, biological, chemical and integrated pest management methods, forest protection through people committee. Forest Mensuration: Methods of measuring - diameter, girth, height and volume of trees; form-factor; volume estimation of stand, current annual increment; mean annual increment. Sampling methods and sample plots. Yield calculation; yield and stand tables, forest cover monitoring through remote sensing; Geographic Information Systems for management and modeling.

## **HORTICULTURE**

### **Text book**

1. Prasad, S. and Kumar, U. (2010). Principles of Horticulture. Agrobios (India). Jodhpur.
2. Edmond Senn, Arews, Halfacre. (1987). Fundamentals of Horticulture, Tata McGraw Hillbook Co., Ltd. New Delhi
3. Manibhushan Rao, K (1991). Text Book of Horticulture, Macmillan Publications, Hyderabad.
4. Kumar, N. (1977). Introduction to Horticulture, Rajalakshmi Publications, Nagercoil, India.

### **Reference books**

1. Arora, JS. (1990). Introductory Ornamental Horticulture, Kalyani Publications
2. Bailey, L.H. (1901). The Standard Cyclopaedia of Horticulture Volume 1,2 and 3, Macmillan Publications
3. Chauhan, V.S (1972). Vegetable production in India, Ram Prasad & Sons
4. Shujnrrnoto, (1982). The Essentials of Bonsai, David & Charles
5. Bose, T.K. and Mukherjee, D. (1972). Gardening in India, Oxford & 1BH Publishing Co., Kolkata, Mumbai, NewDelhi.

6. Pratibha, P. and Trivedi. (1987). Home gardening, ICAR Publication, New Delhi.
7. Randhawa, (1997). Ornamental Horticulture in India, Today & Tomorrow Publishers, New Delhi.

## **FORESTRY**

### **Text books**

1. Negi, S.S., (1994). India's Forests, Forestry and Wildlife, Indus publishing Co., New Delhi.
2. Khanna, S. (1984). Principles and practices of silviculture. Khanna Bandhu, DehraDun
3. Lal, J.B. (1989). India's Forests Myth & Reality. Nataraj Publishers, DehraDun.
4. Ramprakash, (1986). Forest management. IBD Publishers, Debra Dun.
5. Dwivedi, A.P. (1992). Agroforestry – Principle and practices. Oxford and IBH Publishing Co., New Delhi.
6. Chaturvedi, A.N and Khanna, L.S. (2015). Hand book of forestry 5/ed
7. Sagreta, K.P (2000). Forest and Forestry, National book trust India, New Delhi.
8. Parthiban, K.T (2018). Introduction to forestry & agro forestry.

### **Reference books**

1. Frederick S. Backer, (1950). Principles of silviculture, McGraw Hill Book Co. New York
2. Donald Bruce and Francis X. Schumacher. (1950). Forest mensuration, McGraw Hill Book Co. New York.
2. Bor, N.L. (2010). A Manual of Indian Forest Botany,( Second Edition) Asiatic pub., New Delhi.
3. Benu Singh, (2010). A Modern Book on Forestry and Horticulture, Vista International Pub. New Delhi.
4. Stebbing E.P. (1982). The forest of India, A.J. Reprints agency, New Delhi.
5. FAO (1987). Forestry Extension Methods, SLNo. 80, FAO Publication, Caracal, Rome, Italy.
6. Jha, L.K. and Sen Sarma, P.K. (1996). A manual of Forestry Extension Education, APH Publishing Corporation, New Delhi.

**THIRD SEMESTER**  
**ELECTIVE COURSE - III**  
**PLANT BIOTECHNOLOGY AND GENETIC ENGINEERING**

**Course objectives**

- To learn the fundamentals of plant biotechnology.
- To learn the importance of gene regulation in plant systems.
- Knowledge on the role of rDNA technology in agriculture.
- To study the importance of plant tissue culture.

**Course outcomes**

- Knowledge on plant tissue culture.
- Understanding the importance of gene expression in plant systems.
- Knowledge on transgenic plants and its importance.
- Knowledge on the importance of Genetic engineering.

**UNIT I - Introduction to Plant tissue culture****15hrs**

Basic of plant tissue culture - Totipotency and concept of plant tissue culture, Laboratory organization, Aseptic techniques, plant culture Media - MS Medium and B<sub>5</sub> Medium, Explants Preparation. Methods of sterilization. Transfer and incubation of culture - Transplantation area.

**UNIT II – Micro propagation, protoplast culture and haploid plant production** **15hrs**

Callus induction, Cell suspension culture, somatic embryogenesis, Micropropagation - stages of micro propagation - multiplication by shoots and callus. Hardening, a factor affecting micropropagation. synthetic seed technology, Protoplasts culture- isolation, culture and fusion; somatic hybridization. Anther culture, production of haploids. Application of cell culture systems in metabolic engineering.

**UNIT III – Genetic engineering tools****20hrs**

Brief history, principles of rDNA technology. Molecular tools in Genetic engineering - DNA polymerases, S1 nucleases, Restriction endonucleases, DNA ligases and alkaline phosphatases. Cloning vectors - Plasmids - types, Mechanism of plasmids, Isolation of plasmids. Cosmids and phage vectors. Construction of Genomic library, polymerase chain reaction (PCR), Molecular Markers (RAPD, RFLP and AFLP). Blotting techniques (Southern, Northern and Western blot). Sequencing of DNA. Chemical Method, Enzymatic, Pyrosequencing and Microarray technology.

**UNIT IV – Genetic transformation and Transgenic Plants****20hrs**

Method of gene transfer in plants - aims, strategies for development of transgenic plants - specific and non-specific methods of gene transfer - organization of Ti plasmid *in*

*Agrobacterium tumefaciens* - Ti plasmid mediated gene transfer. DNA transfer by particle bombardment, micro and macro injection methods - lipofection - electroporation. Transfer of nitrogen fixing genes (nif genes) to legume plants. Genes of agronomic interest and transgenic crops- Golden rice, Edible vaccines, Insect resistance (Bt cotton and Bt brinjal), terminator seed technology- antisense RNA(flavr savr) and RNAi technology – disease resistance, herbicide resistance, salt and stress tolerance, enhancement of shelf life of flowers and fruits.

#### **UNIT V - Bio technology: Ethical, social & Bio safety aspects**

**20hrs**

Socio-economic and ethical aspects of biotechnology. Environmental laws; Intellectual property rights; World Intellectual Property Organization (WIPO) GATT, TRIPS, PBR and Farmers rights ,and its role; Objective of patent system, patentable subjects and protection in biotech; Basic Principles of patent system, UPOV for plant protection. GLP/GMP. Objectives and levels of biosafety: Objectives; recombinant DNA safety; biological containment; risk groups and risk analysis. Cartagena Protocol; OECD guidelines. Govt of India guidelines for r- DNA technology and GMO's. Ecological impact and biosafety issues of GM crops.

#### **PLANT BIOTECHNOLOGY**

##### **Text books**

1. Dubey, R.C. (2001). A textbook of biotechnology. S. Chand & Co., New Delhi.
2. Gupta, P.K. (1994). Elements of Biotechnology. Rastogi Publications, Meerut.
3. Ignacimuthu, S.J. (2003). Plant Biotechnology. Oxford & IBH Publishing, New Delhi.
4. John Jothi Prakash, E. (2005). Outlines of Plant Biotechnology. Emkay Publishers, New Delhi.
5. Kalyan Kumar, De. ( 2008). Plant tissue culture. New Central Book Agency, Calcutta.
6. Kumar H.D. (1993). Molecular Biology and Biotechnology. Vikas Publishers, New Delhi.
7. Sathyanarayana, B.N and Varghese, D.B. (2000). Plant tissue culture- Practices and new experimental protocols, ILK Publ. New Delhi

##### **Reference books**

1. Bhojwani, S.S. & Razdan, M.K. (2004), Plant Tissue Culture, Read Elsevier India Pvt., Ltd.
2. Glick, B.R. & J.J. Pasternak, (2009). Molecular biotechnology, Panima Pub.co.,
3. Hammond, J.C., McGarvey and V. Yusibov, (2009). Plant biotechnology, Springer Verlag, New York.
4. Sambrook, J and Russel, D.W. (2001). Molecular Cloning, A laboratory Manual, Cold Spring Harbour Publi.
5. Satyanarayana, U. (2005). Biotechnology, Books and allied (P) Ltd., Kolkata.
6. Brown, T.A. (2001). Gene Cloning and DNA analysis: An Introduction, Sixth edition Wiley - Blackwell Publication.

7. Sandhya Mitra. (2015). Genetic Engineering : Principles and Practice, Second Edition, McGraw Hill Education (India), Pvt., Ltd.,
8. Purohit, S. (2010). Agricultural Biotechnology (3<sup>rd</sup> edi.), Agrobios (India).
9. Purohit S.S.(2010). Plant tissue culture , Student edition, jodhpur
10. Dix, P.J. (1990). Plant cell line and selection. VCH Publ.
11. Islam, A.S. (1996). Plant tissue culture. Oxford & IBH Publ.
12. Glick, B.R. & J.J. Pasternak. (2009). Molecular biotechnology, Panima Pub. Co.
13. Sambrook, J and Russel D.W. (2001). Molecular Cloning- A laboratory Manual. Cold Spring Harbour Publ.

**FOURTH SEMESTER****CORE COURSE - XIII****ECOLOGY, CONSERVATION BIOLOGY AND PHYTOGEOGRAPHY****Course objective**

- Empower the student to know the concept and principle of ecology.
- Study the plant communities and stages of plant succession
- Know the causes, effects and control measures of pollution.
- Learn Biodiversity conservation and management.
- Learn the principle and concept of phytogeography

**Course Outcomes**

- To understand the basic concepts of ecosystem and energy flow
- To acquire knowledge on population dynamics and plant succession
- To understand the causes and consequences of climate change.
- To learn the conservation strategies of biodiversity
- To study the principle and concepts of Phytogeography

**UNIT I - Autecology and Synecology****25 hrs**

History and scope of ecology, **Autecology**: Characteristics of a population; population growth curves; population regulation; life history strategies (r and K selection); concept of metapopulation – demes and dispersal, interdemic extinctions, age structured population, **Synecology** – Characteristics of community, composition and structure, origin and development, ecotone, edge effect, ecological niche. Ecological interdependence and interaction - positive and negative interaction. Competition – interspecific and intraspecific . Ecological Succession: Types, mechanisms, concept of climax

**UNIT II – Concept of ecology****20 hrs**

Concept and dynamics of Ecosystem: Types of Ecosystem, components, Food chain, food webs. Concept of trophic level, Ecological pyramids, Energy flow ecosystem. Mineral cycling (C, N, P); primary production and decomposition; structure and function of some Indian ecosystems: terrestrial (forest, grassland) and aquatic (fresh water, marine, Estuarine).

**UNIT III – Environmental pollution and Management****15 hrs**

Environmental pollution; Types, causes, effects and control measures of air, soil, water, thermal, noise and heavy metal; Bioremediation and biodegradation - Bio-mining, microbes in leaching metals .Biodiversity management; climate change and its consequences; global environmental change; greenhouse effect, Climate change conferences.-Kyoto Protocol climate agreement -Carbon trade and carbon credits. Blue carbon and IPCC. Tools to study global climate change. GIS application in Biodiversity and Environmental Impact Assessment (EIA).

#### **UNIT IV – Biodiversity conservation**

**15 hrs**

Conservation-need for conservation-in situ conservation - sanctuaries, national parks, biosphere reserves; ex situ conservation- Gene banks, seed banks, Pollen banks, and Cryopreservation -Role of indigenous people in conservation of sacred species, sacred groves; Human and animal conflicts in Biodiversity conservation, social movement for conservation – Chipko movement, Narmada bachao and olan, Red List categories of IUCN. Forest conservation through laws - the biological diversity Act (2002) in force.

#### **UNIT V – Phytogeography**

**15 hrs**

Phytogeography – Principle of plant geography - Phytogeographic region of India, Dispersal and migration barrier hypothesis, Willis age and area hypothesis. Continues range, cosmopolitan, circumboreal and circum austral, pantropical, Discontinuous distribution Wegner’s theory continental drift hypothesis, land bridges hypothesis, Endemism, hotspot region of India and world.

#### **Text books**

1. Sharma, P.D. (2009). Ecology and Environmental, Rastogi Publishers, Meerut.
2. Ambasht, R.S. (1988). A text book of plant ecology. Students, Friends & Co., Varanasi.
3. Kormondy, E.J. (2004). Concepts of Ecology, 4<sup>th</sup> Edi. Prentice –Hall of India Pvt. Ltd., New Delhi.
4. Sharma, P.D. (2015). Ecology and environment. Rastogi Publications, New Delhi.

#### **References books**

1. Edward, J. Kormondy, (1996). Concept of Ecology, Prentice Hill of India Pvt, Ltd. New Delhi.
2. Emil T. Charlett. Environmental Protection. Tata Mc Graw Hill New Delhi.
3. George, L. Clarke, (1954). Elements of Ecology. John Wiley & Sons. Inc., New York.
4. Misra, K.C. (1980). Manual of plant ecology (second edition). Oxford and IBH Publishing Co., New Delhi.
5. Odum, E.P. (1971). Fundamentals of ecology, W.B. Saunders Co., Philadelphia, London.
6. Perkins, H.C. (1974). Air pollution, McGraw Hill Kongotusta Ltd, Tokyo.
7. Robert Smith, (1977). Elements of ecology and field biology, Harper and Raw Publishers, New York, London.
8. Michael, P. (1984). Ecological methods for field and laboratory investigations, Tata McGraw Hill publishing company Ltd., New Delhi.
9. Misra, R. (1986). Ecology workbook, Oxford and IBH publishing company, New Delhi.
10. Coull, J. Cronstant, (1974). Water pollution. Hancount pracojavanocichetne, New York, Atlanta.

**FOURTH SEMESTER****CORE COURSE - XIV****BIOINSTRUMENTATION, RESEARCH METHODOLOGY,  
BIOSTATISTICS AND BIOINFORMATICS****Course objectives**

- To study the interdisciplinary areas of life sciences.
- To develop laboratory skill by various biochemical experiments.
- To create awareness about bioinformatics tools in solving biological problems.
- To provide an overview of the applications of bioinformatics.

**Course outcomes**

- Knowledge on various biological techniques.
- Knowledge on the applications of various instruments used in botanical studies.
- Skill for the statistical analysis of experimental data.
- Skill for using various bioinformatics tools effectively.

**BIOINSTRUMENTATION****UNIT I - Analytical techniques based on optical principles****20hrs**

Photomicrography: Camera as the remote sensing device – types – shutter speed – aperture – depth of field – photographic techniques – printing (photographic emulsion, enlarger, developer and fixer). Spectrophotometer : Principles, Beer Lambert's Law, components and working mechanism – Colorimetric, UV visible and InfraRed (IR), nuclear magnetic resonance (NMR), electron paramagnetic resonance ( EPR), atomic absorption spectroscopy (AAS)

**UNIT II - Quantitative procedures based on physical principles****20hrs**

Centrifugation - Principles, components, Mechanism and application of Clinical, Ultra Centrifuges, Chromatography - principles and applications of paper Chromatography, TLC, HPTLC, Column Chromatography, Ion Exchange, affinity Chromatography, HPLC. Agarose gel Electrophoresis, PAGE, Zymogram and ImmunoElectrophoresis. pH meter- pH concept, electrodes

**UNIT III - Research Methodology****20hrs**

Choosing the research problem - Literature Collection - bibliography - indexing and abstracting. Writing the research report - the components of a research report - title Authors and address - abstract - summary - synopsis - key words introduction - materials and methods, results & discussion. Publications in research journals, breeders' journals, monographs – Reference Management Software reprints – proof correction – Full paper – Short Communication – Review paper, Oral and poster presentation. Outline of plagiarism, UGC care list

#### **UNIT IV – Biostatistics**

**15hrs**

Collection - Classification, Tabulation and presentation of data (Diagrammatic and graphical), Measures of central tendency - Mean, Median and mode. Measures of dispersion - Standard deviation, variance and standard error. correlation - types, correlation coefficient. Regression analysis - simple, linear, Test of significance, parametric - Chi-square test, Multiple mean comparison tests (DMRT).

#### **UNIT V – Bioinformatics**

**15hrs**

History, scope and applications of bioinformatics - Biological databases (BDB) - Nucleotide sequence (EMBL), GENBANK, DDBJ) Protein sequence, (PIR, SWISS-PROT, TrEMBL), Secondary data bases (Prosite, Prints, Blocks). Computational biology and bioinformatics - sequence similarity, homology. Sequence alignment - Pairwise and multiple sequence alignments, score matrices - PAM and BLOSUM series, BLAST and FASTA algorithms. Phylogenetic trees - distance based method (UPGMA, NJ), Maximum parsimony and maximum likelihood method.

#### **Test Books**

1. Palanivelu P (2013). Analytical biochemistry and separation techniques, 20<sup>th</sup> century Publication, Palkalai Nagar, Madurai
2. Jayaraman, J. (1985). Laboratory Manual in Biochemistry Wiley Eastern Ltd., New Delhi.
3. Khan, I.A, and Khannum, A. (1994). Fundamentals of Biostatistics, Vikas Pub, Hyderabad.
4. Gurumani, N. (2011). Research Methodology: For Biological Sciences, Mjp Publishers, Chennai.
5. Attwood, T.K and Parry Smith D.J. (1999). Introduction to bioinformatics, Addison Wesley Longman Ltd., England.

#### **Reference Books**

1. Bryan Bergeron, M.D. (2006). Bioinformatics computing, Prentice Hall of India, New Delhi.
2. Kothari. C.R, (1991). Research Methodology Methods and techniques, Wiley Eastern Ltd., New Delhi.
3. Pavel. A, Pevzner (2005). Computational Molecular Biology Algorithmic approach, prentice, Hall of India Pvt., Ltd.,
4. Zar, JH, (1984). Biostatistical analysis, Prentice Hall international, New Jersey.
5. Sree Ramulu, V.S (1988). Thesis Writing Oxford, and IBH, Pub, New Delhi.
6. Gupta, S.P. (2014). Elementary Statistical Methods, S. Chand & Co., Ltd., New Delhi.
7. Wilson, K. and Walker, J. (2000). Principles and Techniques of Practical Biochemistry (5<sup>th</sup> Edition), Cambridge University Press, Cambridge.

## **FOURTH SEMESTER**

### **CORE COURSE - XV**

#### **PRACTICAL - V (Covering Course - XIII & XIV)**

#### **ECOLOGY, CONSERVATION BIOLOGY AND PHYTOGEOGRAPHY, BIOINSTRUMENTATION, RESEARCH METHODOLOGY, BIOSTATISTICS AND BIOINFORMATICS**

#### **ECOLOGY, CONSERVATION BIOLOGY AND PHYTOGEOGRAPHY**

1. Vegetation sampling methods – Different types of quadrat, line and belt transects
2. Estimation of total biomass and herbage yield by harvest method.
3. Soil and water
  - (a) Garden soil experiment to make texture
  - (b) Capillary water.
  - (c) Field capacity
  - (d) Wilting coefficient
  - (e) pH of the soil/water
  - (f) Chemistry of the soil ( $\text{NO}_3$ ,  $\text{PO}_3$  &  $\text{SO}_3$ )
  - (g) Water analysis for dissolved oxygen and carbon-di-oxide.
  - (h) Analysis of biological oxygen demand (BOD)
4. Estimation of primary production in the given water sample by the Light-Dark bottle Method.
5. Estimation of carbonate, bicarbonate and chloride content in water samples.
6. Measuring the transparency level of aquatic systems using the secchi disc.

#### **Demonstration**

1. Description of Zonation in a pond and stratification in a forest.
2. Spotting of phytogeographical regions of India in maps (Soil, vegetation and
3. Botanical).
4. Demonstrate the map reading / map scale and direction.
5. Demonstrate the Grid system – latitude & longitude, equatorial line.
6. Demonstrate the Ecological tool - Altimeter / Hygrometer / Anemometer/ Lux meter

#### **Note**

- Field study of an area (not less than a period of 4 days) to document environmental assets and study the ecosystems and different types of vegetation (Forest / Grassland / Mountain / National parks / Sanctuary / Botanical garden / Lake / Pond / River / Waterfalls / Estuary / Mangrove / Sea coast) submit a tour report (during the internal practical examination).
- Certified record of work done in the laboratory during practical classes

## **BIOINSTRUMENTATION**

1. Verification of Beer's Law using  $\text{CuSO}_4$  /  $\text{K}_2\text{Cr}_2\text{O}_7$  solution.
2. Separation of sugar / Amino acid by paper chromatography.
3. Separation of photosynthetic pigments by paper / Thin layer Chromatography (TLC).
4. Calibrate the pH meter and test the pH of different sample solutions

## **Demonstration**

1. Electrophoretic separation of nucleic acid (Agarose gel), Protein (SDS PAGE)

## **RESEARCH METHODOLOGY**

1. Prepare an outline of a dissertation and research paper.
2. Demonstrate bibliography writing pattern –MLA/APA
3. Present a small project in the class with the help of LCD projector
4. Demonstrate Reference Management Software.
5. Demonstrate the proof correction

## **BIOSTATISTICS**

1. Calculate Mean, Median, Mode and Standard deviation from the primary data.
2. Find out the correlation between two traits in a plant population.
3. Find Out regression, significance test for regression coefficient from plant population.
4. Calculation of Chi-square test (To test the goodness of fit, to test the detection of linkage).
5. Calculation of student's t' tests (Comparison of means of two samples).
6. Calculation of one factor and two factor analysis of variance (ANOVA).

## **BIOINFORMATICS**

1. Exploring NCBI database system.
2. Querying the PUBMED and Gen bank database.
3. EBI server and searching the EMBL databases.
4. Exploring and querying SWISSPROT and UniprotKB.
5. Structural visualization of DNA, RNA and proteins by using RCSB website

## **Important websites for bioinformatics**

1. <http://www.ncbi.nlm.nih.gov/Entrez/nucleotide.html>
2. <http://www.ddbj.nig.ac.jp/>
3. [www.ncbi.nlm.nih.gov/blast/db/](http://www.ncbi.nlm.nih.gov/blast/db/)
4. <http://www.rcsb.org/pdb/india.html>.

**FOURTH SEMESTER****ELECTIVE - IV****PHYTOCHEMISTRY AND DRUG DEVELOPMENT****Course objective**

- To study the history and scope of plant derived drugs
- To study the characteristic and importance of major phytochemicals
- To know the extraction, purification and characterization of phytochemicals
- To know the process for development of plant drugs

**Course outcome**

- Knowledge on the history and scope of plant derived drugs
- Knowledge on the characteristic and importance of major phytochemical
- Knowledge on extraction , purification and characterization of phytochemical
- Understand the process for development of plant derived drugs

**UNIT I - Secondary metabolites and classification** **20hrs**

Phytochemistry - Definition, history, principal, secondary metabolites: Definition, classification, occurrence and distribution in plants, their function, chemical constituents. Alkaloids, Terpenoids, flavonoids, steroids coumarins, volatile oils and other related compounds.

**UNIT II - Biosynthetic pathway of phytochemical and its applications** **15hrs**

Biosynthetic pathway of secondary metabolites: Shikimic acid pathway, Acetate-Mevalonate pathway, pathway for commercially important phytochemicals: Ephedrine, taxol and Vinca Alkaloids. Application of phytochemicals in medicine, pharmaceuticals, food, flavor and cosmetic industries.

**UNIT III - Biologically active secondary metabolites** **20hrs**

Biological source, uses and chemical constituents of bio active compounds: carbohydrate and derived compound – gums (Acacia gum, Indian gum and gum Arabic, isabgol), pectin – Ghatti gum). Glycosides (*Alove*, Digitalis, *Olender*, *Dioscorea*, Ginseng, *Vanilla*, *Shatavari*). Cyanogenic glycosides – (*Amygdalin* ). Alkaloids (*Belladonna*, *Ergot*; *Rauwolfia*, *Cinchona*, *Opium*, *Holarrhenna*, *Ashwagandha*, *Cocoa*). Tannins (Malbar Kino, *Arjuna*, Black catechu). Volatile oil (*Peppermint*, *Pudina*, *Sandalwood oil*, *Chinese cinnamon*, *Citronella oil*, *Clove*, *Gaultheria oil*. Resins (*Indian cannabis*, *Ginger*). Lipid – (*Almond oil*, *Rice bran oil*, *Safflower oil*). Enzymes and protein drugs - *Bromelin*, *Papain*, *Malt extract*, *Gelatinum*, *Ficin*).

**UNIT IV - Extraction and quantification of Phytochemical** **15hrs**

Extraction methods of phytochemical: organic solvent extraction, extraction with supercritical gas, steam distillation, soxhlet extraction, Purification, concentration, lyophilization. Qualitative screening of phytochemical compounds. Quantification

compound: TLC, HPLC, GC-MS, LC-MS .Characterization of phytochemical spectroscopic analysis UV-VIS, IR, NMR and MASS Spectra, FTIR.

#### **UNIT V- Pharmacognosy**

**20hrs**

Crude drugs scope & importance, classification of drugs – morphological, Taxonomical, pharmacological and chemical. Cultivation, collection, harvesting and drying of crude drugs. Drug Adulteration, Evaluation of Crude Drug Medicinal and aromatic plants – cultivation, utilization of medicinal and aromatic plants in India. Role of plant tissue culture in enhancing secondary metabolites – Elicitation – Biotransformation factors affecting secondary metabolites production.

#### **Text books**

1. Shah, B.N. and Seth, A.K. (2010). Textbook of pharmacognosy and phytochemistry, published by Elsevier, a division of reed Elsevier India Pvt. Ltd
2. Gokhale, S.B, Kokate, C.K and Gokhale, A. (2016). Pharmacognosy of traditional drugs, Nirali prakashan, 1/Ed
3. Harborne, A.J. (2008). Phytochemical methods. A guide to modern techniques of plant analysis. Chapman and Hall publisher.
4. Hornok, L. (1992). Cultivation and Processing of Medicinal Plants. Wiley-Blackwell.
5. Joshi, S.G. (2018). Medicinal Plants. Oxford & IBH Publishing C., Pvt., Ltd., New Delhi.
6. Qadry, J.S. 2014. A textbook of Pharmacognosy Theory and Practicals. CBS Publishers & Distributors, 17<sup>th</sup> Edition.

#### **Reference Books**

1. Ahmad, I., Aqil, F., and Owais, M. (2006). Modern phytomedicine: Turning medicinal plants into drugs. John Wiley & Sons, New Jersey.
2. Khan, M.S. A., Ahmad, I., and Chattopadhyay, D. (2018). New Look to Phytomedicine: Advancements in Herbal Products as Novel Drug Leads. Academic Press.
3. Khare, C.P. (2004). Indian herbal remedies: rational Western therapy, ayurvedic, and other traditional usage, Botany. Springer science & business media, Germany.
4. Mangathayaru, K. (2013). Pharmacognosy: an Indian perspective. Pearson Education India.
5. Chand Kuldip. (1996). Medicinal Plants Source Book India. International Library Association, Switzerland.
6. Premendra singh. (2013). Medicinal plants: conservation, cultivation and utilization, days publishing house – A division of astral international Pvt. Ltd.

## **FOURTH SEMESTER**

### **CORE COURSE - XVI**

### **PROJECT AND DISSERTATION WORK**

Project is a component of the active learning module that teaches approach and research techniques. Students would have hands-on experience in investigating a selected research problem where he/she shall be trained in framing and testing hypotheses through suitable research design. Students are required to select their research topic in one of the following domains.

#### **BROAD RESEARCH AREAS**

- Plant diversity and Systematic
- Plant physiology and Biochemistry
- Plant Molecular Biology and Biotechnology
- Microbiology and Plant pathology
- Environmental biology
- Ethnobotany
- Nanobiology
- Horticulture

#### **Allocation**

- Students may select their broad research area during the end of the third semester and will be guided by a suitable research supervisor in the area allotted by the HOD.
- Each research supervisor may be allotted with one or two students based on the number of students
- Summer vacation may be used by the students to initiate their project work.

#### **Objective of the study**

- Topics investigated will have defined areas of study.
- Project students will have hands-on experience in all the instruments and techniques of conducting his/her original research.
- Minimum of 5-10 yrs of literature will be added in the review with recent publication of the year.
- Standard of the project work should be high enough to be presented in conferences or to communicate as papers and be subjected to peer review.

## **Evaluation**

### **Internal assessment mark based on**

1. Literature collection	10 marks
2. Documentation of data	10 marks
3. Methodology	10 marks
4. Presentation of Results (Statistical analysis/ tabulation/thesis writing / Reference citing)	10 marks

**Total** **40 marks**

### **External 60mark**

1. Dissertation	–	40 marks
2. Viva – Voce	–	20 marks

### **Dissertation format**

- Introduction
- Review of literature
- Materials and methods
- Results
- Discussion
- Summary
- Bibliography

**EXTRA DISCIPLINARY COURSE – I**  
**HORTICULTURE**

**Course objectives**

- To understand the basic concept of horticulture
- To learn the various methods of plant propagation and management
- To understand the arts of floriculture and landscape gardening
- To know the arts of fruit crop and vegetable crop cultivation

**Course outcome**

- Understand the importance and division of horticulture
- Demonstrate the propagation, growth, and maintenance of plants in horticulture systems.
- To know the art of indoor gardening
- Apply horticultural skills and knowledge to explore career opportunities in the horticulture industry.

**UNIT I - Introduction to Horticulture****15hrs**

Horticulture – Introduction, Importance, Scope of horticulture, Divisions of horticulture. Classification of horticultural crops – Garden tools and equipment. Manures and fertilizers – organic manures -inorganic fertilizers, biofertilizers. Water irrigation, Nursery preparation and maintenance.

**UNIT II – Plant propagation****10hrs**

Methods of Plant Propagation: natural method, propagation through seeds and specialized vegetative structure. Artificial methods: cutting, layering, grafting, budding. Stock – Scion relationship in grafting, role of tissue culture in horticulture plants.

**UNIT III - Gardening****15hrs**

Principle and methods of designing outdoor gardens – hedges, edges, fences, trees, climbers. rockeries , arches , terrace garden , lawn making and maintenance , water garden –cultivation water plants , layout for a model college garden .indoor garden –Foliage plants , flowering plants , hanging basket , Bonsai plants –training and pruning

**UNIT IV - Floriculture****10hrs**

Importance of Floriculture - Cultivation of commercial flowers: Rose, Jasmine and Chrysanthemum, crossandra, Anthurium and gerberas – cut flower - vase life period – package for export of cut flower, flower decoration – Dry and wet decoration

**UNIT V - Cultivation of Fruit crop****10hrs**

Fruit crop – induction of flowering, flowering thinning, fruit setting, fruit development, importance of Plant growth regulators in fruit crop. Floriculture – classification of vegetables – cultivation of important – tomato, potato, cabbage, snake guard, onion.

**Text books**

1. Chadha, (2001). HandBook of Horticulture. ICAR Publications, New Delhi.
2. Chauhan, V.S. Vegetable Production in India, Ramprasad Publications, Agra.
3. Edment Senn Andrews, (1994). Fundamentals of Horticulture. TATA McGraw Hill Publishing Co., Ltd., New Delhi.
4. Manibhushan Rao, K. Text book of Horticulture. Macmillan India Ltd.

**Reference books**

1. Randhava, G.S. (1973). Ornamental horticulture in India. Today and Tomorrow Printers and Publishers, New Delhi.
2. Williams, C.N., Uzo, J.O. and Peregrine, W.T.H. (1991). Vegetable production in the Tropics. Longman Scientific & Technical, Essex (UK).
3. Yawalkar, K.S. (1961). Vegetable crops of India. Agri - Horticultural Publishing House, Dharmapath, Nagpur

## **EXTRA DISCIPLINARY COURSE - II**

### **HERBAL BOTANY**

#### **Course objective**

- To learn the different types of Indian traditional medicinal system
- To study the value and importance of medicinal plants for human welfare
- To explore the uses of plants as medicine ranging from medicinal to modern pharmaceuticals
- To learn the preparation of herbal formulation to cure various ailments.

#### **Course outcomes**

- Knowledge on application traditional medicine for cure various disease
- Acquired knowledge on some important medicinal plants and their usage
- To acquire knowledge on phytochemicals and their applications various health care
- To understand the herbal formulation and practice by ethnic community

#### **UNIT I –Traditional Medicinal System in India 15hrs**

History, scope and importance Medicinal plants – traditional and alternative system of medicine – naturopathy, folk medicine, Ayurveda, Siddha, homeopathy and Unani. WHO regulation of herbal medicine. National Medicinal Plants Board of India, AYUSH.

#### **UNIT II - Classification and cultivation of herbal drugs 10hrs**

Definition of Drug - Classification of crude drugs: Alphabetical, Morphological, Pharmacological and Chemical. Cultivation, collection, harvesting, processing and storage of herbal drugs conservation of medicinal plants.

#### **UNIT III - Overview of selected medicinal plants 15hrs**

Morphology, family, vernacular and botanical names, useful parts, active principle and phototherapeutics of following: whole plant Keelanelli, Root - Nithyakalyani, vetiver, Bark – cinnamon, Arjuna, leaves – Neem, Aloe, tulasi, flower – clove, saffron . Underground stem – turmeric, ginger, vasambu. Gum –asafoetida, resin – turpentine, oil – castor, neem

#### **UNIT IV - Ethnobotany and herbal formulation 10hrs**

Herbal concoctions – Kashayam, chooranam, lagiyum, tincture, poultice, Food: herbal salad, chutney, soup and herbal tea. Ethnic communities in Tamil Nadu and their medicinal usage.

#### **UNIT V - Herbs for societal health care 10hrs**

Cosmetic preparation: incorporating the herbal extract in various cosmetic formulations like skin care preparations (crèmes and lotions), sunscreens and sunburn application, hair care preparations – hair oil, hair shampoo, hair was powder .Beautifying preparation – lipstick, face powder and nail polish, herbal dish wash.

## **Text books**

1. Amruth, H. (2002). The Medicinal plants Magazine (All volumes) Medplant Conservatory, Society, Bangalore.
2. Arumugam, K.R. and Muruges, N. (1990). Textbook of Pharmacognosy. Sathya Publishers, Chinnalapatti (Tamilnadu) - 624 201.
3. Bhattacharjee, S.K. (2004). HandBook of Medicinal plants. Pointer Publishers, Jaipur.
4. Gokhale, S.B., Kokate, C.K. and Purohit, A.P. (2003). Pharmacognosy. Nirali Prakashan, Pune.
5. Guha Bakshi, D.N. Sen Sharma, P. and Pal, D.C. (1996). A Lexicon of Medicinal Plants in India. Naya Prakash, Calcutta.
6. Handa, S.S. and V.K. Kapoor, (1993). Pharmacognosy. Vallabh Prakashan. New Delhi.
7. Harbourne, J.B. (1998). Phytochemical methods: A Guide to Modern Techniques of Plant Analysis (3rd edition). Chapman and Hill Co., New York.
8. Jain, (2001). Medicinal plants. National Book Trust, New Delhi.
9. John Jothi Prakash, E. (2003). Medicinal Botany and Pharmacognosy. JPR Publication, Vallioor, Tirunelveli.
10. Joshi, S.G. (2001). Medicinal plants. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
11. Medicinal Plants Source Book India, (1996). International Library Association, Switzerland.
12. Prajapathi, Purohit, Sharma and Kumar. (2003). A Handbook of Medicinal plants. Agrobios Publications, Jodhpur.
13. Purohit and Vyas, (2004). Medicinal Plants Cultivation. Agrobios Publications, Jodhpur.
14. Thirugnanam, (1995). Mooligai maruthuvam (Tamil). Selvi pathipakam, Trichy.
15. Wallis, T.E. (2005). Textbook of Pharmacognosy. C.B.S. Publishers and Distributors

**MODEL QUESTION PAPER**

(For the candidates admitted from 2021–2022 onwards)

M.Sc. DEGREE EXAMINATION,

First semester

Botany

CORE COURSE – I

**BIODIVERSITY OF PLANTS – I**

**(ALGAE, FUNGI, LICHENS AND BRYOPHYTES)**

**Time: Three hours**

**Maximum: 75 marks**

**PART – A (15 × 1 = 15 marks)**

**Answer ALL questions**

1. Phycobilins are accessory pigments found in
  - a) Green algae
  - b) Blue green algae and red algae
  - c) Blue green algae and diatoms
  - d) Red algae and brown algae
2. Which algae shows Haplodiplontic life cycle?
  - a) *Spirogyra*
  - b) *Sargassum*
  - c) *Batrachospermum*
  - d) *Laminaria*
3. Which of the following is the most advanced group of algae
  - a) Rhodophyta
  - b) Phaeophyta
  - c) Cyanophyta
  - d) Chlorophyta
4. Iodine is obtained from
  - a) *Ulothrix*
  - b) *Ectocarpus*
  - c) *Laminaria*
  - d) *Oedogonium*
5. Parasitic algae is
  - a) Cephaleuros
  - b) Ulothrix
  - c) Spirogyra
  - d) Chlamydomonas
6. Which algae species is response for ride tide
  - a) *Gonyaulax*
  - b) *Trichodesmium erythreum*
  - c) *Microcystis*
  - d) *Oscillatoria*
7. The spores produced inside the sporangia are
  - a) Conidia
  - b) Endospore
  - c) Zoospore
  - d) Oidia



**PART - C (5 × 10 = 50 marks)**

**Answer ALL questions.**

21. a) Describe the classification of Algae by Fritsch

Or

b) Write a essay on evolutionary trend in algae

22. a) Explain the pigmentation, stored food materials and economic importance of Phaeophyceae

Or

b) Briefly explain the thallus organization of Algae

23. a) Discuss the Spore dispersal mechanism in fungi -

Or

b) Explain the heterothallism in fungi

24. a) Describe the different types of lichen structure with diagrams

Or

b) Write brief notes on economic importance of lichen

25. a) Describe the structure, reproduction and affinities of Sphagnum.

Or

b) Write about the life cycle of Marchantia.





**PART - C (5 × 10 = 50 marks)**

**Answer ALL questions**

21. a.) Explain the general features and origin of *Lycopsida*.

Or

b.) Describe the Sporn classification of Pteridophytes

22. a.) Discuss the Eusporangiate type of sporangium development

Or

b.) Write an essay on types and organization of stele

23. a.) Give an account on general character and anatomical structure of Pentoxylales

Or

b.) Diagrammatically describe reproductive structure of order Coniferales

24. a.) Discuss the vegetative characters of Ginkgoales and Gnetales.

Or

b.) Explain the affinities of gymnosperms with pteridophytes.

25. a.) Write an essay on a geological time scale.

Or

b.) Explain the fossil types and fossilization.

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PU- M.Sc., Botany (College), 2021-2022

**MODEL QUESTION PAPER**

(For the candidates admitted from 2021–2022 onwards)

M.Sc. DEGREE EXAMINATION,

First Semester

Botany

CORE COURSE –III

**TAXONOMY OF ANGIOSPERMS AND ECONOMIC BOTANY**

**Time:** Three hours

**Maximum:** 75 Marks

**PART - A (15 × 1 = 15 Marks)**

**Answer ALL questions.**

1. Sexual system of classification is proposed by
  - a) Bessy
  - b) Benham and Hooker
  - c) Linnaeus
  - d) Takhtajan
2. Cladistics is
  - a) relationship between subspecies and species
  - b) relationship between two most forward races
  - c) relationship between endangered and endemic species
  - d) method of classification is based on phylogenetic relationship.
3. Father of Indian taxonomy is
  - a) V.Puri
  - b) H.Santapau
  - c) P.Maheshwari
  - d) Linnaeus
4. ICN stands for
  - a) International Code of Botanical Nomenclature
  - b) International Code of Nomenclature for algae, fungi and plants
  - c) International Code of Biological Nomenclature
  - d) International Code of Nomenclature for plants and animals
5. One specimen used by the author as the nomenclatural type is called
  - a) syntype
  - b) holotype
  - c) Isotype
  - d) paratype



**PART – B (2 × 5=10 marks)**

**Answer ANY TWO questions.**

16. Write outline of Engler and Prantl classification.
17. Explain various types of typification.
18. Write systematic position of families Meliaceae and Moraceae.
19. Comparison of the monochlamydeae and monocotyledons.
20. Write botanical name, useful parts and uses of two essential oil yielding plants.

**PART - C (5 × 10 = 50 marks)**

**Answer ALL questions.**

21. a) Explain the natural system of classification.  
or  
b) Describe Chemotaxonomy, and Sero taxonomy
22. a) Explain binomial nomenclature and list out principles of ICBN.  
or  
b) What is herbarium? Explain herbarium preparation and data information.
23. a) Enumerate the economic importance of the families Rosaceae and Rubiaceae  
or  
b) Describe the general characteristics of Magnoliaceae
24. a) Describe the general characteristics of Orchidaceae  
or  
b) Enumerate the economic importance of the families Aristolochiaceae and Cyperaceae.
25. a) Give the botanical name and morphology of product used in  
i). Cardamom, ii). Cinnamon, iii). Jute, iv). Asafoetida, v). Gum Arabic  
or  
b) Write briefly oil yielding plants Sun flower and Gingelly.

PU- M.Sc., Botany (College), 2021-2022

**MODEL QUESTION PAPER**

For the candidates admitted from 2021–2022 onwards)

M.Sc. DEGREE EXAMINATION,

First Semester

Botany

ELECTIVE COURSE - I

**ETHNOBOTANY**

**Time: Three hours**

**Maximum: 75 Marks**

**PART - A (15 × 1=15 Marks)**

**Answer ALL questions.**

1. The term Ethnobotany was first applied by
  - a) Jones
  - b) Faulks
  - c) Harshberger
  - d) S.K.Jain
2. The wild plant species used by tribals are recorded in
  - a) All India Coordinated Research Project in Ethnobiology
  - b) All India Coordinated Research Planning in Ethnobotany
  - c) All India Coordinated Research Programme in Ethnobiology
  - d) All India Coordinated Research Programme in Ethnobotany
3. Which one is not a sub discipline of ethnobotany?
  - a) ethno algology
  - b) ethnobiology
  - c) ethnolichenillogy
  - d) anthropology
4. Which one of the following tribes does not belong in Tamil Nadu?
  - a) Bondo
  - b) Todas
  - c) Kurumbas
  - d) Kanis
5. Generally the tribes Jenukuruba are distributed in
  - a) Kerala
  - b) Tamil Nadu
  - c) Karnataka
  - d) Andhra Pradesh
6. Occupation of Toda tribes is/ are
  - a) Honey collection
  - b) cattle – herding and dairy work
  - c) Fishing
  - d) poaching
7. The plant bark is used for curdling of milk by ethnics.
  - a) *Madhuca indica*
  - b) *Curcuma angustifolia*
  - c) *Grewia tiliaefolia*
  - d) *Oroxylum indicum*



**PART - C (5 × 10 = 50 marks)**

**Answer all questions.**

21. a). List out any five interdisciplinary subjects of ethnobotany with explanation.  
or  
b). Describe the current ethnobotanical scenario in the world and India.
22. a). How the tribes are involved in conservation of biodiversity  
or  
b). Enumerate the Tamil Nadu government policies and upliftment programmes for aboriginals.
23. a). How are plants associated with cultural, social and religious activities of ethics?  
or  
b). How are folks using the plants for their livelihood, sustainable harvesting and value addition?
24. a). Explain the major tools for studying ethnobotany.  
or  
b). Write about the need and method of ethnobotanical research.
25. a). What is TK? Explain the Challenges to protecting TK?  
or  
b) Discuss ethnobotanical equitable benefits sharing and the problem of sharing in a world scenario.

**MODEL QUESTION PAPER**

For the candidates admitted from 2021–2022 onwards)

M.Sc. DEGREE EXAMINATION,

Second Semester

Botany

CORE COURSE –V

**MICROBIOLOGY AND PLANT PATHOLOGY**

**Time: Three hours**

**Maximum: 75 marks**

**PART - A (1 × 15= 15 marks)**

**Answer ALL questions**

1. The outer membrane of gram negative bacteria made up of
  - a) Peptidoglycan
  - b) NAG and NAM only
  - c) lip polysaccharide
  - d) lip polysaccharide with protein
2. Which one of following bacteria called as filamentous bacteria
  - a) mycoplasmas
  - b) spirochetes
  - c) Actinomycetes
  - d) vibrios
3. The time required for a cell to undergo binary fission is called the:
  - a) exponential growth rate
  - b) growth curve
  - c) generation time
  - d) lag period
4. COVID-19 infectious disease caused by a
  - a) SARS-CoV-2
  - b) SARS
  - c) SARS-CoV
  - d) CoVs
5. Bacteriophages T<sup>4</sup> belong to
  - a) DNA viruses
  - b) ssDNA viruses
  - c) dsRNA
  - d) +ssRNA
6. Geminiviridae described as
  - a) DNA viruses
  - b) ss DNA virus
  - c) dsRNA
  - d) animal virus
7. Specialized transduction is mediated by
  - a) Lytic phages
  - b) Lysogenic phages
  - c) both a and b
  - d) T<sup>4</sup> phages

8. DNA sequences that is able to move from one location to another in the genome
- a) Insertion DNA sequence                      b) selfish genetic elements  
c) Transposable elements                      d) Retrotransposons
9. Which of the following is true for a plasmid?
- a) Contains an origin of replication  
b) Imparts a useful characteristic to the host bacterium  
c) Possesses one or more genes  
d) Replicates only when the host genome is undergoing replication
10. The fungus used in the industrial production of citric acid:
- a) *Rhizopus oryzae*                                      b) *Fusarium moniliforme*  
c) *Rhizopus nigricans*                                  d) *Aspergillus nigricans*
11. Which of the following microorganisms is not used as a bio-fertilizer?
- a) *Rhizobium*    b) *Nostoc*  
c) *Mycorrhiza*    d) *Agrobacterium*
12. Yeast is used for the production of
- a) Tetracycline    b) Butanol  
c) Ethanol    d) Citric Acid
13. Late blight caused by potatoes?
- a) *Phytophthora erythroseptica*                      b) *Phytophthora infestans*  
c) *Pythium aphanidermatum.*                      d) None of the above.
14. The Bordeaux mixture was first time used for the control of
- a) Downy mildew of grape vine                      b) Powdery mildew of pea  
c) Root rot of beet    d) Damping of Pea
15. Good disease forecasting systems must be..?
- a) Reliable.    b) Simple.  
c) Applicable too many diseases                      d) All of the above.

**PART - B (2 × 5= 10 Marks)**

**Answer ANY TWO questions**

16. Diagrammatically describes the gram negative bacterial cell wall.
17. Write short note on cauliflower mosaic virus.
18. Discuss the mechanism of generalized transduction,
19. Write detail note on food borne disease and management.
20. List out the general Symptoms of Plant Diseases.

**PART - C (5 × 10 = 50 marks)**

**Answer ALL questions**

21. a) Write in detail classification of bacteria by Bergey

Or

b) Discuss the different types of sterilization method

22. a) Describe the isolation and purification of plant viruses.

Or

b) Diagrammatically describe the structure and chemical composition of dsDNA viruses.

23. a) Give an account on specialized transduction in bacteria.

Or

b) Write an essay on Transposable elements and their evolutionary significance.

24. a) Explain the cheese production technology.

Or

b) Write a essay on microbes used as biofertilizer.

25. a) Write a symptoms, causative organism and management of little leaf of brinjal disease.

Or

b) Explain the plant disease management strategies.

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**MODEL QUESTION PAPER**

For the candidates admitted from 2021–2022 onwards)

M.Sc. DEGREE EXAMINATION,

Second Semester

Botany

CORE COURSE -VI

**(ANATOMY OF ANGIOSPERMS, PLANT MICROTECHNIQUES AND  
EMBRYOLOGY OF ANGIOSPERMS)**

**Time: Three hours**

**Maximum: 75 marks**

**PART - A (1 ×15 = 15 marks)**

**Answer ALL questions**

1. What is the characteristic feature of a meristematic tissue?
  - a) All are immature cells
  - b) Lack or minimized vacuole
  - c) Prominent Nucleus
  - d) All of these
2. Tunica-Corpus theory proposed by
  - a) Nageli
  - b) Schmidt
  - c) Hanstein
  - d) Fahn
3. The study of plant's age by counting the annual rings is called
  - a) Histology
  - b) Dendrochronology
  - c) Paleontology
  - d) Ornithology
4. Bulliform cells are found in
  - a) Dorsi-ventral leaves
  - b) Isobilateral leaves
  - c) Xerophytic leaves
  - d) Dicot leaves
5. The cells which are found in leaves and facilitating sugar supply are called
  - a) Passage cells
  - b) Supplying cells
  - c) Transfer cells
  - d) Facilitating cells
6. A flower is a
  - a) Modification of leaf
  - b) Modification of stem
  - c) Modification of petiole
  - d) Modification of pedicel
7. "Annulus" is a part used in
  - a) Phase-Contrast microscope
  - b) Light Microscope
  - c) TEM
  - d) SEM

8. During maceration, we are dissolving
  - a) Middle lamella
  - b) Plasmodesmata
  - c) Microgranules
  - d) Plasma Membrane
9. Which one of the following is NOT a fixative?
  - a) FAA
  - b) Alcohol
  - c) Formalin
  - d) DPX
10. Which one of the following is supplies food for the growing microspore
  - a) Middle layer
  - b) Tapetum
  - c) Epithelium
  - d) Endothelium
11. Pollination by means of birds is called
  - a) Entomophily
  - b) Ornithophily
  - c) Hydrophily
  - d) Anemophily
12. Polygonum type embryo sac is
  - a) 8-Nucleate, 7-celled
  - b) 8-Nucleate, 8-celled
  - c) 7-Nucleate, 7-celled
  - d) 4-Nucleate, 3-celled
13. When pollen tube enter through funiculus it is called
  - a) Porogamy
  - b) Chalazogamy
  - c) Mesogamy
  - d) Isogamy
14. The gametes are formed without the formation of gametophyte is called
  - a) Apogamy
  - b) Apospory
  - c) Apomixis
  - d) None of the above
15. Coleorrhizae present in
  - a) Dicot Embryo
  - b) Monocot Embryo
  - c) Monocot leaf
  - d) Dicot Leaf

**PART - B (2 × 5 = 10 Marks)**

**Answer ANY TWO questions**

16. Write about various types of meristems based on the location.
17. Write a short note on leaf galls.
18. Write in briefly about Fixation and fixatives.
19. Explain Megasporangium with suitable diagrams.
20. Explain polyembryony and its causes.

**PART - C (5 × 10 = 50 marks)**

**Answer ALL questions**

21. a) Write in detail about activity of Vascular cambium during secondary growth.

Or

b) Write in detail about various types of nodal anatomy

22. a) Write an essay on structure, development and function of transfer cells.

Or

b) Explain the role of sucrose in vascular differentiation.

23. a) Give an account on structure and function of Electron Microscope.

Or

b) Write an essay on various types of stains.

24. a) Write an essay on various types of embryo sac in dicot plants.

Or

b) Explain in detail about various methods to overcome incompatibility.

25. a) Give an account on endosperms.

Or

b) Write in detail about monocot and dicot embryos.

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**MODEL QUESTION PAPER**

(For the candidates admitted from 2021–2022 onwards)

M.Sc. DEGREE EXAMINATION,

Third Semester

Botany

**CORE COURSE – VII**

**CELL BIOLOGY, GENETICS AND MOLECULAR BIOLOGY**

**Time: Three hours**

**Maximum: 75 Marks**

**PART - A (15 × 1 = 15 Marks)**

**Answer ALL questions.**

1. Structure is not found in prokaryotic cell
  - a) cell wall
  - b) cell membrane
  - c) nuclear membrane
  - d) cytoplasm
2. Ribosomes are present in
  - a) endoplasmic reticulum
  - b) cytoplasm only
  - c) endoplasmic reticulum and cytoplasm
  - d). golgi complex
3. Mitosis results
  - a) Doubling of chromosome number
  - b) No change in the chromosome number
  - c) Reduction of chromosome number
  - d) Produced four cells
4. The enzyme helicase involved in
  - a) removes positive supercoiling
  - b) unwinding of DNA by breaking hydrogen bonds
  - c) DNA replication is initiated
  - d) lysis the DNA and RNA
5. Which of the following is not true?
  - a) DNA is found only in nucleus
  - b) DNA is found in mitochondria, chloroplast and nucleus
  - c) Ribosomes are found in mitochondria, chloroplast and nucleus
  - d) Mitochondria and chloroplast are called endo - symbionts.
6. Chlorophyll consists of
  - a) 75% chlorophyll a and 25% chlorophyll b
  - b) 75% chlorophyll b and 25% chlorophyll a
  - c) 60% chlorophyll a and 40% chlorophyll b
  - d) 100% chlorophyll a



18. Describe the chromosomal basis of inheritance.
19. Explain biochemical mutation in *Neurospora*.
20. Describe the process of transcription in prokaryotes.

**PART - C (5 × 10 = 50 marks)**

**Answer ALL questions.**

21. a) Explain the detailed structure of the eukaryotic cell.

Or

- b) Describe meiotic cell division and its significance.

22. a) Describe the nuclear organization of pro and eukaryotes.

Or

- b) Explain endo symbiotic theory.

23. a) What is called crossing over? Explain mechanism and its types.

Or

- b) Explain the cytoplasmic inheritance with examples.

24. a) Enumerate the Hardy and Weinberg law.

Or

- b) What is polyploidy? Explain its role in Agriculture.

25. a) Explain the lactose and tryptophan Operon concept of gene regulations.

or

- b) What is transcription? Explain post transcriptional modification in eukaryotes.

**MODEL QUESTION PAPER**

(For the candidates admitted from 2021–2022 onwards)

M.Sc. DEGREE EXAMINATION,

Fourth Semester

Botany

CORE COURSE - X

**PLANT PHYSIOLOGY AND BIOPHYSICS**

**Time: Three hours**

**Maximum: 75 marks**

**PART - A (1 × 15 = 15 marks)**

**Answer ALL questions**

- Water potential of pure water will be
  - Always negative sign
  - Always positive sign
  - Always “0”
  - Always “100”
- Which one of the following mineral playing a vital role in stomatal movement
  - Mg<sup>++</sup>
  - Mn<sup>++</sup>
  - K<sup>+</sup>
  - Fe<sup>++</sup>
- Which one of the following theory explains both Positive and negative ion uptake
  - Contact exchange theory
  - Carbonic acid theory
  - Cytochrome pump theory
  - Protein-Lecithin theory
- Which one of the following is NOT responsible for the Cyclic ETS in Photosynthesis?
  - Higher CO<sub>2</sub> in atmosphere
  - Unavailability of NADP
  - Absence of NADP Reductase
  - Failure of cytochrome reduction
- The intermediary compound formed only in C<sub>3</sub> cycle is
  - Aspartate
  - PEP
  - OAA
  - 3-PGA
- Choose the correct order of cell organelles involved in photorespiration
  - Chloroplast, Mitochondria and Peroxisome
  - Peroxisome, chloroplast and Mitochondria
  - Mitochondria, Chloroplast and Peroxisome
  - Chloroplast, Peroxisome and Mitochondria



19. Give plant responses against water stress.
20. Explain briefly about Entropy and enthalpy.

**PART - C (5 × 10 = 50 marks)**

**Answer ALL questions**

21. a.) Write in detail about Stomatal movement in plants.

Or

- b.) Give an account theories have been proposed to explain Mineral absorption

22. a.) Write an essay on interaction of light chlorophyll pigments in plants.

Or

- b.) “C<sub>4</sub> plants are more efficient than C<sub>3</sub> Plants”- Justify.

23. a.) Write in detail about Oxidative Phosphorylation.

Or

- b.) Give an account on Biological nitrogen fixation with reference to Nitrogenase enzyme.

24. a.) Write chemical structure and action Mechanism of Cytokinins in detail.

Or

- b.) What is seed dormancy? Explain various tools to break seed dormancy.

25. a.) Explain Action and absorption spectra in detail.

Or

- b.) Explain in detail about redox reactions and redox potential.

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PU- M.Sc., Botany (College), 2021-2022

**MODEL QUESTION PAPER**

(For the candidates admitted from 2021–2022 onwards)

M.Sc. DEGREE EXAMINATION,

Third Semester

Botany

CORE COURSE - XI

**BIOCHEMISTRY AND NANOBIO TECHNOLOGY**

**Time: Three hours.**

**Maximum: 75 marks**

**PART – A (15 × 1 = 15 marks)**

**Answer ALL questions**

- No of moles of solute dissolved per liter of solution is called
  - molarity
  - normality
  - molality
  - mole fraction
- The boiling point of water is exceptionally high because
  - there is a covalent bond between H and O
  - water molecule is linear
  - water molecules associate due to hydrogen bonding
  - water molecules are not linear
- If a bond is made up of a large number of organic compounds, then the bond is termed as?
  - Ionic bond
  - Metallic bond
  - Covalent bond
  - Dipolar bond
- Maltose is a disaccharide of
  - Glucose and galactose
  - Glucose and glucose
  - Glucose and lactose
  - Fructose and lactose
- The repeating units in both DNA and RNA are called as
  - amino acids
  - hydrogen bonds
  - nucleic acids
  - nucleotides
- When all the monosaccharides in a polysaccharide are the same type, such type of a polysaccharide is called as
  - Glycogen
  - Homoglycan
  - Heteroglycan
  - Oligosaccharide



**PART – B (2 × 5 = 10 marks)**

**Answer ANY TWO questions.**

16. Write a detail about the buffer solution and their types.
17. Explain the function of glycoprotein.
18. Write a note on the types and biological functions of Vitamins.
19. Discuss the affecting factors of enzyme activities.
20. Explain the various applications of Nanoparticles in agriculture.

**PART – C (5 × 10 = 50 marks)**

**Answer ALL the questions.**

21. a) Describe the structure and properties of water with ionization.  
Or  
b) Write briefly the various types of chemical bonds.
  22. a) Write an account of the structure and types of Oligosaccharides.  
Or  
b) Explain the detailed structure and biological functions of Nucleotide.
  23. a) Discuss the classification of lipids.  
Or  
b) Write on the structure and biological properties of alkaloids.
  24. a) Describe the detailed secondary structure of protein.  
Or  
b) Discuss about the metabolism of amino acids.
  25. a) What is a biosensor? Explain the working principle and their applications.  
Or  
b) Write an account on the principles and structure of SEM and their applications.
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**MODEL QUESTION PAPER**

(For the candidates admitted from 2021-2022 onwards)

M.Sc. DEGREE EXAMINATION, MARCH/APRIL 2021.

Third Semester

Botany

ELECTIVE COURSE - II

**HORTICULTURE AND FORESTRY**

**Time: Three hours.**

**Maximum: 75 marks**

**PART – A (15 × 1 = 15 marks)**

**Answer ALL questions**

1. Which of the following nitrogen fixers is found in rice fields associated with Azolla?  
(a) *Tolypothrix* (b) *Frankia*  
(c) *Anabaena* (d) *Spirulina*
2. Which of the following plant growth regulators (PGRs) promotes root initiation, flowering and induced parthenocarpy?  
(a) Gibberellin (b) Auxin  
(c) Cytokinin (d) Ethylene
3. With what type of mounting does a sprinkler irrigation network give the best results?  
(a) Revolving Sprinkler Heads (b) Nozzles  
(c) Open Pipes (d) Pipes with holes near the crop
4. In Lemon and China rose plants, which method of artificial propagation is used?  
(a) Cuttings (b) Layering  
(c) Grafting (d) Tissue Culture
5. Which is not applicable to vegetative propagated plants  
(a) To get true to type plants (b) To protect an elite quality  
(c) To conserve a plant (d) To get a new type of plant
6. Burning of fossil fuels result in  
(a) increased oxygen level (b) increases greenhouse gases  
(c) decreases greenhouse gases (d) increased ethane level
7. Roots of a plant in hydroponics are submerged in a solution of dissolved by  
(a) fertilizers (b) oxygen  
(c) mineral salts (d) chemicals

8. A good substitute for sand, this material provides aeration in the root media.
- (a) peat moss (b) perlite  
(c) vermiculite (d) rock wool
9. Vegetable garden rows should be planted running east and west, if possible, to:
- (a) keep in the direction of the prevailing wind  
(b) prevent shading  
(c) assure that the rows are in a correct compass orientation  
(d) keep disease spread at a minimum
10. How do forests influence the climate of a place?
- (a) Modify local climate (b) Control wind force and temperature  
(c) Cause rainfall (d) All the above
11. How do forests increase the atmosphere's humidity?
- (a) By transpiration (b) By inspiration  
(c) By expiration (d) By oxidation
12. National Biodiversity Authority is located at
- (a) Chennai (b) New Delhi  
(c) Nagpur (d) Gurgaon
13. Which of the following is not the best way to fight a forest fire?
- (a) Evacuate from the forest surrounding places  
(b) Not using water as a fire suppression tool  
(c) Deploy suppressant foam
14. Which of the following is not a type of non-probability sampling?
- (a) Quota sampling (b) Convenience sampling  
(c) Snowball sampling (d) Stratified random sampling
15. Which of the following is not a principle of remote sensing?
- (a) Interaction of energy with satellite (b) Electromagnetic energy  
(c) Electro-magnetic spectrum (d) Interaction of energy with atmosphere

**PART – B (2 × 5 = 10 marks)**

**Answer ANY TWO questions.**

16. Discuss the preparation of organic manure.

17. Write a detailed note on the greenhouse.

18. Give a note on the objectives of kitchen garden its Importance.
19. Discuss the Biological Diversity Act 2002 helpful in the conservation of flora and fauna?
20. Shortly explain the methods of sampling.

**PART – C - (5 × 10 = 50 marks)**

**Answer ALL the questions.**

21. a) Explain the types of bio-fertilizer in horticulture and their applications.

Or

- b) Discuss detailed methods and the importance of water irrigation.

22. a) Explain the various artificial methods of plant propagation

Or

- b) Write a note on the guidelines of nursery management.

23. a) Describe the prospects of Indian floriculture.

Or

- b) Explain the different types of hydroponic methods.

24. a) Explain how forests help in maintaining ecological balance.

Or

- b) Write an account of the different types of forest in India.

25. a) Write on the vegetation affecting forests in the forest.

Or

- b) Briefly explain the principles and structure of remote sensing its applications.

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**MODEL QUESTION PAPER**

For the candidates admitted from 2021–2022 onwards)

M.Sc. DEGREE EXAMINATION,

Third Semester

Botany

ELECTIVE COURSE - III

**PLANT BIOTECHNOLOGY AND GENETIC ENGINEERING**

**Time: Three hours.**

**Maximum: 75 marks**

**PART – A (15 × 1 = 15 marks)**

**Answer ALL questions**

- The formation of embryoids from the pollen grains in the tissue culture medium is due to  
(a) Organogenesis. (b) Test tube culture  
(c) Double fertilization (d) Cellular totipotency
- Which of the following is the main application of embryo culture?  
(a) Clonal propagation. (b) Production of embryoids  
(c) Induction of somaclonal variations. (d) Overcoming hybridisation barriers
- Selection of culture media depends on  
(a) Type of plant species used (b) Time for preparation of culture media  
(c) Cost for preparation (d) Maintenance of culture media
- The phenomenon of the reversion of mature cells to the meristematic state leading to the formation of callus is known as  
(a) redifferentiation. (b) dedifferentiation  
(c) both (a) & (b). (d) none of the above
- Which of the following mediums is composed of chemically defined compounds?  
(a) Natural media (b) Artificial media  
(c) Synthetic media (d) None of the above
- Which breeding method uses a chemical to strip the cell wall of plant cells of two sexually incompatible species?  
(a) Mass selection (b) Protoplast fusion  
(c) Transformation (d) Transpiration

7. The DNA molecule to which the gene of insert is integrated for cloning is called
- (a) carrier (b) transformer  
(c) vector (d) none of these
8. Which of the following bacterial genomes was sequenced first?
- (a) *Escherichia coli* (b) *Streptococcus pneumoniae*  
(c) *Haemophilus influenzae* (d) *Streptococcus thermophilus*
9. All the statements are true regarding RFLP and RAPD except
- (a) RAPD is a quick method compared to RFLP  
(b) RFLP is more reliable than RAPD  
(c) Species specific primers are required for RAPD  
(d) Radioactive probes are not required in RAPD
10. *Agrobacterium* based gene transfer is efficient
- (a) only with dicots. (b) only with monocots  
(c) with both monocots and dicots. (d) with majority monocots and few dicots
11. The physical method for direct transfer of genes
- (a) PEG mediated. (b) Dextran mediated  
(c) Calcium mediated (d) Liposome fusion
12. The part of the bacterial plasmid incorporated in the plant genome includes
- (a) Virulence region (b) T DNA, 25 base pair repeats  
(c) Entire plasmid (d) Only T-DNA
13. RNAi is a mechanism to silence genes with the help of
- (a) ssRNA (b) dsRNA  
(c) ssDNA (d) dsDNA
14. The international agreement for all World Trade Organization countries by TRIPS. The agreement is
- (a) Maximum Standards for protection of intellectual property  
(b) Sets minimum standards for intellectual property protection  
(c) Basic standards  
(d) Basic Limitations
15. Various measures taken to prevent any risks to normal organisms from transgenic organisms are known as
- (a) biosafety (b) patent  
(c) bio-patent (d) bio-piracy

**PART – B (2 × 5 = 10 marks)**

**Answer ANY TWO questions.**

16. Write the objectives of plant tissue culture.
17. Discuss the somatic embryo formation in *in-vitro* condition.
18. Give notes on the principle of polymerase chain reaction with their application.
19. Discuss in detailed about the nif genes.
20. Explain the role and function of WIPO.

**PART – C (5 × 10 = 50 marks)**

**Answer ALL the questions.**

21. a) Explain the sterilization methods in plant tissue culture.  
Or  
b) Write briefly the Murashige and Skoog medium preparation.
  22. a) Briefly explain the isolation methods of protoplast culture.  
Or  
b) Write a detailed about the production of artificial seed.
  23. a) Explain the principle and methods of rDNA technology with their applications.  
Or  
b) Write an account on the northern blotting technique.
  24. a) Briefly discuss the methods of gene transfer in plants.  
Or  
b) Discuss the mechanism of edible vaccines.
  25. a) Explain the objectives and process of the patent system.  
Or  
b) Write an account on the principles and concepts of biosafety.
-

**MODEL QUESTION PAPER**

(For the candidates admitted from 2021–2022 onwards)

M.Sc. DEGREE EXAMINATION,

Fourth Semester

Botany

CORE COURSE - XIII

**ECOLOGY, CONSERVATION BIOLOGY AND PHYTOGEOGRAPHY**

**Time: Three hours**

**Maximum: 75 marks**

**PART - A (15 × 1 = 15 marks)**

**Answer ALL questions**

1. The ability of individual of population to produce new individual called as
  - a) Realized mortality
  - b) natality
  - c) migration
  - d) Vitality
2. Study of relationship between communities and environment is called
  - a) autecology
  - b) synecology
  - c) ecology
  - d) ethnology
3. Geographic limit within which a population exists is called
  - a) Biome
  - b) ecosystem
  - c) niche
  - d) habitat
4. Organisms which break down dead or waste matter into simpler substances is termed as
  - a) producers
  - b) consumers
  - c) decomposer
  - d) scavengers
5. The rate of storage of organic matter not used by heterotrophs is called as
  - a) Net productivity
  - b) Net community productivity
  - c) Gross primary productivity
  - d) Secondary productivity
6. Which following one is a sedimentary cycle?
  - a) Nitrogen cycle
  - b) carbon cycle
  - c) Phosphorus cycle
  - d) water cycle
7. UV light reacts with oxide of nitrogen called as
  - a) London smog
  - b) Los angel smog
  - c) smog
  - d) fumes

8. Which one following responsible for Antarctic ozone hole
  - a) Polar stratospheric cloud
  - b) Cfc
  - c) carbon monoxide
  - d) chlorine nitrate
9. Carbon stored in coastal and marine ecosystem called as
  - a) gas carbon
  - b) blue carbon
  - c) lamp black
  - d) white" carbon
10. Which of the following was India's First Biosphere Reserves?
  - a) Sunderbans
  - b) Nanda Devi
  - c) Nilgiri
  - d) Pachmarhi
11. Which one of the following is the marine biosphere reserve in India?
  - a) Great nicobar biosphere reserve
  - b) Gulf of mannar biosphere reserve
  - c) Simlipal biosphere reserve
  - d) Sundarbans biosphere reserve
12. The 'Chipko Movement' is related to \_\_\_\_
  - a) Forest conservation
  - b) deforestation
  - c) wildlife preservation
  - d) protect the water resources
13. Plant or animal are occurring in all regions of the tropics called as
  - a) circumboreal
  - b) pantropical,
  - c) endemic
  - d) cosmopolitan
14. A taxon is evolutionarily young and not yet spread over the new area called as
  - a) Palaeo-endemism
  - b) Neo endemism
  - c) epibiotic
  - d) Holoendemics.
15. Who proposed the theory of continental drift
  - a) Alfred Wegener
  - b) Taylor
  - c) Georges Lemaître
  - d) John Christopher Willis

**PART - B (2 × 5 = 10 marks)**

**Answer ANY TWO questions.**

16. Give short account on population growth curve
17. Explain the grazing food with suitable example
18. Write a detail notes management of air pollution in India
19. List out the national park in India
20. Give short notes on hotspot region in India

**PART - C (5 × 10 = 50 marks)**

**Answer ALL questions.**

21. a) Write a detailed account on population characteristics.

Or

b) Explain the positive and negative interaction species with suitable examples.

22. a) Write a detailed account on Ecological pyramids.

Or

b) Explain the carbon cycle and significance.

23. a) Discuss the water pollution causes, effects and control measures.

Or

b) Explain the Kyoto Protocol climate agreement.

24. a) Describe the in situ conservation methods.

Or

b) Give an outline of biological diversity Act -2002

25. a) Write an essay on the Phytogeographic region of India.

Or

b) Explain Willis age and area hypothesis

**MODEL QUESTION PAPER**

(For the candidates admitted from 2021–2022 onwards)

M.Sc. DEGREE EXAMINATION,

Fourth Semester

Botany

CORE COURSE – XIV

**BIOINSTRUMENTATION, RESEARCH METHODOLOGY, BIOSTATISTICS AND  
BIOINFORMATICS**

**Time: Three hours**

**Maximum: 75 marks**

**PART - A (15 × 1 = 15 marks)**

**Answer ALL questions**

1. The total amount of light that is captured
  - a) focus
  - b) aperture
  - c) exposure
  - d) shutter speed
2. The amount of light absorbed is directly proportional to the concentration of the solute in the solution.
  - a) Beer's Law
  - b) Lambert's Law
  - c) Beer-Lambert's law
  - d) extinction coefficient
3. NMR spectroscopy is used for determining structure in which of the following materials?
  - a) Radioactive materials
  - b) Insoluble chemical compounds
  - c) Liquids
  - d) Gases
4. Differential centrifugation is based on the differences in \_\_\_\_\_ of biological particles of different \_\_\_\_\_
  - a) Size, density
  - b) Sedimentation rate, size and density
  - c) size, structure
  - d) mass, size
5. What does the electrophoresis apparatus consist of
  - a) Gel, buffer chamber and fire pack
  - b) Buffer chamber and electrophoresis unit
  - c) Electrophoresis unit and gel separator
  - d) Power pack and electrophoresis unit
6. Which chemical present in glass electrodes is?
  - a) Ag/AgCl
  - b) Hg<sub>2</sub>Cl<sub>2</sub>
  - c) Hcl
  - d) buffer solution

7. A preliminary study that is insufficiently complete to merit publication as a full research article.
- a) Short communication journal                      b) full-length article  
 c) Review paper    d) Synopsis
1. The data collected by researchers directly from main sources through interviews, Surveys, experiments called as
- a) Secondary data    b) primary data  
 c) qualitative    d) quantitative data
2. A detailed written study of a single specialized subject called as
- a) monographs    b) synopsis  
 c) bibliography    d) autobiography
10. Standard deviation
- a) The square root of variance  
 b) measured using the unit of the variable  
 c) Measured using the squared unit of the variable  
 d) Values generally comparable with the average value
11. Find the mode in the following data set
- 11, 12, 13, 14, 14
- a) 11    b) 12.8  
 c) 13    d) 14
12. The most frequently occurring value of a data set is called the
- a) Range    b) Mode  
 c). Mean    d) median
13. The term bioinformatics was coined by
- a) JD Watson    b) Margaret Dayhoff  
 c) Pauline Hogeweg    d) Frederic Sanger
14. The first published complete gene sequence was of
- a) M13 phage    b) T<sup>4</sup> phage  
 c) o X174    d) Lambda phage
15. The process of finding relative location of genes on chromosomes called as
- a) gene tracing    b) genome mapping  
 c) genome walking    d) chromosome walking

**PART - B (2 × 5 = 10 marks)**

**Answer ANY TWO questions.**

16. Give short note principles of photography.
17. Discuss the principle and application of paper chromatography.
18. What are the components of a research article? Discuss.
19. What is tabulation? Discuss the types of Tabulation.
20. Give short notes on DDBJ.

**PART C — (5 × 10 = 50 marks)**

**Answer ALL questions.**

21. a) Discuss the main components and function mechanism of a UV VIS spectrophotometer.

Or

- b) Explain structure and function of atomic absorption spectroscopy.

22. a) Write a detailed account on Agarose Gel Electrophoresis.

Or

- b) Explain the working mechanism of the pH meter.

23. a) What do you mean by plagiarism explained with the help of an example?

Or

- b) What are the components to writing a review paper? Discuss.

24. a) Calculate the mean deviation about median and compare the variability of the two series X and Y:

X: 725 700 750 675 725 625 675 800 625 725 700 725 675

Y: 575 625 600 575 675 600 650 575 625 550 680 550 560

Or

- b) Define relative measures of dispersion. Find the coefficient of variation of the data

43 32 60 12 8 4 1

25. a) Explain FASTA along with its steps.

Or

- b) Discuss the importance of biological databases in bioinformatics.

**MODEL QUESTION PAPER**

(For the candidates admitted from 2021–2022 onwards)

M.Sc. DEGREE EXAMINATION

FOURTH SEMESTER

Botany

ELECTIVE COURSE - IV

**PHYTOCHEMISTRY AND DRUG DEVELOPMENT**

**Time: Three hours**

**Maximum: 75 marks**

**PART - A (15 × 1 = 15 marks)**

**Answer ALL questions**

1. \_\_\_\_\_ first person to isolate an active ingredient associated with a medicinal plant
  - a) Wilhelm F
  - b) Caventou J
  - c) Pelletier PJ
  - d) Croteau
2. Which of the following is NOT the class of secondary metabolites?
  - a) Amino acids
  - b) Terpenes
  - c) Phenolics
  - d) Alkaloids
3. Beta-carotene, a plant pigment falls under which of the following classes of terpenes?
  - a) Triterpenes
  - b) Teteraterpenes
  - c) Diterpenes
  - d) Polyterpenes
4. What is the shikimate pathway in plants?
  - a) Synthesis of aromatic amino acids
  - b) synthesis of glutamate,
  - c) methionine
  - d) proline
5. Anti-cancer drug obtained from
  - a) *Taxus baccata*
  - b) *Withonia somnifera*
  - c) *Curculigo orchioides*
  - d) *Ephedra*
6. \_\_\_\_\_ is responsible for tomatoes' red color.
  - a) Anthocyanins
  - b) Lycopene
  - c) flavonoids
  - d) isothiocyanates
7. What does shatavari mean?
  - a) *Nerium oleander*
  - b) *Panax quinquefolius*
  - c) *Asparagus racemosus*
  - d) *Dioscorea spp.*



**PART - C (5 × 10 = 50 marks)**

**Answer ALL questions.**

21. a) Write a detailed account on properties, classification and function of alkaloids.

Or

b) Give a detailed account on classification and properties of terpenoids.

22. a) Explain the Acetate-Mevalonate pathway.

Or

b) Discuss the application of phytochemicals in the food, flavor and cosmetic industry.

23. a) Give a detailed account on biological source, uses, chemical constituents of gum and gum yielding plants.

Or

b) Write an essay on properties, biological sources and uses of tannin.

24. a) Discuss the method used qualitative screening of phytochemical compounds.

Or

b) Explain any two method used for characterization of phytochemical compound

25. a) Give a detailed account on various types' classification of crude drugs.

Or

b) Explain the Evaluation of Crude.

**MODEL QUESTION PAPER**

(For the candidates admitted from 2021–2022 onwards)

M.Sc. DEGREE EXAMINATION

SECOND SEMESTER

EXTRA DISCIPLINARY COURSE – I

**HORTICULTURE**

**Time: Three hours**

**Maximum: 75 marks**

**PART – A (15 × 1 = 15 marks)**

**Answer all questions**

1. A green manure is
  - a) Maize
  - b) Rice
  - c) sesbania
  - d) sorghum
2. Micro irrigation also called
  - a) localized irrigation
  - b) flood irrigation
  - c) nano irrigation
  - d) petite irrigation
3. Brown manuring refer to application
  - a) oil cake
  - b) farm yard manure
  - c) vermicompost
  - d) fertilizer
2. Which of following method is commonly practiced for root induction
  - a) cutting
  - b) layering
  - c) grafting
  - d) budding
5. In grafting, the rooted plant is called the stock ,the stem cutting donor plant is called
  - a) Transplant
  - b) scion
  - c) bud graft
  - d) root stock
6. Name a method in which the cut stems of two different plants are joined together to grow as a single plant?
  - a) Layering
  - b) Grafting
  - c) Cutting
  - d) budding
7. In a formal garden the imaginary central line is known as
  - a) edges
  - b) axis
  - c) focal point
  - d) hedges



**PART - C (5 × 10 = 50 marks)**

**Answer ALL questions.**

21. a) Write a detailed account on the importance and scope of horticulture.

Or

b) Discuss the nursery bed preparation and maintenance.

22. a) Write about types of grafting and its application.

Or

b) Discuss the role of tissue culture in horticulture plants.

23. a) Give a detailed account on designing outdoor gardens.

Or

b) Describe the bonsai techniques.

24. a) Write a detailed account of cultivation of rose and chrysanthemum.

Or

b) Discuss the types and importance of floral decoration.

25. a) Classify the vegetable crop with suitable examples.

Or

b) Write a detailed account of cultivation of tomato and snake guard.

**MODEL QUESTION PAPER**

(For the candidates admitted from 2021–2022 onwards)

M.Sc. DEGREE EXAMINATION

SECOND SEMESTER

EXTRA DISCIPLINARY COURSE - II

**HERBAL BOTANY**

**Time: Three hours**

**Maximum: 75 marks**

**PART - A (15 × 1 = 15 marks)**

**Answer ALL questions**

1. Ayurveda recognizes five essential elements of nature. Air, earth, fire and water are four of them; which is the fifth element?
  - a) Metal
  - b) Space
  - c) Leeloo
  - d) Oil
2. Who is traditionally regarded as the founder of Ayurveda?
  - a) Kamadhenu
  - b) Shri Laxmi
  - c) Airavata
  - d) Dhanvantari
3. Naturopathy refers to
  - a) Medical treatments based on spinal manipulation to achieve proper alignment.
  - b) The principle of "like cures like."
  - c) An alternative medical system from India.
  - d) Creating a process that promotes the body's ability to heal itself.
4. Which one of the following is classified as an organized crude drug?
  - a) Resin
  - b) leaves
  - c) alkaloid
  - d) opium
5. Identify the drug packed in kerosene tin
  - a) *Aloe*
  - b) *Asafetida*
  - c) *Colophony*
  - d) *Ergot*
6. Plants like *Aegle marmelos*, *Ocimum sanctum* and *Ficus religiosa* are a group of plants designated as
  - a) Traditional food crops
  - b) sacred species of plants
  - c) medicinal plant species
  - d) lesser know food plants



**PART - B (2 × 5 = 10 marks)**

**Answer ANY TWO questions.**

16. Give a short account on Siddha medicine.
17. Explains the processing of crude drugs.
18. Write botanical name, bioactive compound and application of Nithyakalyani.
19. Write a short account on herbal food products.
20. Discuss the herbal beautifying preparation.

**PART – C (5 × 10 = 50 marks)**

**Answer ALL questions.**

21. a) Write a detailed account on WHO regulation of herbal medicine.  
Or  
b) What are the principles of homeopathy? List any three homeopathic medicines.
22. a) Write an essay on classification of crude drugs.  
Or  
b) Discuss the conservation of medicinal plants.
23. a) Describe the bio active compound, botanical name and application of crude drug from rhizome.  
Or  
b) Describe the bio active compound, botanical name and application of crude drug from whole plants.
24. a) Write a detailed account on herbal concoctions and application.  
Or  
b) Write an essay on ethnic groups in Tamil Nadu.
25. a) Give a detailed account of herbal hair care preparation.  
Or  
b) Describe the cosmetic formulations of herbal skin care and sunscreen products.

**MODEL QUESTION PAPER**

(For the candidates admitted from 2021–2022 onwards)

SEMESTER –II

CORE COURSE - IV

**PRACTICAL –I (Covering Course I & II)**

**(ALGAE, FUNGI, LICHENS, BRYOPHYTES, PTERIDOPHYTES,  
GYMNOSPERMS AND PALEOBOTANY)**

Time: 4 Hrs.

**Max. Marks: 60 marks**

**Practical: 50 marks**

**Record: 05 marks**

**Viva – Voce: 05 marks**

1. Make suitable micro preparations of **A, B, C, D** and **E**. draw and identify, give the reasons, Submit the slides for valuation 5 × 4 = 20 marks
2. Make suitable micro preparations of **F** and **G**. draw and identify, give the reasons, Submit the slides for valuation 2 × 5 = 10 marks
3. Name the group ,species of any two algae from the given algal mixture **H** 2 × 3= 6 marks
4. Name the genus and group of the given specimens **I, J, K, L, M, N** 6 ×2 =12 marks
5. Identify and write notes on economic importance of **O** 2 marks

**Key:**

Q.No	Specimen	Marks Distribution	Total marks
1.	A. Algae B. Fungi C. Bryophytes D. Pteridophytes E. Gymnosperms	Each sub question carry 4 mark, Preparation -1, Identification -1 Diagram -1, Reason -1 mark	4×5=20 marks
2.	Reproductive parts of F. Pteridophytes G. Gymnosperms	Each sub question carry - 5 mark, Preparation -1, identification -1, Diagram -1, Reason -2 mark	5×2=10 Marks
3.	H. Mixture of three micro algae	Identification group – 1 mark, Identification species – 1 mark, Diagram – 1 mark	2×3= 6 marks
4.	Macroscopic part / Slide of I. Bryophytes J. Pteridophytes K. Gymnosperms L. Fungi M. Lichens N. Fossil	Each sub question carry - 2 marks Identification group – 1 mark, Genus - 1 mark	2×6= 12 marks
5.	O. Any algae or fungi product	Identification -1 mark, Uses – 1 mark	2 mark

**Note:**

- Submission of minimum 15 herbarium sheets from Algae / Fungi / Lichens / Bryophytes / Pteridophytes / Gymnosperms (during the internal practical examination).
- Field trip to a hill station and coastal area for a minimum period of five days for the
- Collection of specimens and to study the plants in their natural habitat.
- Certified record work done in the laboratory during practical classes

**MODEL QUESTION PAPER**  
(For the candidates admitted from 2021–2022 onwards)

SEMESTER –II

CORE COURSE – VIII

Practical –II (Covering Course III & V)

**(TAXONOMY OF ANGIOSPERMS AND ECONOMIC BOTANY &  
MICROBIOLOGY AND PLANT PATHOLOGY)**

Time: 4 Hrs.

**Max. Marks: 60 marks**

**Practical: 50 marks**

**Record: 05 marks**

**Viva – Voce: 05 marks**

- |   |  |                 |
|---|--|-----------------|
| 1 | Find out the binomials of <b>A</b> and <b>B</b> .  | 3 x 2 = 6marks  |
| 2 | Refer specimens <b>C</b> and <b>D</b> to their respective families; give the reasons at each level of hierarchy. | 4 x 2 = 8marks  |
| 3 | Construct a key using <b>E, F, G, H, I</b> and <b>J</b> .  | 6 marks         |
| 4 | Mention the family, genus and species of <b>K</b> and <b>L</b>   | 3 x 2 = 6 Marks |
| 5 | Write the economic importance of plants <b>M</b> and <b>N</b> .  | 2 x 2=4marks    |
| 6 | Determine whether the given sample <b>O</b> is contaminated with bacteria or not. leave sample for valuation     | 4 marks         |
| 7 | Perform the gram staining to identify the given bacterial sample <b>P</b>  | 5 marks         |
| 8 | Name the causal organism, disease symptoms and control measures of the given specimen <b>Q</b>                   | 3 marks         |
| 9 | Write notes <b>R, S, T &amp; U</b>   | 4 x 2 = 8 marks |

**Key:**

<b>Q.No</b>	<b>Specimen</b>	<b>Marks Distribution</b>	<b>Total marks</b>
1.	A & B - Families prescribed in the syllabus	Each sub question carry - 3 mark, Genus, species, author citation and page number in flora	3x2=6 marks
2.	C & D - Flowering plants from families prescribed in the syllabus.	Taxonomical hierarchy – 2 marks, Reasons – 2 marks	4x2=8 marks
3.	E, F, G, H, I & J - Flowering twigs.	Construct the dichotomous key	6 marks
4.	K & L – Plants given in practical syllabus	Family – 1mark, Genus – 1 mark, Species -1 marks	3x2=6 marks
5.	M & N - Economic importance of plants mentioned in syllabus	Name of plant -1 mark, Edible part & uses -1 marks	2x2=4 marks
6.	O - Using milk by methylene blue reductase (MBRT)	Procedure – 2 marks, Identification – 1 marks, Submission -1 marks	4 marks
7.	P - Milk/ Curd,/Root nodules / hay water	Procedure – 3 marks, Identification – 1 marks, Submission -1 marks	5 marks
8.	Q – infected plant specimen specified in the syllabus	causal organism – 1 mark, disease symptoms – 1 mark, control measures -1 mark	3 mark
9.	R, S, T & U Spotters from microbiology (Equipment's /Instruments/Chemicals/culture)	Identification -1 mark, Reason – 1 mark	4x2=8 marks

**MODEL QUESTION PAPER**

(For the candidates admitted from 2021–2022 onwards)

SEMESTER –II

CORE COURSE - IX

**PRACTICAL – III (Covering Course VI & VII)**

**ANATOMY OF ANGIOSPERMS, PLANT MICROTECHNIQUE, EMBRYOLOGY  
OF ANGIOSPERMS, CELL BIOLOGY, GENETICS AND MOLECULAR BIOLOGY**

Time: 4 Hrs.

**Max. Marks: 60 marks**

**Practical: 50 marks**

**Record: 05 marks**

**Viva – Voce: 05 marks**

- |   |   |              |
|---|---|--------------|
| 1 | Cut transverse section of 'A'. Identify the anomaly by giving reasons. Draw labeled sketches and submit the slides for valuation                    | 6 marks      |
| 2 | Macerate 'B', identifies the elements and measures the length or breadth using a Micrometer.  | 6 marks      |
| 3 | Dissects and displays any two stages of embryo in 'C' mention the stage, Submit the slides for valuation.   | 6 marks      |
| 4 | Prepare a smear of the given flower bud D and identify any two stages of microsporogenesis. Draw labeled sketches. Submit the slides for valuation. | 6 marks      |
| 5 | Prepare a squash of 'E'. Display any two stages of cell divisions. Draw labeled sketches  | 4 marks      |
| 6 | Construct a chromosome map; calculate interference and coefficient of variation from three point test cross data given in 'F'.                      | 8 marks      |
| 7 | Solve the genetic problem 'G' and 'H'   | 2x3=6 mark   |
| 8 | Write notes of interest on 'I, J, K and L'  | 2 x 4=8 mark |

**Key:**

Q.No	Specimen	Marks Distribution	Total marks
1.	A - Stem showing anomalous growth, prescribed in the syllabus	Preparation -1, Identification -1  Diagram -2, Reason -2 mark	6 marks
2.	B - macerate wood specimen given in practical syllabus	Preparation - 2, Measurement, calculation and result -4 mark,	6 marks
3.	C - Dissect embryo from <i>Tridax</i> flower	Submission any two stage 2×2 =4 Diagram -2	6 marks
4.	D - flower bud onion or Rhoec	Submission any two stage -2×2 =4 Diagram -1	6 marks
5.	E - onion root tip	Submission any two stage 2×2 =4 Diagram -2	6 marks
6.	F - Three point test cross data	Find out distance -3 marks, Gene order -2 mark, Construct the chrome map -2 mark	7 marks
7.	G & H - Genetic problem given in the practical	Phenotype/genotype ratio 2×3=6	6 marks
8.	Spotters (Slide/ Chemical/ Instrument I - Anatomy J – Microtechnique K - Embryology L - Cell biology L.- Molecular biology	Each sub question carry 1 mark, Identification -1 mark  5×1=5	5 mark

**Note:**

- Submission of 5 double stained permanent slides (Microtome or free hand sections – 2, Cleared material - 1, Peel – 1 and Maceration - 1).
- Certified record work done in the laboratory during practical classes.

**MODEL QUESTION PAPER**

(For the candidates admitted from 2021–2022 onwards)

SEMESTER –IV

CORE COURSE - XII

**PRACTICAL - IV (Covering Course X and XI)**

**PLANT PHYSIOLOGY, BIOPHYSICS, BIOCHEMISTRY AND NANO  
BIOTECHNOLOGY**

.Time: 4 Hrs

**Max. Marks: 60 marks**  
**Practical: 50 marks**  
**Record: 05 marks**  
**Viva – Voce: 05 marks**

- 1 Conduct the physiological experiment **A** Assigned to you.  
Record your observation and interpret the Results .Leave the set  
up for valuation. 10 marks
- 2 Comment on the setup **B**. 6 marks
- 3 Writes notes of physiological/Biophysics interest of **C, D, E** 3x3= 9 marks
- 4 Conduct the Biochemistry experiment (**F**) assigned to you. 10 marks  
Record your results. Leave the set up valuation
- 5 Comment on the setup **G** 6 marks
- 6 Write notes of Biochemistry/Nan biotechnology interest **H, I, J** 3x3=9 marks

**Key:**

<b>Q.No</b>	<b>Experiment / Spotters</b>	<b>Marks Distribution</b>	<b>Total marks</b>
1.	<b>A.</b> Draw lots from the list of physiology experiments provided in syllabus	Principle – 2 marks, Procedure – 3 mark, Material & Methods – 2, marks, Results – 2, Comments/ Interpretation – 1 marks	10 marks
2	<b>B-</b> Physiology experiment setup provided in syllabus	Identification -1 mark, principle–1, Reason -3 marks, Diagram -1 mark	6 marks
3	Plant physiology & Biophysics Charts/Figures/Graphs/tables/Instruments/Apparatus, Chemicals/Models/photographs <b>C, D &amp; E</b>	Identification -1 marks, Reason-2 mark	3×3=9 marks
4	<b>F.</b> Draw lots from the list of Biochemistry experiments provided in syllabus	Principle – 2 marks, Procedure – 3, mark, Material & Methods – 2 marks, Results – 2, Comments/ Interpretation – 1 marks	10 marks
5	<b>G-</b> Biochemistry experiment setup provided in syllabus	Identification -1 mark, principle-1, Reason -2 marks, Diagram -1 mark	6 marks
6	Plant physiology & Biophysics Charts/Figures/Graphs/tables/Instruments/Apparatus, Chemicals/Models/ photographs <b>H, I &amp; J</b>	Identification -1 marks, Reason -2 mark	3×3=9 marks

**MODEL QUESTION PAPER**

(For the candidates admitted from 2021–2022 onwards)

SEMESTER –IV

CORE COURSE – XV

**PRACTICAL - V (Covering Course - XIII & XIV)**

**ECOLOGY, CONSERVATION BIOLOGY AND PHYTOGEOGRAPHY,  
BIOINSTRUMENTATION, RESEARCH METHODOLOGY, BIostatISTICS AND  
BIOINFORMATICS**

Time: 4 Hrs

**Max. Marks: 60 marks**

**Practical: 50 marks**

**Record: 05 marks**

**Viva – Voce: 05 marks**

1. Find out the abundance, frequency and density of species from the vegetation given as **A** by using quadrat method. Record your observation and interpret the results 10 marks
2. Determine the content of the given Sample **B** 7 marks
3. **C.** verify Beer-Lambert Law using the given solution or Determine the pH of given sample using pH meter. Record your observation and interpret the results 7 marks
4. Separate and identify the compound in given sample **D** using TLC or paper chromatography 5 marks
5. For the given data **E** perform student “t’ test and prove the statement 5 marks
6. Workout the problem **F**, find out mean , mode , standard deviation 6 marks
7. Comment on Ecology interest **G, H, I , J & K** 10 Marks

**Key:**

Q.No	Experiment / Spotters	Marks Distribution	Total marks
1.	A. Meter quadrat	Presentation of data in table form – 5 mark, Abundance – 1, Frequency – 1 Density - 1 mark, interpretation – 2 marks	10 marks
2	B. Draw lots from the list of Ecology experiments provided in syllabus	Principle and procedure – 3 mark, calculation – 2 mark, Results – 2 mark	7 marks
3	C. Cu So <sub>4</sub> / k <sub>2</sub> cr <sub>2</sub> o <sub>7</sub> solution/Water sample for pH	Principle and procedure– 3 mark, Presentation of data – 2 marks, Results – 2	7 marks
4	D. Amino acid/ sugar/pigments	Principle and procedure – 3 mark, Results – 2	5 marks
5	E. Provide the statistical data	Calculation – 3 marks, Results, interpretation - 2 marks	5 marks
6	F. Provide seeds or leaves sample (50 number)	Mode – 2 mark, Mean – 2 mark, Standard division – 2 marks	6 marks
<b>Spotters</b>			
	G. - Ecology		
7	H. - Phytogeography	Identification and reason - 2 marks	5×2=10 marks
	I. - Bioinstrumentation		
	J. - Research Methodology		
	K. - Bioinformatics		