

**SRI DHARMASTHALA MANJUNATHESHWARA COLLEGE, UJIRE-574240**

**(Autonomous)**

**(Re-Accredited by NAAC at 'A' Grade with CGPA 3.61 out of 4)**



# **DEPARTMENT OF BOTANY**

*Syllabus of*  
**Bachelor's Degree in  
Botany**

**(CREDIT BASED SEMESTER SCHEME)  
2016 - 2017 onwards.**

**Approved by the :BOS meeting held on 4<sup>th</sup> Sept. 2015  
Approved by the Academic Council meeting, held on 05.03.2016**



## BOTANY AS A DISCIPLINE

Botany is the scientific study of plants that deals with the structure, function, classification, distribution, evolution, reproduction and economic applications of plants ranging from Algae to Angiosperms. Plants are the unique organisms capable of trapping solar energy and preparing food and providing energy for all heterotrophic organisms. It is fascinating to study the wide spectrum of reproductive processes in Algae, Fungi, Lichens, bryophytes, Fern allies, Gymnosperms and flowering plants. A student of botany has been learning taxonomy, anatomy, physiology, ecology, cytogenetics, plant breeding and biotechnology through various course curricula. Even the molecular aspects of the plants and mechanism of pathogenesis & disease resistance are studied with due importance. A student of botany appreciate the vastness of biodiversity and ecological interactions of the plants. The subject Botany provides a comprehensive knowledge of Flora and helps us to understand the current and future threats to our native plants, ecosystems and sustainability of agricultural and horticultural crops. The study of plants no doubt enthuses and inspires young minds to appreciate the beauty and diversity of organisms with a particular reference to the plants. The laboratory and the field studies surely paves path to continue their studies in interdisciplinary subjects.

### Course Objectives

- To make the students to appreciate the beauty and wondrous of diversity of flora.
- To make the students to understand the importance of plants to mankind in diverse capacities
- To understand the biodiversity, structure, form, function and ecological significance of plants and their biological services.
- To train young minds in exploration, identification, evaluation and assessment of plants by laboratory and field studies.
- To study the significance of conservation of nature and natural resources and conservation strategies of endangered plant species.
- To attract, enthuse, sustain and promote the interest of learners for selecting plant sciences.



- To update course contents by introducing a good measure recent development in plant sciences.
- To provide mobility of students among institutions and different disciplines.
- To inculcate the habit of perceiving the subject from the research and analytical view point.
- To empower the students with skill based knowledge and encourage for advanced studies in the same discipline as well as inter disciplines.

### PAPER DESCRIPTION

Semester	Paper	Title
ISem.	PAPER – I	Viruses, Bacteria and Algae Viruses, Bacteria and Algae – Practicals
II Sem.	PAPER - II	Mycology, Plant pathology, Lichens and Bryophyta Mycology, Plant Pathology, Lichens and Bryophyta - Practicals
III Sem.	paper-III	Pteridophyta, Gymnospermae and Angiosperm Embryology. Pteridophyta, Gymnospermae and - Angiosperm Embryology - Practicals
IV Sem.	PAPER-IV	Morphology of Angiosperms, Taxonomy and Economic Botany Morphology of Angiosperms, Taxonomy and Economic botany – Practicals
V Sem	PAPER- V	Plant Physiology – I and Ecology - I Plant Physiology – I and Ecology- I - Practicals
	PAPER-VI	Cell biology, Molecular Biology and Genetics Cell biology, Molecular Biology and Genetics – Practicals
VI Sem	PAPER-VII	Plant physiology –II and Ecology- II Plant physiology –II and Ecology – II - Practicals
	PAPER-VIII	Anatomy, Plant propagation, and Applied Botany Anatomy, Plant propagation and Applied Botany – Practicals



### SCHEME OF EXAMINATION

Sl.No	Semester	Paper	Credits	Marks		
				IA	Sem End	Total
1	ISem.	Theory Paper 1	2	20	80	100
		Practical paper I	1	10	40	50
2	II Sem.	<b>Theory Paper-II</b>	2	20	80	100
		Practical paper I	1	10	40	50
3	III Sem.	<b>Theory Paper-II</b>	2	20	80	100
		Practical paper I	1	10	40	50
4	IV Sem.	Theory Paper IV	2	20	80	100
		Practical paper IV	1	10	40	50
5	V Sem	Theory Paper V	2	20	80	100
		Practical paper V	1	10	40	50
		Theory Paper VI	2	20	80	100
		Practical paperVI	1	10	40	50
6	VI Sem	Theory Paper VII	2	20	80	100
		Practical paperVII	1	10	40	50
		TheoryPaper VIII	2	20	80	100
		Practical paperVIII	1	10	40	50
<b>Total</b>			<b>24</b>	<b>240</b>	<b>960</b>	<b>1200</b>



**I SEMESTER - Paper I**  
**VIRUSES, BACTERIA & ALGAE**  
**Teaching Hours : 03 per week**

**Rationale /Learning Objectives:**

- To study the diversity & distribution of microbes
- To appreciate the ultrastructure, reproductive features and mode of transmission of viruses & bacteria
- To study the plant diseases caused by microbes.
- To study the diversity distribution, thallus organization, reproduction and economic significance of Blue greens & algal representatives.
- To understand economic importance of lower cryptogams.

**UNIT – 1**

**VIRUSES** – Discovery, occurrence, nomenclature, morphology, chemical nature, replication, transmission, infectivity and symptoms of plant viral diseases with examples. A detailed account of **TMV** and **T4** Bacteriophage.

**MYCOPLASMA** – Nature, structure and reproduction; Sandal spike disease – symptoms and management.

**BACTERIA** – Discovery, distribution, morphology, nutrition, spore formation and reproduction- budding, fission, conjugation, transformation and transduction.  
Economic importance.

**CYANOBACTERIA** – General characteristics; thallus construction and reproduction of *Nostoc*.

Economic importance of Cyanobacteria with a special reference to *Spirulina*

**UNIT- 2**

**CHLOROPHYCEAE** – General characteristics of Chlorophyceae

Structure, reproduction and life cycle of *Volvox*, *Spirogyra*, *Oedogonium*, and *Chara*.



## UNIT – 3

**BACILLARIOPHYCEAE:** Structure and reproduction of **Pennate diatoms**

**PHAEOPHYCEAE:** Salient features of Phaeophyceae : Structure, reproduction and life cycle of *Sargassum*

Economic importance of Algae: as food, fodder, biofertilizers, industry, medicine and pollution indicators.

### VIRUSES, BACTERIA & ALGAE - PRACTICALS

(10 practicals of 3 hrs duration each, One practical per week)

1. Study of parts of compound microscope, method of using, care, cleaning and precautions
2. Study of Morphological types of **Bacteria**, Study of **root nodule Bacteria**
3. Simple staining of *Lactobacillus* by Methylene blue
4. Study of the type *Nostoc*.
5. Study of the type *Volvox*
6. Study of the type *Spirogyra*
7. Study of the type *Oedogonium* .
8. Study of the type *Chara*.
9. Study of the type **Pennate diatoms**
10. Study of the type *Sargassum*

#### Student Activities:

The students shall visit the nearby places for specimen collection.

- The students shall submit THREE specimens with field notes in a field note book during practical examination (the specimens should be from Viruses, Bacteria or Algae).
- Students should submit curriculum related assignments.

#### Books for Reference:

##### Basic reading

1. Kumar H.D.1990. Introductory Phycology, Affiliated East- West Press.
2. Lee R.E. 1980. Phycology, Cambridge Univ. Press
3. Luria S.E. et al 1978. General Virology 3 edition John Wiley & Sons
4. Mandahar C.L. 1987. Introduction to Plant viruses, S. Chand.
5. Nester W.E. et al 1983. Microbiology 3 edition John Wiley & Sons



6. Pandey S.N. & P.S. Trivedi. 1977. A text book of Botany Vol. L, Vikas
7. Pelczar M.J., E.C.S. Chan & N.R. Krieg. 1988. Microbiology 5 edition, Mc Grow Hill
8. Purohit S.S. 1989. Viruses, Bacteria & Mycoplasmas, Agrobotanical Publ.
9. Smith G.M. 1955. Cryptogamic Botany Vol I, Algae & Functi. McGraw Hill Book Co. Inc.

#### **Additional Reading**

10. Ananthanarayanan R. & C.K. Jayaram Paniker. 1996. Text Book of Microbiology, Orient Longman
11. Aneja K.R. 1966. Experiments in Microbiology, Plant Pathology, tissue culture & Mushroom cultivation 2 edition Wishwa Prakashan, New Delhi.
12. Bhatia K.N. 1994. Algae, R. Chand
13. Desikachary T.V. 1959. Cyanophyta, ICAR, New Delhi
14. Fritsch F.E. 1952. The Structure & Reproduction of the Algae Vol. I & II Cambridge at the Univ. Press.
15. Frobisher M.R.D. Hinsdill, K.T. Crabtree, C.R. Goodheart. 1974. Fundamentals of Microbiology Sannders Co. 9 edition
16. Jacquelyn G. Black. Microbiology, Principles and Explorations, Prentice hall
17. Kumar H.D. & H.N. Singh. 1996. A Text Book of Algae, East West Press, New Delhi
18. Madigan M.T., J.M. Martinko, J.Parker, 2003. Biology of Microorganism 10 edition
19. Presacott G.W. 1969. The Algae: A review Thomas Nelson & Sons Ltd.
20. Smith K.M. 1990. Plant viruses 6 edition Universal Book stall New Delhi
21. Srivastava H.N. 1998. Algae, Pradeep
22. Vasishta B.R., A.K. Sinha & V.P. Singh. 2004. Botany for degree students – Algae, S. Chand.
23. Venkataraman G.S. 1972. Algal biofertilisers & rice cultivation. Today & Tomorrows Printers & Publishers, New Delhi.



**II SEMESTER – Paper II**  
**MYCOLOGY, LICHENS , PLANT PATHOLOGY & BRYOPHYTA**  
**Teaching hours : 03 hours per week**

**Rationale /Learning Objectives:**

- To study the diversity & distribution of fungi
- To study the diversity, distribution, classification, morphology, reproduction and life cycle of Fungi.
- To study the causative agent, etiology, epidemiology, management of selected plant diseases.
- To study the diversity distribution thallus organization reproduction and economic significance of lichens.

**UNIT – 1**

**MYCOLOGY**

General characteristics of Kingdom **Mycota**,

Classification system of Mycota and General characteristics of classes

Importance of fungi:

1. Economic Importance – Edible Mushrooms, Fungal Antibiotics, Fermentation process, Cultivation methods of *Calocybe indica*
2. Ecological Importance as decomposers.

Study of Classes of Mycota as follows:

1. Class ZYGOMYCETES – Structure and reproduction of *Rhizopus*
2. Class ASCOMYCETES – Structure and reproduction of *Aspergillus* and *Peziza*
3. Class BASIDIOMYCETES – Structure, reproduction and life cycle of *Puccinia*.

**UNIT – 2**

**LICHENS**

General account, structure, nutrition, reproduction and economic importance of Lichens

**PLANT PATHOLOGY**

Etiology, Symptoms, transmission and disease management of the following:

1. Katte disease of cardamom





2. Bunchy top disease of banana
3. Citrus canker
4. Bud rot of coconut
5. Koleroga of arecanut
6. Stem bleeding disease of coconut
7. Leaf rust of coffee
8. Blast disease of rice
9. Root knot of Brinjal.

Brief account of seed borne diseases.

Biological control of plant diseases (*Trichoderma*), Biopesticides (**Neem**).

### UNIT – 3

#### BRYOPHYTA

Study of distribution, general characters, structure and reproduction of the following:

Class- HEPATICOPSIDA - *Riccia* and *Porella*

Class – ANTHOCEROTOPSIDA - *Anthoceros*

Significance of *Anthoceros* in the evolution of land plants

Class BRYOPSIDA –*Funaria*.

Ecological Importance of **Bryophytes**.

#### Student activities :

- Students should submit assignment on Horticultural crops
- Field visits to study plants of commercial and Horticultural importance.
- Field visits to study the plant diseases *in-situ*.



## MYCOLOGY , LICHENS, PLANT PATHOLOGY & BRYOPHYTA–PRACTICALS

(10 practical of 3 hrs duration each, one practical per week)

1. Study of Asexual & Sexual stages of *Rhizopus* and asexual stage of *Aspergillus*
2. Study of Fructification of *Peziza* and study of stages in the life cycle of *Puccinia*
3. Study of Lichens – types, asexual stages and apothecial study
4. Demonstration of seed borne fungi by standard blotter method.
5. Katte disease of Cardamom, Bunchy top disease of banana, Citrus canker, Bud rot of coconut and Kole roga of Arecanut
6. Stem bleeding of Coconut, Leaf rust of Coffee, Blast disease of Rice and Root knot disease of Brinjal
7. Study of thallus and reproduction of *Riccia*
8. Study of thallus and reproduction *Porella*
9. Study of thallus and reproduction of *Anthoceros*
10. Study of thallus and reproduction of **Moss**. (locally available)

### Note:

- Study of plant diseases mentioned in the theory (specimens/photos/ herbarium Sheets can be used)
- The students shall be taken to some nearby places for collection of available specimens.
- The students shall submit THREE specimens with field notes in a field note book during practical examination (The specimens should be from Fungi, Plant diseases, Lichens and Bryophytes)

### **Books for Reference:**

#### **Basic Reading**

1. Alexopoulos C.J. 1962. Introductory Mycology Wiley Eastern Ltd
2. Kamat M.N. 1967. Introductory Plant Pathology 3 edition. Prakash Publ. House, 360, Budhwar Pet, Poona-2
3. Misra A. & R.P. Agarwal 1978. Lichens- A Preliminary Text Oxford & IBH



4. Pandey B.P. 1999. Plant Pathology S. Chand & Co.
5. Smith G.M. 1955. Cryptogamic Botany Vol I. Algae & Fungi, McGraw Hill Book Co. Inc. 2 edition
6. Vasishta B.R. 1963. Bryophyta. S.Chand.

#### **Additional Reading**

7. Agrios G.N. 1969. Plant Pathology 4 edition Harcourt Asia Pte Ltd. Academic Press.
8. Barnett H.L. (1972) & B.B. Hunter 3/e illustrated genera of imperfect Fungi. Burgess Publ. Co. Minnesota
9. Dube H.C. 1983. An Introduction to Fungi Vikas Publications
10. Dubey R.C. & Maheshwar K.(200) A Text book of Microbiology, S. Chand
11. Jha D.K. (1995), Laboratory Manual of Seed Pathology. Vikas
12. Pandey S.N. & P.S. Trivedi 1977. A text Book of Botany vol I. Vikas
13. Rangaswami G. 1972. Diseases of Crop Plants in India. Prentice Hall of India Pvt. Ltd. New Delhi
14. Sharma P.D. (1989) Plant Pathology Rastogi
15. Singh R.S. 1963. Plant diseases 2 edition. Oxford & IBH
16. Smith G.M. 1955. Cryptogamic Botany Vol II. Bryophytes and Pteridophytes. Mc.GrowHill.
17. Vashishta B.R. 1999. Fungi 9 edition S. Chand Co
18. Srivathsava H.N. 1988 Bryophyta. Pradeep.
19. Webster J. 1980. Introduction to Fungi 2 edition



**III SEMESTER – Paper III**  
**PTERIDOPHYTA, GYMNOSPERMAE AND ANGIOSPERM EMBRYOLOGY**  
**Teaching hours : 03 hours per week**

**Rationale /Learning Objectives:**

- To study the diversity & distribution of cryptogams
- To study the distribution, morphology, reproduction, life cycle and economic
- significance of Pteridophytes and Gymnosperms.
- To study the stages of formation and development of plant embryo.

**UNIT – I**

**PTERIDOPHYTES:** General characters.

**PSILOTALES – *Psilotum*** (External morphology & Reproduction only)

**LYCOPODIALES:**

***Lycopodium*:** Morphology, Stem Anatomy, Asexual reproduction, Structure of antheridium archegonium and gametophyte.

***Selaginella*:** Morphology, Stem Anatomy, Asexual reproduction, Structure of antheridium archegonium and gametophyte.

**SPHENOPHYLLALES:**

***Equisetum*:** Morphology, Stem Anatomy, Asexual reproduction, Structure of antheridium archegonium and gametophyte.

**FILICALES :**

***Ophioglossum* :** Study of morphology and Spike.

***Hymenophyllum* :** Study of morphology and Sorus.

***Pteris* :** Study of morphology and asexual reproduction.

**MARSILEALES :**

***Marsilea* :** Study of structure of sporocarp.



## UNIT – II

### GYMNOSPERMS :

General characteristics; Classification and general characteristics of classes,

Brief account of Origin and Evolution of Gymnosperms.

Economic importance of Gymnosperms : Timber, Medicine and food

Study of the following genera.

1. **Cycas** :Morphology, Anatomy of coralloid root & leaflet, study of reproductive organs – male cone, microsporophyll, megasporophyll, structure of ovule.
2. **Pinus**: Morphology, Anatomy of Stem – young and old, needle. Study of reproductive organs – male & female cone, structure of pollen grain, structure of ovule.
3. **Gnetum**: Morphology, anatomy- anomalous secondary growth of stem, study of reproductive organs - male & female cone, structure of ovule
4. Xerophytic characters of Cycas & Pinus, Affinities of Gnetum with Angiosperms.

## UNIT – III

### EMBRYOLOGY OF ANGIOSPERMES

1. General life cycle of angiosperms showing alternation of generation.
2. Development of male reproductive structures: Brief account on structure of stamen. Structure of young anther, microsporogenesis, structure of mature anther T.S. Nature of pollen tetrads, structure of microspore, formation of male gametophyte,
3. Development of female reproductive structures: Brief account on structure of carpel. Structure of anatropous ovule, types of ovules and placentation. Megasporogenesis with brief note on tenuinucellate and crassinucellate types of development. Monosporic-(*Polygonum*) type of embryo sac development. Study of female gametophyte: structure of embryo sac with functional details of egg apparatus, antipodal cells and primary nucleus.



#### 4. Pollination

Types of pollination: self pollination- homogamy, cleistogamy, cross pollination – **entomophily**, adaptations for entomophily-colour, nectar, scent. **Anemophily** – pollination in maize. Brief note on **hydrophily** & **zoophily** (birds, squirrels, bats and snails – one example for each)

Advantages & disadvantages of self & cross pollinations.

Contrivances to cross pollination: dicliny, self sterility, dichogamy, heterostyly and herkogamy with one example each.

#### 5. Fertilization

Entry of pollen tube - chalazogamy, porogamy & mesogamy.

Process & significance of double fertilization and triple fusion.

#### 6. Post fertilization processes

**Endosperm:** development of endosperm, types of endosperm development – nuclear type, cellular type and helobial type.

**Seed:** development of monocot embryo, structure of maize grain (*Zea mays*).

Development of dicot embryo, structure of gram seed (*Cicer arietinum*)

### PTERIDOPHYTA, GYMNOSPERMAE & ANGIOSPERMAE EMBRYOLOGY PRACTICAL

(10 Practicals of 3hrs duration each, one practical per week)

1. Study of *Psilotum*: Morphology, Free hand sectioning of stem, Internal structure of Stem, structure of Synangium. Study of *Lycopodium* - morphology of *L. cernuum*, Anatomy – T.S of stem of *L. cernuum*. L.S of strobilus
2. Study of *Selaginella* : Morphology, Free hand sectioning of stem and Rhizophore. Anatomy – T.S of stem, T.S Rhizophore, L.S of Strobilus.
3. Study of *Equisetum*: Morphology, Free hand sectioning of stem, Anatomy – T.S of stem, L.S of Strobilus, T.S of Strobilus and spores.
4. Study of *Ophioglossum*: Morphology with spike, L.S Of Spike. T.S of Spike.  
Study of *Pteris* : Morphology, Anatomy- T. S of Pinnae through sorus, Study of



- Hymenophyllum* with sorus.
5. Study of *Marsilea* : Morphology, Anatomy- T.S Rhizome, T.S. of petiole. Sporocarp HLS
  6. Study of *Cycas*: Morphology of leaflet, Coralloid root, male cone, female sporophyll. Anatomy of Leaflet, Coralloid root and Ovule.
  7. Study of *Pinus* : Morphology of Needle, male and female cones. Anatomy of Needle, Primary and Secondary wood, Male & Female Cone and Ovule.
  8. Study of *Gnetum*: Morphology of wood , male and female cones, Anatomy of Male and female cones and Ovule.
  9. **Study of Anther**: T.S. of young and mature anther showing Archegonium, sporogenous tissue, spore mother cells and tetrad stages.  
Study of types of placentation - Axile, Parietal and Basal. Types of ovules - Anatropous, Orthotropous, Camphylotropous. Dicot embryo (at least two stages).
  10. Preparing two double stained free hand micro preparations of a Pteridophyte and a Gymnosperm.

**Note:**

Students should be trained to take free hand sections , Staining with safranin, washing or destaining and mounting in dilute glycerine.

**Student activity:**

- Students shall submit assignments on curriculum and floriculture.
- Field visit to study Floriculture

**Books for Reference:**

**Basic Reading**

1. Bhojwani S.S, and Bhatnagar, S.P., 2000. The embryology of Angiosperms 4th revised and enlarged ed. Vikas Publishing house , Delhi
2. Eames A.J. 1936. Morphology of vascular plants. Tata McGraw Hill.
3. Parihar N.S. 1973. The biology and morphology Pteridophytes. Central Book Depot, Allahabad.



4. Sporne K.R. 1965. The morphology of Gymnosperms. B.I. Publ.
5. Srivastava H.N. 1998. Gymnosperms. Pradeep.
6. Dwivedi J.N. 1990. Embryology of Angiosperms 2 edition Rastog & Co. Meerut

### **Additional Reading**

7. Campbell D.H. 1918. The structure and development of mosses and ferns 3<sup>rd</sup> edition. MacMillan.
8. Chopra.G.L. and Verma 1988. Gymnosperms. Praadeep Publ. Jalandhar-144008.
9. Delevoryas T. 1966. Plant diversification. Publ. Gulab Primlani, Amerind Publ. Co. Ltd. N.88 Connaught circus NewDelhi.
10. Gupta K.M. 1962. Marselia. CSIR NewDelhi.
11. Maheshwari P and R.N. Konar. 1971. Pinus. CSIR, NewDelhi.
12. Maheshwari P. & Vimala Vasil 1961. Gnetum. CSIR, NewDelhi.
13. Pandey S.N., S.P. Misra and P.S. Trivedi. 1972. A Text book of botany. Vol II, 2nd edition Vikas Publ.
14. Rashid A. 1976. An introduction to Pteridophytes. Vikas Publ.
15. Raven P.H., Evert R.F and Eichhorn S.E., 1999. Biology of plants, 7th edition. W.H. Freeman & Co. Worth Publishers, New York
16. Srivastava H.N. 1998. Fundamentals of Pteridophytes. Pradeep.
17. Thomas .P. 2000. Trees-their natural history, Cambridge University press, Cambridge





**IV SEMESTER – Paper IV**  
**MORPHOLOGY OF ANGIOSPERMS, TAXONOMY & ECONOMIC BOTANY**  
**Teaching hours : 03 per week**

**Rationale /Learning Objectives:**

- To study the morphology of angiosperms with a special reference to flower and its various parts in detail.
- To learn Identification, Nomenclature & classification of Plants
- To study Family level organization with the help of APG-III system of classification
- To study the distribution, cultivation pattern, extraction and economical importance of various Plants & Plant products.

**UNIT – 1**

**MORPHOLOGY:**

- a. General Description of Angiospermic Plant.
  - i. Components – habit, root, stem, leaf, inflorescence, flower, Fruit and Seed.
  - ii. Floral Diagram & Floral Formula.

(Other morphological aspects to be dealt along with families in the head ‘Morphological peculiarities’)

**2. TAXONOMY:**

- a. Introduction to taxonomy- Definition, Brief history, Importance.
- b. Salient features of - Linnaean system of classification, Bentham & Hookers system of Classification, Engler’s System of Classification.
- c. Brief account of recent trends in taxonomy – Chemotaxonomy, Cladistics. Numerical Taxonomy.
- d. Brief account on **APG – III System of Classification.**



- e. Plant nomenclature – Binomial nomenclature. ICBN- Breif note on Regulations & Typification.
- f. Taxonomy literatures: Important floras- Flora of British India, Flora of Madras Presidency, Flora of South Kanara.
- g. Field and herbarium techniques.
- h. General account on BSI, Botanical gardens and Herbaria of India. Royal Botanical Gardens Kew, Missouri Botanical Garden.

## UNIT – 2

**TAXONOMY:** Study of selected families of Angiosperms. **According to APG-III system of classification** : General description with special emphasis on Diagnostic Characters, Morphological Peculiarities and Economic Importance.

### DICOTS:

#### POLYPETALAE

##### 1) Magnoliaceae:

- a) **Diagnostic characters**- Aromatic flowers, Perianth lobes with Spiral arrangement. Gynoecium with Apocarpous condition.
- b) **Morphological peculiarities** – Apocarpous ovary, Aggregate fruits
- c) **Economic importance** – *Magnolia*, *Michelia* as fragrant flowers.

##### 2) Malvaceae:

- a) **Diagnostic characters**- stellate hairs, mucilage on stem, Solitary cyme inflorescence, Bracteoles with Epicalyx, Monadelphous stamens, Axile placentation.
- b) **Morphological peculiarities** – Solitary cyme, Epicalyx, Monadelphous stamens, Axile placentation. Fruit as capsule.
- c) **Economic importance** – *Gossypium* as fibre yielding plant, *Abulmoschus esculentus* as vegetable, *Hibiscus* Ornamental plant, *Sida* as medicinal plant.

##### 3) Anacardiaceae

- a) **Diagnostic characters** – Trees, Caustic juice, Panicle inflorescence, Small, polygamous flowers, false fruit in cashew.



b) Morphological peculiarities – Drupe, Nut.

c) Economic importance – Fruits – Mango, Cashew, Spondias pinnata

4) **Fabaceae** : Pulvinous leaf base, Monocarpellary gynoecium with marginal Placentation, Fruit a legume.

a) **Papilionoidae**:

i) **Diagnostic characters** – Nature of leaves. Papilionaceous corolla. Nature of Stamens.

ii) **Morphological peculiarities** – Pinnately compound leaves. Papilionaceous corolla, Vexillary aestivation, Adelphous condition of stamens, Marginal Placentation. Presence of Gynophore, Legume.

iii) **Economic importance**: Pulse yielding – Cicer arietinum, Lens culinaris, Cajanus cajan, Pisum sativum, Phaseolus aureus, P. mungo. Vegetables – Dolichos lablab, Vigna sinensis, Phaseolus vulgaris. Timber Yielding – Dalgergia sissoo, D. Latifolia. Oil yielding – Arachis hypogaea.

b) **Caesalpinoidae**:

i) **Diagnostic characters** – Nature of leaves.

ii) **Morphological peculiarities** – Corymb inflorescence,

iii) **Economic importance** – Ornamental Plants, Timber Yielding plants

c) **Mimosae**:

i) **Diagnostic characters** – Thygmonastic movement of Leaves, Globose Head inflorescence, Tetramerous Flower, Lomentum.

ii) **Morphological peculiarities** – Lomentum.

iii) **Economic importance** – Condiments, Gum yielding,



5) **Myrtaceae:**

- i) **Diagnostic characters** – Peeling of bark, Intramarginal Venation, Inward curvature of stamens in Buds. Epigyny.
- ii) **Morphological peculiarities** – Intramarginal Venation, Epigyny.
- iii) **Economic importance** – Eucalyptus, Clove, Guava, Ornamental

6) **Cucurbitaceae:**

- i) **Diagnostic characters** – Fistular stem, Tendrils, Leaf structure and venation, Unisexual flowers, Union of Stamens, Epigyny. Parietal placentation. Pepo
- ii) **Morphological peculiarities** – Nature of Tendrils, Syngenacious and Synandruos stamens, Parietal placentation and Pepo.
- iii) **Economic importance** – Vegetables of Cucurbitaceae.

7) **Apiaceae:**

- i) **Diagnostic characters** – Aromatic herbs, Decomound leaves, Umbel inflorescence, Antero-posterior ovary, Stylopodium, Cremocarp.
- ii) **Morphological peculiarities** – Decomound leaves, Umbel inflorescence, Stylopodium, Cremocarp.
- iii) **Economic importance** – Spices and Condiments. Carrot, Centella asiatica.

**GAMOPETALAE:**

8) **Rubiaceae:**

- i) **Diagnostic characters** – Opposite Decussate phyllotaxy, intra or interpetiolar stipules, cymose inflorescence, salver shaped corolla, Epipetalous stamens,
- ii) **Morphological peculiarities** – Opposite Decussate phyllotaxy, intra or interpetiolar stipules, cymose inflorescence, salver shaped corolla, Epipetalous stamens,



iii) Economic importance – Medicinal plants, Ornamental Plants, Coffee.

9) **Asteraceae:**

i) Diagnostic characters – Presence of Latex, Head inflorescence, Ray & Disc Florets, Calyx as Cappus, Syngenesious and epipetalous stamens, Basal placentation, Cypsella.

ii) Morphological peculiarities – Head inflorescence- Homozygous & Heterozygous heads, Ligulate corolla, Cypsella.

iii) Economic importance – Sunflower, Ornamental plants.

10) **Apocynaceae:**

i) Diagnostic characters – Presence of Latex, Apocarpous ovary, Hour glass shaped Stigma, Pair of follicles.

ii) Morphological peculiarities – Gynoecium of Apocynaceae.

iii) Economic importance – Medicinal Plants.

11) **Solanaceae:**

i) Diagnostic characters – Rotate corolla, Oblique ovary, Berry.

ii) Morphological peculiarities – Persistent calyx ,Oblique ovary, Berry.

iii) Economic importance – Vegetables, Medicinal plants, Narcotic plants.

12) **Acanthaceae:**

i) Diagnostic characters – Conspicuous bracts & Bractioles, Bilipped corolla, Dydinamous stamens, Seeds with Jaculators.

ii) Morphological peculiarities – Bilipped corolla, Dydinamous stamens and Jaculators.

iii) Economic importance – Medicinal Plants, Ornamental Plants.



13) **Verbenaceae:**

- i) Diagnostic characters – Strong smell, often Quadrangular stem, Involucre of bracts, often Bilipped corolla, Didynamous & epipetalous stamens.
- ii) Morphological peculiarities – Dichasial cyme
- iii) Economic importance – Teak, Duranta, Avicennia, Vitex negundo.

14) **Lamiaceae:**

- i) Diagnostic characters - Quadrangular stem, leaves with Oil glands, Verticillaster inflorescence, Persistent calyx, Bilabiate corolla, Didynamous & epipetalous stamens, Gynobasic Style, Nutlets.
- ii) Morphological peculiarities – Quadrangular stem, Verticillaster inflorescence, Gynobasic Style and Nutlets.
- iii) Economic importance – Medicinal plants.

**MONOCHLAMYDEAE:**

15) **Amaranthaceae:**

- i) Diagnostic characters – Herb, Bisexual or unisexual flower, Scarious bracts and bracteoles, Perianth lobe, fruit-Urticle.
- ii) Morphological peculiarities – Urticle.
- iii) Economic importance – Leafy vegetables.

16) **Euphorbiaceae :**

- i) Diagnostic characters – Plants with acrid milky juice, stipulate leaves, cyathium inflorescence, Unisexual flowers, Tricarpellary condition.
- ii) Morphological peculiarities – Cyathium inflorescence, Fruit – regma.
- iii) Economic importance – Castor, Indian Goosberry, Rubber, Ornamental.



## UNIT – 3

### MONOCOTS:

#### 17) **Orchidaceae:**

- i) Diagnostic characters – Epiphytic plants, Clinging roots, Epigynous flower, Perianth structure, Stamens with staminodes.
- ii) Morphological peculiarities – Clinging roots with Velamen, Perianth- Labellum, Stamen- Rostellum, Polinia, Gynostemium.
- iii) Economic importance – Ornamental Plants.

#### 18) **Musaceae:**

- i) Diagnostic characters – Psuedostem, Sheathing leaf bases, Spadix Inflorescence, Perianth structure, Tricarpellary ovary.
- ii) Morphological peculiarities – Spadix Inflorescence, Berry
- iii) Economic importance – Banana.

#### 19) **Zingiberaceae:**

- i) Diagnostic characters – Leaves distichous with Sheathing leaf bases, Petaloid staminodes,
- ii) Morphological peculiarities – Distichous phyllotaxy.
- iii) Economic importance – Ginger, Turmeric, Costus, Cardamom.

#### 20) **Areaceae:**

- i) Diagnostic characters – Leaves forming a crown, pinnate and palmate leaves, spadix or spike inflorescence, flower – sessile, small, unisexual, monoicous, tricarpellary ovary.
- ii) Morphological peculiarities – Pinnate and palmate leaves



iii) Economic importance – Oil yielding, Date-palm. Ornamental Palms.

21) **Poaceae:**

- i) Diagnostic characters – Culms, Sheathing leaf base, Spikelet inflorescence, Lodicules feathery stigma, Caryopsis.
- ii) Morphological peculiarities – Spikelet inflorescence, Caryopsis
- iii) Economic importance – Cereals, Millets, Sugar yielding Plants.

**ECONOMIC BOTANY:**

Distribution, family, botanical name, parts used, extraction and processing of the commercially important products of the following:

1. **Oil yielding plants :**

- a) Ground nut, Coconut, Oil palm, , Sunflower.
- b) Sandal wood and Eucalyptus.

2. **Medicinal Plants:** *Rauwolfia serpentina*, *Cinchona officinalis*, *Digitalis purpurea*, *Papaver somniferum*, *Atropa belladonna*, *Strychnos nuxvomica*, *Aloe vera* and *Catharanthus roseus*.

3. **Beverages:** Coffee, Tea and Cocoa.

4. **Rubber yielding plants:** *Hevea*.

5. **Sugar yielding plants :** Sugarcane.

6. **Fibre yielding plants :** Cotton ,Coir and Jute.

7. **Timber yielding plants:**

- i) Teak, Rosewood,
- ii) Jack and Wild Jack,
- iii) Bogi and Rakta Chandana.

8. **Cereals and Millets:** Wheat, Maize, Paddy, Ragi and Jowar.

9. **Spices and Condiments:** Pepper, Clove, Coriander, Ginger, Cardamom, Garlic, Onion, Turmeric, Chilli And Cinnamomum.





10. **Pulses:** *Cajanus, Dolichos, Cicer* and *Pisum*.

**Student activity:**

Students should prepare assignments on morphology of stem, root, leaf, Inflorescence, flower and fruits.

Students have to make frequent field visits to study and appreciate the diversity of flora.

**MORPHOLOGY OF ANGIOSPERMS, TAXONOMY & ECONOMIC BOTANY –  
PRACTICALS**

*(10 practicals of 3 hrs duration each, one practical per week)*

1. Study of at least 3 families selected from the locally available plants as per the syllabus.
2. Study of at least 3 families selected from the locally available plants as per the syllabus
3. Study of at least 3 families selected from the locally available plants as per the syllabus
4. Study of at least 3 families selected from the locally available plants as per the syllabus
5. Study of at least 3 families selected from the locally available plants as per the syllabus
6. Study of at least 3 families selected from the locally available plants as per the syllabus
7. Study of at least 3 families selected from the locally available plants as per the syllabus
8. Study of at least 3 families selected from the locally available plants as per the syllabus
9. Economic Botany
10. Herbarium techniques with field notes.



### **Note:**

- The students shall be given training in herbarium methods and making field notes of plants collected. Herbarium (5 sheets) with field notes to be submitted at the time of practical examination.
- A botanical excursion to study the flora and vegetation is recommended. Local field trips: the students shall be taken around the college campus and nearby places for the study of local flora and a field diary shall be maintained by them.

### **Books for Reference:**

#### **Basic Reading**

1. D.H.M.Lawrence 1958. Taxonomy of Vascular Plants. Mac Millan Co. New York.
2. Gupta R.K. 1972. Text Book of Systematic Botany. Atma Ram & Sons. Delhi-6
3. Mukerjee S.K. 1984. College Botany vol III. New Central Book Agency.
4. Rendle A.B. 1956. The classification of Flowering Plants Vol. 1& II Cambridge Univ. Press.
5. Sambamurthy A.V.S.S. & N.S.Subrahmanyam 1989. A Text Book of Economic Botany Wiley Eastern Ltd.

#### **Additional Reading**

6. Arya Vaidya Sala Kottakkal 1994- 1997. Indian Medicinal Plants Vol I-V, Orient Longmann
7. Asolkar L.V., K.K. Kakkar & O.J. Chakre 1992. Second supplement to Glossary of Indian Medicinal Plants with active principles, Part I A-K (1965-1981). CSIR Publ.
8. Asolkar L.V., K.K.Kakkar & O.J. Chakre. Supplement to Glossary of Indian Medicinal Plants CSIR.
9. Chopra R.N., S.L.Nayar, I.C. Chopra. 1956. Glossary of Indian Medicinal Plants CSIR.
10. Mitra J.N. An Introduction to Systematic Botany & Ecology World Press Pvt Ltd. Calcutta
11. Nadkarni A.K. 1954. Indian Materia Medica Vol 1&2. Popular Book Depot, Bombay –7.
12. Sutar F.N. 1962. 3 edition A Text Book of Systematic Botany. Khadataya Book Depot. Bala Hanuman, Agmedabad.



**V SEMESTER – Paper V**  
**PLANT PHYSIOLOGY –I AND ECOLOGY-I**  
**Teaching hours : 03 per week**

**Rationale /Learning Objectives:**

- To understand and appreciate the basic functioning pattern of plant system.
- To study the role of Biological molecules in various metabolic activities.
- To study the structure, functioning pattern and operative systems of Ecosystem.

**UNIT – I**

**PLANT WATER RELATIONS:**

Water absorption – Physical concepts of absorption – Imbibition, Diffusion and Osmosis.

Plant cell as an osmotic system – water potential;  $\psi = \psi_p + \psi_s + \psi_m$ , Plasmolysis.

**MECHANISM OF WATER ABSORPTION** – Passive and active absorption, apoplast and symplast concepts.

**ASCENT OF SAP:** Path and mechanism of ascent of sap – Root pressure theory, Cohesion tension theory.

**TRANSPIRATION** – Definition, significance, Cuticular, Lenticular and Stomatal transpiration, mechanism of stomatal movement – Starch hydrolysis theory and  $K^+$ /proton ion exchange theory, factors affecting the rate of transpiration.

**GUTTATION** – Brief account.

**MINERAL NUTRITION:** Soil solution, availability of mineral salts, Hydroponics, Mineral nutrition – role of micro and macro elements.

**SALT ABSORPTION MECHANISM** – Passive and Active absorption of salts by land plants, Lundegardh's theory and Bennett Clark's theory.

**UNIT –II**

**PLANT ENZYMES:** Nomenclature, classification, structure and composition of enzymes, co-enzymes and co-factors, properties of enzymes, mode of enzyme action, enzyme inhibitors, factors affecting enzyme activity.

**FAT METABOLISM-** General account of fats, synthesis of fatty acids, synthesis of glycerol and condensation of fatty acid and glycerol, fat degradation,  $\alpha$  and  $\beta$  (Beta) – oxidation, glyoxylate cycle and its significance, plant waxes and phospholipids.



**CARBOHYDRATE METABOLISM-** Structure of ribose and deoxyribose sugars, glucose, fructose, sucrose, starch and cellulose, metabolism of sucrose, starch and cellulose.

**NITROGEN METABOLISM** – Sources of nitrogen, physical and biological nitrogen fixation and mechanism of nitrogen fixation, nitrogen in soil – Nitrate reduction and amino acid synthesis.

### **UNIT-III**

#### **ECOLOGICAL FACTORS :**

**Climatic factors** – influence of light , temperature, precipitation, humidity and wind on vegetation.

**Edaphic factors** – soil formation, soil profile, types of soil, soil complex – soil water, mineral particles, organic matters, , soil humus, soil pH and soil microorganisms.

**Biotic factors** – plants, animals and human being as biotic factors.

**Topographic factors.**

**ECOSYSTEM** – concept of ecosystem, pond ecosystem, energy flow, food chain and ecological pyramids.

**PLANT SUCCESSION** – Development of vegetation – migration, invasion, aggregation, competition, ecesis and colonization.

Definition of succession, types of succession – Study of Hydrosere and Xerosere in detail.

#### **Students activity.**

- Students have to submit assignment on Agricultural/Commercial Crops and topics related to curriculum.
- Field visit to study cultivation practices of agricultural & Commercial crops.



## **PRACTICAL: PLANT PHYSIOLOGY – I AND ECOLOGY-I**

*(10 practicals of 2 hrs duration each, one practical per week)*

### **MAJOR EXPERIMENTS (1-5)**

1. Experiment to measure the solute potential of the cell sap by plasmolytic method.
2. Determination of the relation between absorption and transpiration.
3. Experiment to determine the Suction due to Transpiration.
4. Experiment to show the effect of environmental factors on transpiration rate using Ganong's potometer .
5. Determination of porosity and pH by pH paper, of forest, field and coastal soils
6. Biochemical tests for proteins, carbohydrates and fat

### **DEMONSTRATION EXPERIMENTS**

1. Experiment to demonstrate imbibition pressure by germinating seeds and Potato osmoscope experiment.
2. Thistle funnel experiment to demonstrate endosmosis and Determination of differential rate of transpiration on the two surfaces of leaf using Garreau's apparatus.
3. Experiment to prove aeriferous system in plants
4. The study of pond ecosystem

### **Books for References:**

#### **Basic Reading**

1. Devlin R.M. & F.H. Witham 1983. Plant Physiology 4 edition CBS Publ.
2. Salisbury F.B. & C.W. Ross 1986. Plant Physiology 3 edition CBS Publ. & Distrib. Delhi-32
3. Sharma P.D. 1990, Elements of Ecology Rastogi.
4. Srivatsava H.N. 2004. Plant Physiology, Pradeep Publ
5. Verma P.S. & V.K. Agarwal 1989. Principles of Ecology S. Chand
6. Weaver J.E. & Clements F.E. 1929. Plant Ecology 2 edition Tata McGraw Hill



## Additional Reading

7. Bhatia K.N. & K.K. Sharma 1988. A treatise on Plant Ecology 3 edition Pradeep Publish.
8. Bidwell R.G.S. 1979. Plant Physiology 2 edition. MacMillan Publ.
9. Conn E.E., P.K. Stumpf, G. Bruening, R.H. Doi 1995. Outlines of Biochemistry 5 edition John Wiley & Sons
10. Daubenmire 1957. Plant & Environment EEE
11. Devlin T.M. 1997. Text book of Biochemistry with clinical correlations. Wiley-Liss 4 edition
12. Hopkins W.G. 1999. Introduction to Plant Physiology John Wiley & Sons, Inc. 2 edition
13. Lehninger A.L., D.L. Nelson & M.M. Cox 1993. Biochemistry CBS Publ. Delhi –32
14. Levitt Jacob. 1969. Introduction to Plant Physiology. The C.V. Mosby Co. Tokyo
15. Mehra V.B. & Khanna S.K. 1976. Plant Ecology S.Chand
16. Noggle G.R. & G.J. Fritz 1983. Plant physiology 2 edition EEE 2002 reprint.
17. Rao K.N., G. Sudhakara Rao & S. Bharatan 1987. A text Book of Plant Physiology – The functioning Plant. S.Vishwanatahn, Madras
18. Rawn David J. 1983. Biochemistry, Harpen & Row, New York
19. Stryer Lubert 1995. Biochemistry 4 edition W.H. Freeman & Co.
20. Subrahmanyam N.S. & A.V.S.S. Sambamurthy 2000. Ecology. Narosa Publ. House.
21. Taiz L. & Zeiger E. 2003, Plant Physiology 3 edition Panima Publ. Co. 16, Prakash Apts.
22. Voet Donald & J.G. Voet 1998. Biochemistry, John Wiley
23. Voet Donald & J.G. Voet 1998. Biochemistry, John Wiley



**V SEMESTER - Paper VI**  
**CELL BIOLOGY, MOLECULAR BIOLOGY & GENETICS**  
**Teaching Hours : 03 per week**

**Rationale /Learning Objectives:**

- To understand the concept of cell structure with respect to biological molecules, organelles & membranes.
- To study the structure and role of genes in the pattern of inheritance.
- To study the concept of inheritance & variations.

**UNIT – 1**

**CYTOLOGY** – Structure of plant cell, Cell wall, Plasma membrane, Endoplasmic reticulum, Lysosomes, Plastids, Ribosomes, Golgi complex, Mitochondria, Peroxisome, Living and non living inclusions,

Nucleus in general, nuclear membrane and nucleolus.

**CHROMOSOMES** – Chromosome morphology – size, structure, number, centromere, telomere, numerical changes in number and kinds of chromosomes (Gaint chromosomes not included). Structure of the chromosome – nucleosome model

**CELL DIVISION** – cell cycle, mitosis and meiosis

**STRUCTURE AND CHEMISTRY OF THE GENE:**

DNA as genetic material, evidences from bacterial transformation – experiments of Griffith and Avery Mac Leod.

Evidence from experiment with Bacteriophage – Hershey & Chase.

Molecular structure of DNA, Watson and Crick model of DNA, DNA replication, types of RNA.

**UNIT – 2**

Gene concept ( Cistron, recon and muton), Plasmids- puc18, transposons, Gene expression in prokaryotes – Lac operon, Gene expression in Eukaryotes;

Split genes – exons, introns and splicing. Genetic code and Protein synthesis

**MENDELISM:** Mendel's work –mono and dihybrid crosses. Mendel's laws of inheritance.

Back cross and test cross. Exceptions to Mendelism: incomplete dominance



**LINKAGE:** coupling and repulsion, linkage and crossing over with plant examples.

Sex determination in plants.

### UNIT – 3

**INTERACTION OF GENES:** concept of epistasis, recessive epistasis / supplementary genes, duplicate recessive epistasis, complementary genes, dominant epistasis, duplicate and dominant epistasis / duplicate genes. Multiple alleles in plants.

**MULTIPLE FACTORS** or polygenic inheritance with example from plants.

**GENE MUTATIONS:** Gene mutations – mutagenesis by tautomer shifts: mutagens – physical mutagens and chemical mutagens. Role of mutations in plant breeding and evolution.

**CHROMOSOMAL ABERRATIONS** – deficiencies, duplication, inversions and translocations.

**POLYPLOIDY** : autopolyploids and allopolyploids

#### Students activity.

- Students have to prepare assignments related to the curriculum
- Students have to prepare PPTs related to the curriculum

### CELL BIOLOGY, MOLECULAR BIOLOGY & GENETICS – PRACTICALS

*(10 practicals of 2 hrs duration each, one practical per week)*

1. Study of cell organelles under light microscope
2. Study of ergastic substances – starch (potato, rice grain), aleurone (wheat grain), calcium oxalate (*Pistia*), calcium carbonate (*Ficus* leaf) and oil globules (Castor seed).
3. Training in fixing, acetocarmine staining, squashing and making micro preparations for cytological studies – Study of mitosis – root tip of onion
4. Identification of stages of mitosis
5. Study of meiosis – flower buds of onion
6. Identification of stages of meiosis





7. Translocation of heterozygote in Rhoeo/ Tradescantia
8. Solving genetic problems in monohybrid and dihybrid crosses
9. Solving genetic problems in incomplete dominance
10. Solving genetic problems in interaction of genes.

### **Boosk for References:**

#### **Basic Reading**

1. Karp Gerald 2002. Cell and Molecular Biology – concepts and experiments 3 edition John Wiley & Sons.
2. Vasishta P.C. & P.S. Gill 1998. Cell Biology & Molecular Biology, Pradeep
3. Verma P.S. & V.K. Agarwal 1985. Cytology. S. Chand
4. Thorpe N.O. 1984. Cell Biology, John Wiley & Sons.
5. Weaver R.F. & D.W. Hedrick 1997. Genetics 3 edition WCB Publ.
6. Winchester A.M. Genetics 3<sup>rd</sup> edition. 1966. Oxford & IBH Publ.
7. Alberts Bruce et al 2002. Molecular Biology of the Cell 4 edition. Garland Sciences, Taylor & Francis Group.

#### **Additional Reading**

8. De Robertes E.D.P., F.A. Saez & E.M.F.De Robertis Jr. 1975. Cell Biology 6 edition W.B. Saunders.
9. DeRobertis E.D.P. & E.M.F. De Robertis 1987. Cell and Molecular Biology 8 edition Lea & Febiger , Philadelphia.
10. Kumar H.D. 2000. Molecular Biology Vikas 2 edition
11. Lewin Benjamin 2000. Genes VII. Oxford Univ. Press.
12. Malacinski G.M. & D.Freifelder 1998. Essentials of Molecular Biology. Jones & Bartlatt Publ. Boston. 3 edition
13. Powar C.B. 1983, Cell Biology 3 edition Stimagate Publ.
14. Sheeler P. & D.E. Bianchi 1987. Cell and Molecular Biology 3 edition John Wiley & Sons.



15. Turner P. C. et al. 1998. Instant Notes in Molecular Biology, Viva Books Pvt.Ltd.
16. Lewin Benjamin (2005) Genes VIII oxford
17. Atherly A.G., J.R. Girton, J.F. McDonald. 1999. The Science of Genetics. Saunders College Publ.
18. Burns G.W. 1983. The Science of Genetics – An Introduction to Heredity- 5 edition Mac Millan Publ.
19. Dharmalingam K. 1986. Experiments with M13. Gene Cloning & DNA sequencing Mac Millan (112 pages)
20. Gardner E.J., M.J. Simmons & D.P. Snustad. 1991. Principles to Genetics 8 edition John Wiley & Sons
21. Klug W.S. & M.R. Cummings 2003. Concepts of Genetics 7 edition – Pearson Edition 482, F.I.E. Patparganj Delhi – 110092
22. Moore Peter 1996. Recombinant DNA technology, East West Press (42 pages)
23. Purohit S.S. 2003. Agricultural Biotechnology 2 edition. Agrobios (India)
24. Sambamurty A.V.S.S. 1999. Genetics Narosa Publ. House
25. Singh B.D. 1998. Biotechnology, Kalyani Publ.
26. Sinnott E.W. & L.C. Dunn & T. Dobzhansky 1953. Principles of Genetics 5 edition. TMHEd.
27. Stanfield W.D. 1986. Theory & Problems of Genetics 2 edition Schaum's Outline series Mc Graw Hill
28. Strickberger M.W. 1985. Genetics 3 edition, MacMillan Publ.
29. Tamarin Robert & R.W. Leavitt 1991. Principles of Genetics. W.C. Brown Publ. USA 3 edition
30. Winter P.C., G.I. Hickey & H. L. Fletcher 1999. Instant Notes in Genetics. Viva Books Pvt. Ltd. New Delhi.



**VI Semester - Paper VII**  
**PLANT PHYSIOLOGY – II & ECOLOGY – II**  
**Teaching Hours : 03 per week**

**Rationale /Learning Objectives:**

- To study the concept & mechanism of vital processes like Photosynthesis, Translocation, Respiration & growth.
- To understand plant adaptations to various ecological conditions & types of vegetation.
- To study an account of environmental pollution and its consequences.
- To study biodiversity and its conservation.

**UNIT –I**

**PHOTOSYNTHESIS** : Definition, photosynthetic apparatus, photosynthetic pigments and their composition, action spectrum, absorption spectrum,

Red drop and Emerson effect and two pigment system.

Mechanism of photosynthesis – light reaction or Hill's reaction- Photolysis of water, cyclic and noncyclic electron transport and photophosphorylation, production of reductant and energy (NADPH<sub>2</sub> and ATP )

C<sub>3</sub> pathway (Calvin cycle) C<sub>4</sub> pathway.

C<sub>3</sub> and C<sub>4</sub> plants.

Factors affecting photosynthesis, law of limiting factors.

**TRANSLOCATION OF ORGANIC SOLUTES:** Path of translocation, mechanism of translocation – pressure flow theory (Munch hypothesis.)

**UNIT –II**

**RESPIRATION:** Definition and significance of respiration, types of respiration, mechanism of aerobic respiration – Glycolysis ( EMP pathway ) in detail, phosphorylation in glycolysis, breakdown of pyruvic acid and formation of acetyl co-enzyme – A; Krebs's cycle – electron transport system (ETS chain),

Anaerobic respiration, fermentation, Pasteur's effect, [enzymes in respiration must be mentioned].

Respiratory Quotient (RQ) and its significance.



**DORMANCY:**Bud dormancy – induction and removal of bud dormancy, Seed dormancy, Method to break seed dormancy.

**PHYSIOLOGY OF PLANT GROWTH:** Plant growth – phenomenon of growth, phases of growth, sigmoid curve, factors affecting growth, auxanometers.

Plant growth regulators: growth promoters – Auxins, Gibberellins And Cytokinins; growth inhibitors – Ethylene and Abscisic acid (ABA).

**PHYSIOLOGY OF FLOWERING :** Photoperiodism – short day, long day and photoneutral plants, photoperiodic stimulus, induction and response, practical application of photoperiodism; Vernalisation.

**PLANT MOVEMENTS** – Introduction – Types of movements – Tactic, Tropic and Nastic.

### **UNIT –III**

**ECOLOGICAL ADAPTATIONS:** Morphological and Anatomical adaptations of Hydrophytes, Mesophytes, Xerophytes, Epiphytes and Halophytes.

**VEGETATIONAL TYPES:** a general account.

**ENVIRONMENTAL POLLUTION:** Air pollution, water pollution and their impact on vegetation, pollution control, green house effect, acid rain, sewage treatment and biogas production.

### **BIODIVERSITY AND CONSERVATION ECOLOGY**

Biodiversity,

Threatened plants, endemic plants of India and their conservation;

Hot spots in India.

Conservation of nature and natural resources - Soil, water and forests.

Soil erosion and conservation methods.

Conservation of water.

Conservation of Forests: Forests, Afforestation, Reforestation, Monoculture and its effects

Wildlife conservation, *in-situ* conservation - National parks, sanctuaries and bioreserves. Ex-situ conservation – Arboretum.



### **Students activity.**

- Students have to prepare assignments related to the curriculum
- Students have to prepare PPTs related to the curriculum

## **PLANT PHYSIOLOGY – II & ECOLOGY – II- PRACTICALS**

(10 Practicals of 2 hrs duration each, one practical per week)

### **MAJOR EXPERIMENTS**

1. Experiment on liberation of oxygen in photosynthesis
2. Extraction of leaf pigments by Paper chromatography
3. Measurement of Respiration Quotient using Ganong's respirometer
4. Experiment on Fermentation using Kuhne's fermentation tube.
5. Study of Plant adaptations (Anatomical & Morphological) of Hydrophytes & Xerophytes (Any two specimens mentioned in the syllabus may be given)

### **DEMONSTRATION EXPERIMENTS**

1. Demonstration of
  - a. Ganong's colored light screen apparatus.
  - b. Moll's half leaf experiment
2. Demonstration of
  - a. Geotropism by Clinostat
  - b. Hydrotropism by Porous clay funnel
3. Demonstration of
  - a. Heliotropism using heliotropic chamber
  - b. Growth using Pfeffer's auxanometer
4. Study of Ecological groups of Plants
  - a. Mesophytes – Anatomy of leaf and stem of any mesophyte (Dicot plant).
  - b. Halophytes: External morphology of Spinifex, Rhizophora – stilt roots and vivipary, Avicennia – pneumatophore, T.S. of pneumatophore.
  - c. Epiphytes – external morphology of Vanda, Bulbophyllum, Drynaria with mantle leaf.



## 5. Study of Spotters : Effect of growth regulators, Plant movements

Note: Students of Botany should be taken to nearby forests and coastal regions to make them study different types of vegetation.

### Books for References:

#### Basic Reading

1. Agarwal K.C. 1993. Environmental biology 2 edition Agro Botanical Publ. India
2. Devlin R.M. & F.H. Witham 1983. Plant Physiology 4 edition CBS Publ.
3. Hall H.O.& Rao K.K. 1994. Photosynthesis 5 edition Cambridge Low Price Edn.
4. Hopkins W.G. 1999. Introduction to Plant Physiology John Wiley & Sons Inc.2 edition.
5. Levitt Jacob. 1969. Introduction of Plant Physiology. The C.V. Mosby Co. Tokyo
6. Purohit S.S. & S.Ranjan 2002. Photosynthesis Agrobios, India

#### Additional Reading

7. Abrol Yashpal, P. Mohanty & Govindiee 1993. Photosynthesis Oxford & IBH.
8. Ananda Rao T. & A.N. Sheriff 2002. Coastal Ecosystems of Karanataka State, India. I Mangroves II Beaches.
9. Atlas & Bartha( 2005) Microbial Ecology
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12. Devlin T.M. 1997. Text Book of Biochemistry with clinical correlations. Wiley –Liss 4 edition
13. Groombridge Brain & M.D. Jenkins 2002. World Atlas of Biodiversity: Earth's Living Resources in the 21<sup>st</sup> century. Univ. of California Press
14. Lawlor D.W.2001. Photosynthesis 3 edition viva Books Pvt.Ltd. 4262/3, Ansar Road, Daryaganj, New Delhi –110 002



15. Lechinger A.L., D.L. Nelson & M.M. Cox 1993. Biochemistry CBS Publ. Delhi- 32
16. Mackie & Mc Cartney ( 2001) Microbial Infections ELBS
17. Mackie & Mc Cartney(2001) Medical Practical Microbiology Vol.1&2 ELBS
18. McKinney M.L. & R.M. Shoch. 1998. Environmental Science – Web enhanced edition Jones & Bartlett Publ. Boston
19. Noggle G.R. & G.J. Fritz 1983. Plant Physiology 2 edition EEE 2002 reprint
20. Prathibha M. 1988. Biology-Photosynthesis & Respiration. HKES College, Bangalore 6
21. Raghavendra A.S. 1998. Photosynthesis –Cambridge Univ. Press.
22. Ramakrishnan P.S. 2001. Ecology & Sustainable development. National Book Trust, India
23. Rao K.N.G. Sudhakara Rao & S. Bharatan 1987. A Text Book of Plant Physiology – The functioning Plant. S. Vishwanathan, Madras
24. Rawn David J. 1983. Biochemistry, Harpen & Row, New York.



**VI Semester - Paper VIII**  
**(ANATOMY, PLANT PROPAGATION & APPLIED BOTANY)**  
**Teaching Hours : 03 per week**

**Rationale /Learning Objectives:**

- To study the internal Structure of Plant organs.
- To study the basic concept of Microbiology
- To study the principles of Plant biotechnology
- To study the tools & techniques in Plant propagation.

**UNIT – 1**

ANATOMY – Meristems, apical meristems, organization of the shoot apex Tunica – corpus theory. Structure of the root apex – Histogen theory. Intercalary meristem and lateral meristem. Origin of the lateral roots.

Parenchyma, Mechanical tissues- collenchyma, sclerenchyma and sclereids- their position and distribution in plant parts and their significance.

Xylem- tracheids, tracheae, primary and secondary xylem, xylem parenchyma, xylem fibres.

Phloem – sieve tubes, companion cells, phloem parenchyma, bast fibres. Secretory tissues, glandular and laticifer tissue system.

**UNIT –II**

Leaf –structure of dicot and monocot leaf.

Stem – Primary structure of dicot and monocot stem

Root – Primary structure of dicot and monocot root.

Secondary structures of dicot stem and root.

Annual rings, rays, phellogen, periderm, cork, bark, and lenticels.

Vegetative propagation – seeds and other propagules, cutting, grafting and layering.

Micropropagation through tissue culture, culture media, sterilization, incubation. Explant, callus, totipotency. A brief account of Protoplast culture, meristem culture, anther culture and pollen culture. Applications of tissue culture.





### UNIT –III

**MICROBIOLOGY** : History and scope of Microbiology. Beneficial microbes and their applications. (fermented foods, vitamins, dairy, antibiotics steroids, breweries, organic acids and plant hormones) single cell protein (SCP). Harmful microbes: Diseases of plants and man.

**MYCORRHIZAE**: Ectotrophic and Endotrophic vesicular arbuscular mycorrhizae (VAM). Effect of mycorrhizae on their hosts.

Biogas, biomining and bioremediation and Biomanure – a general account

**FOOD SPOILAGE**: canned & frozen food, fruits, vegetables, grains, beer & wine

**FOOD POISONING**: Staphylococcal, Clostridial and Salmonella

**FOOD PRESERVATION** : Principles – low temperature, boiling, autoclaving. High O.P., salting, chemical, irradiation – HACCP.

**BIOTECHNOLOGY**: Gene cloning; restriction endonucleases, vectors- plasmids and phages. Recombinant DNA technology and its practical applications in enzymes, antibiotics, vitamins, vaccines, steroids, brewery, dairy technology, Monoclonal antibodies and crop improvement. Transgenic plants: Golden Rice, Bt cotton, flavr savr tomato.

#### Students activity:

- Students have to prepare assignments related to the curriculum
- Students have to prepare PPTs related to the curriculum

### ANATOMY, PLANT PROPAGATION & APPLIED BOTANY PRACTICALS

*(10 practicals of 2 hrs duration each, one practical per week)*

1. A study of following tissues from locally available plant materials: meristems, parenchyma, collenchyma, sclerenchyma, sclereids.
2. A study of following tissues from locally available plant materials: Xylem and phloem.
3. T.S. of primary and secondary structures of dicot stem and root
4. T.S. of monocot stem and root
5. T.S. of dicot and monocot leaf
6. Demonstrating grafting methods – Approach, wedge, tongue and bud grafting



7. Instruction in Microbiology and Biotechnology: Autoclave, Hot air oven, pH meter, Laminar air flow, Centrifuge incubator, Neubaur Haemocytometer- Counting chamber, Colori meter.
8. Air sampling of microflora by Agar plate method.
9. Observation of Lactobacillus in curds, yeasts in toddy and Rhizobium in root nodule. Study of bacterial motility by hanging drop technique.
10. Media preparation- Potato dextrose agar

**Student activity:**

Visit to nearby Microbiology/ Biotechnology lab is recommended

**Books for References**

1. Cutter E.G. 1978. Plant Anatomy. Part 1 & 2 . ELBS.
2. Dwivedi J.N. 1990. Embryology of Angiosperms 2 edition Rastog & Co. Meerut
3. Eames A.J. & L.H. Mac Danieis 1947. An Introduction to Plant anatomy. Mc Graw Hill Book Co.
4. Esau K. 1953. Plant Anatomy John Wiley & Sons
5. Esau K. 1977. Anatomy of Seed Plants 2 edition Wiley Eastern.
6. Fahn A. 1990 Plant Anatomy. 4 edition Aditya Books (P) Ltd. New Delhi
7. Gemmell A.R. 1969. Developmental Plant Anatomy. Edward Arnold Indian reprint. (60 pages)
8. Harmann H.T. et al. 1997. Plant propagation principles & practices 6 edition. Prentice Hall EEE
9. Maheshwari P. 1950. An Introduction to the Embryology of Angiosperms. TMII Ed.
10. Rao Narayana B.N. 1972. Plant Modifications 2 edition. Wisdom Publ. N.R.Mohalla Mysore-7.
11. Razdan M.K. 2003. Introduction to Plant tissue culture. Oxford & IBH 2 edition.
12. Sadhu M.K. 1989. Plant Propagation Wiley Eastern
13. Srivastava H.N. 1998. Anatomy of Angiosperms. Pradeep.
14. Tayal M. S. 1984. Plant Anatomy. Rastogi
15. Vasishtha P.C. 1994. Plant Anatomy . S. Chand.



16. Barnum S.R. 1998. Biotechnology an Introduction. Vikas Publ.
17. Barnum S.R. 1998. Biotechnology an Introduction. Vikas Publ.
18. Dharmalingam K. 1986. Experiments with M13. Gene Cloning & DNA sequencing Mac Millan (112 pages)
19. Hammond J.P. Mc Garvey & V.Gusibov. 1999. Plant Biotechnology- New Products & Applications. Springer
20. Moore Peter 1996. Recombinant DNA technology, East West Press (42 pages)
21. Purohit S.S. 2003. Agricultural Biotechnology 2 edition. Agrobios (India)
22. Ranjan R. 1999. Transgenic Plants, Agrobotanica 4E 176 J.N.Jagar, Bikaner – 334 003
23. Singh B.D. 1998. Biotechnology, Kalyani Publ.
24. Slater Adrian et al 2003. Plant Biotechnology – The Genetic manipulation of plants Oxford University press.
25. Smith J.E. 1988. Biotechnology 3 edition Cambridge Univ. Press Low Price Ed.
26. 26. Teal A.R. 1996. Enzymes & their role in Biotechnology, East West Press (42 Pages)



**Question paper pattern**  
**S.D.M.College(Autonomous) – Ujire**  
**B.Sc –First Semester**  
**Botany**  
**(Protophyta and Algae)**

Time 3 hrs.

Max. Marks:80

Note:

1. Answer Part A and Part B
2. Answer four full questions from Part B choosing one full question from each unit
3. All questions in Part B carry equal marks.
4. Draw diagrams wherever necessary.

PART – A

1. Answer any ten of the following

2 x 10 = 20

- i)
- ii)
- iii)
- iv)
- v)
- vi)
- vii)
- vii)
- ix)
- x)
- xi)
- xii)

PART – B

UNIT - I

- |       |   |
|-------|---|
| 2. a. | 3 |
| b.    | 4 |
| c.    | 5 |
| d.    | 8 |

OR

- |       |   |
|-------|---|
| 3. a. | 4 |
| b.    | 4 |
| c.    | 4 |
| d.    | 8 |



UNIT - II

4. a.	3
b.	4
c.	5
d.	8

OR

5. a.	4
b.	4
c.	4
d.	8

UNIT - III

6. a.	3
b.	4
c.	5
d.	8

OR

7. a.	4
b.	4
c.	4
d.	8

