

# Botany

B.Sc.: Elective

## Outlines of Tests

Paper	Title of Course	Marks
A	Morphology of Plants	35
B	Plant Systematic Anatomy And Development	35
C	Cell Biology, Genetics and Evolution	35
D	Physiology and Ecology	35
E	Practical Diversity of Plants	15
F	Practical Plant Systematic Anatomy And Development	15
G	Practical Cell Biology, Genetics and Evolution	15
H	Practical Physiology and Ecology	15
	<b>Total</b>	<b>200</b>

## DETAIL OF COURSES

### NOTE:

- HEC course of B.Sc Examination will be adopted as it which consist of four papers. Paper A & B will be taught in the 3<sup>rd</sup> year and paper C & D in the 4<sup>th</sup> year.
- Each paper will be of 50 marks ( 35 for theory and 15 for Practical).
- The 60% portion of question paper will be subjective type and 40% objective type the question paper will be section wise and each question will be divided in parts.
- The choice in attempting the question will be minimized to some extent.

## Syllabi and Courses of Reading

### PAPER A : MORPHOLOGY OF PLANTS

Definition, scope and classification of the plant kingdom.

Basic concepts of evolution in plant diversity

#### 1. Viruses

i. Salient features of viruses, General structure, and biochemical nature.

ii. Introduction to viral disease: Tobacco Mosaic Virus Disease.

#### 2. Kingdom Monera/Prokaryotae (Bacteria and Cyanobacteria)

i. General structure, Reproduction, Classification and Biological importance (Role of bacteria in Rhizosphere Nodulation, Role of bacteria in Nitrogen Cycling).

ii. General economic importance of bacteria.

Cyanobacteria: General account with special emphasis on nitrogen fixation and soil building; Life cycle of *Nostoc*.

#### 3. Fungi

General structure, Occurrence, Reproduction. Life cycles, Economic importance specially in food and industry, and Methods of control of pathogenic forms (Rust and Smut, Downy and powdery mildew, Damping off, root rot).

Plasmodiophoromycota: *Plasmodiophora*

Oomycota: *Pythium*

Ascomycota: *Penicillium, Saccharomyces, Alternaria*

Basidiomycota: *Ustilago, Puccinia, Agaricus.*

Deuteromycota: General accounts

#### 5. Lichens

General account, Structure and life cycle of *Physcia*.

#### 4. Kingdom Protista/Protoctista (Algae)

General structure, Occurrence, Reproduction, Classification, and Life cycles.

Chlorophyta: General account and economic importance; Life cycle of *Volvox*

Charophyta: Life cycle of *Chara*.

Vaucheriophyta: General account; Life cycle of *Vaucheria*.

Bacillariophyta: General account and economic importance; Life cycle of *Pinnularia*.

Phaeophyta: General account and economic importance; Life cycle of *Laminaria*

- Rhodophyta: General account and economic importance; Life cycle of *Batrachospermum* and *Polysiphonia*
6. **Kingdom Plantae (Bryophyta)**  
General account, Reproduction, Classification, Affinities, and Ecological importance with special reference of life cycles of *Porella*, *Anthoceros* and *Polytrichum*
7. **Pteridophyta**  
**Psilopsida:** General account of fossils and methods of fossilization, Geological time scale; General structure and life history of *Psilotum* and its affinities.  
**Lycopsida:** General account, structure and life history of *Selaginella* and its affinities.  
**Sphenopsida:** General account, structure and life history of *Equisetum*  
**Pteropsida:** General account, structure and life history of *Adiantum*, *Marselia* and *Polypodium*.  
**Gymnospermae:** General account with reference to structure and life histories of *Cycas*, *Pinus* and *Ephedra*, and their affinities.  
**Angiospermae:** Introduction to vegetative and reproductive structure

## PRACTICALS

1. Bacterial culture and staining Gram-positive and Gram-negative bacteria.
2. Study of the morphology and reproductive structures of the types mentioned in theory paper.
3. Identification of prepared slides and fresh specimens of the types mentioned.
4. Collection of diseased specimens of plants and their identification

## Recommended Books

1. **Bold, H. C.** Morphology of Plants, Harper and Row, New York.
2. **Hafiz, A. 1986.** Plant Diseases, Pakistan agricultural Research Council, Islamabad, Pakistan.
3. Lee, R. E. **1999.** Phycology, Cambridge University Press, Cambridge, United Kingdom.
4. **Mauseth, J.D.** 1998 An introduction to plant Biology, Multi media enhanced Jones & Bartlett, pub. UK.
5. **Moore, R.C. W.D. & Vodopich, D.S.** 1998. Botany. McGrawHill company, USA.
6. **Pandey, S.N.** 1994. Text book of Botany. Vol.II. S. Chand & Co., New Delhi
7. **Raven, P.X., Evert, R.E. & Eichorn, S.E.** 1999. Biology of plants. W.H.Freeman & Co. Worth Publishers.
8. **Ray, P.M., Sleeves, T.A. & Fultz, T.A. 1998.** Botany, Saunders College Publishing USA
9. **Ross, F.C. 1994.** Introduction to Microbiology. Jon Wiley & Co. USA

## PAPER B : PLANT SYSTEMATICS, ANATOMY AND DEVELOPMENT

### Plant Systematics

1. Introduction to Plant systematics its aims, objectives and importance.
2. Classification: Importance, brief history, introduction, various systems of classification (Brief account of all the systems)
3. Brief introduction to nomenclature, importance of Latin names and binomial system with an introduction to international code of Botanical Nomenclature (ICBN).
4. Morphology and Phytogeography a detailed account of various morphological characters of root, stem, inflorescence, flower, placentation and fruit types.
5. Diagnostic characters, economic importance and distribution pattern of the following families:
  1. Ranunculaceae
  2. Brassicaceae (Cruciferae)
  3. Fabaceae (Leguminosae)
  4. Rosaceae
  5. Euphorbiaceae

6. Rutaceae
7. Moraceae
8. Chenopodiaceae
9. Cucurbitaceae
10. Solanaceae
11. Lamiaceae (Labiatae)
12. Asteraceae (Compositae)
13. Liliaceae
14. Poaceae

### **Anatomy and Development**

1. Cell wall: structure and chemical composition.
2. Tissue and Tissue System: Concept: structure and function of various tissues.
3. Structure and development of root, stem and leaf including various type of meristem. Primary and secondary growth of dicot stem.
4. Early development of plant body (embryology) *Capsella bursa-pastoris* or *Arabdiopsis*

### **Practical.**

1. Study of cross section of monocot and dicot stem.
2. Study of the simple and compound tissue in macerated and sectioned material.
3. Study of cross section of bifacial leaf.
4. To study the prepared slides of secondary growth in dicot stem.
5. Identification of families given in syllabus with the help of keys.
6. Technical description of common flowering plants belonging to families mentioned in theory syllabus.
7. Field trips shall be undertaken to study and collect local plants; Students shall submit 40 fully identified herbarium specimens.

### **Recommended Books**

1. Bold, H.C. (1997), Morphology of Plants. Harper & Row, N.Y.
2. Dickison, W.C. (2000). Integrative Plant Anatomy. Pergamon Press, U.K.
3. Fahn, A. (1990) Plant Anatomy. Pergamon Press, U.K.
4. Mauseth. J.D. (1998). An Introduction to Plant Biology: Multimedia Enhanced Jones and Bartlett Pub, U.K.
5. Moore, R.C., W.D. Clarke and vodopich, D.S. (1998), Botany McGraw Hill Company, U.S.A.
6. Raven, P.H., Evert. R.E. and Eichhorm, S.E. (1999). Biology of Plants. W.H. Freeman and Company Worth Publishers,
7. Ray, kP.M. Steeves, T.A. and Fultz, T.A. (1998). Totany. Saunders College Publishing, USA.
8. Stuessy, T.F. (1990). Plant Taxonomy. Columbia University Press, USA.

## **PAPER C: CELL BIOLOGY GENETICS AND EVOLUTION**

### **Cell Biology**

1. Structures and Functions of Bio-molecules  
Carbohydrates  
Lipids  
Proteins  
Nucleic Acids
2. Cell: The Physico-chemical nature of Plasma membrane and cytoplasm.
3. The ultra structure of plant cell with a brief description and functions of the following organelles
 

(i) Endoplasmic reticulum	(ii) Plastids
(iii) Mitochondria	(iv) Ribosomes
(v) Dictyosomes	(vi) Vacuole
(vii) Microbodies (Glyoxysomes+Peroxisomes)	
(viii) Cytoskeleton	

4. Nucleus: Nuclear membrane, nucleolus, ultrastructure and morphology of chromosomes, karyotype analysis
1. Reproduction in somatic and embryonic cell, mitosis & meiosis, cell cycle
2. Chromosomal aberrations.
  - (i) Changes in the number of chromosomes. Aneuploidy and euploidy
  - (ii) Changes in the structure of chromosomes deficiency, duplication, inversion and translocation.

### Practical

1. Study of cell structure using compound microscope and elucidation of ultra structure from electron microphotographs
2. Measurement of cell size.
3. Study of mitosis and meiosis by smear/squash method and from prepared slides.
4. Study of chromosome morphology and variation in chromosome number.
5. Extraction and estimation of carbohydrate, protein, RNA. DNA from plant sources.

### Genetics

1. Introduction, scope and brief history of genetics. Mendelian inheritance; Laws of segregation and independent assortment, back cross. Test cross. Dominance and incomplete dominance.
2. Sex linked inheritance. Sex linkage in *Drosophila* and man (colour blindness. XO, XY. WZ mechanism Sex limited and sex linked characters, sex determination.
3. Linkage and crossing over: Definition, linkage groups, construction of linkage maps. Detection of linkage.
4. Molecular genetics; DNA replication. Nature of gene, genetic code, transcription, translation, protein synthesis, regulation of gene expression (e.g. lac operon).
5. Transmission of genetic material in Bacteria: Conjugation and gene recombination in *E. coli* transduction and transformation.
6. Principles of genetic engineering/biotechnology: Basic genetic engineering techniques.
7. Application of genetics in plant improvement: Induction of genetic variability (gene mutation, recombination), physical and chemical mutagens, selection, hybridization and plant breeding techniques, establishment of varieties, release of new varieties.
8. Introduction of genetic conservation
9. Evolution

### Practical

1. Genetical problems related to transmission and distribution of genetic material.
2. Identification of DNA in plant material. Carmine, orcein staining.
3. Study of salivary gland chromosomes of *Drosophila*.

### Recommended Books

1. Hoelzel, A.R. 2001. Conservation Genetics. Kluwer Academic Publishers.
2. Dyonsager, V.R. (1986). Cytology and Genetics. Tata and McGraw Hill Publication Co. Ltd., New Dehli,
3. Lodish. H. 2001. Molecular Cell Biology. W.H. Freeman and Co.
4. Sinha. U. and Sinha. S. (1988). Cytogenesis Plant Breeding and Evolution, Vini Educational Books, New Dehli.
5. Strickberger, M.V. (1988). Genetics, MacMillan Press Ltd, London.
6. Carroll, S.B., Grenier J.K. and Welnerbee; S.d. 2001. From DNA. To Diversity Molecular Genetics and the Evolution of Animal Design. Blackwell Science.
7. Lewin. R. 1997. Principles of Human Evolution. Black well Science.

## PAPER D : PLANT PHYSIOLOGY AND ECOLOGY

### Plant Physiology

1. Types and properties of solution; Electrolytes and non-electrolytes; Methods of expressing concentration of solution; Acids and salts; pH; Definition of buffers and their roles in biological systems; Colloidal systems, their nature, properties and biological significance.
2. Water relations (water potential osmotic potential, pressure potential, metric Potential) Absorption and translocation of water. Transpiration, factors affecting transpiration. Stomatal structure and functions.
3. **Mineral uptake:** Soil as source of minerals; Passive and active absorption; Essential mineral elements, their role and deficiency symptoms with emphasis on Ca, N, K and P; Translocation of solutes (inorganic and organic).
4. **Enzymes:** Definition, nature, properties and classification.
5. **Photosynthesis:** Measurements, factors affecting this process; concept of limiting factors; absorption and action spectra. Mechanism (Dark fixation of CO<sub>2</sub> and photophosphorylation) on the basis of two pigment system concept. Products of photosynthesis. Brief introduction to biological compound (Carbohydrate, lipid and protein. Electron transport system and oxidative phosphorylation
6. **Respiration:** Definition and mechanism, Glycolysis (anaerobic respiration). Krebs' cycle. Electron transport system and oxidative phosphorylation. Respiratory substrate and respiratory quotients.
7. **Nitrogen Metabolism:** Protein synthesis, nitrification, nitrification, ammonification, biological nitrogen fixation.
8. **Growth:** Definition; role of auxins, gibberellins and cytokinins in controlling growth. Introduction to plant tissue culture.
9. **Photoperiodism:** Definition, historical background, short day, long day and day neutral plants. Night interruption experiments. Hormonal concept in photoperiodism, role of phytochromes.
10. **Dormancy:** Definition and causes of dormancy, methods of breaking dormancy.
11. **Vernalization:** Annual and biennial forms. Hormonal concept and phasic development theory.
12. **Plant Movements:** Tropic movement, phototropism, gravitropism and their mechanism. Nastic and tactic movements.

### Practical

1. Preparation of solutions of specific normality of acids/bases, salts, sugars, molal and molar solutions and their standardization.
2. Determination of uptake of water by swelling seeds when placed in sodium chloride of different concentrations.
3. Measurement of leaf water potential by the dye method.
4. Determination of the temperature at which beet root cells lose their permeability.
5. Determination of the effects of environmental factors on the rate of transpiration of a leafy shoot by means of a photometer/by cobalt chloride paper method.
6. Tests for sugars (Reducing and non-reducing). Glucose, maltose, fructose.
7. Chemical tests for the following cell constituents:  
(i) Starch (ii) Cellulose (iii) Lignin (iv) Proteins
8. Extraction of chlorophyll from the leaves and separation of component pigments on a paper chromatogram. Study of absorption spectra using spectrophotometer,
9. Comparison of the effects of green, red and blue coloured light on the amount of oxygen evolved by a photosynthesizing plant.
10. Estimation of oxygen utilized by a respiring plant by Winkler's method.
11. Extraction of amylase from germinating wheat seeds and study of its effect on starch breakdown.
12. Measurement of carbon dioxide evolution during respiration of germination seeds by the titration method.

13. Determination of leaf area index.
14. Measurement of growth by leaf area increase method.
15. Study of different stages of seed germination.

### Recommended Books

1. Ihsan Illahi (1995). Plant Physiology. Biochemical Processes in Plants, UGC Press.
2. Witham & Devlin. 1986 Exercises in Plant physiology, AWS Publishers, Boston.
3. Taiz, I. and Zeiger, E. 1998. Plant Physiology. 2<sup>nd</sup> Ed. Sinauers Publ, Co Inc. Calif.
4. Salisbury F.B and Ross C.B. 1999. Plant Physiology. 5<sup>th</sup> Edition. Wadsworth Publishing Co. Belmont CA.
5. W.B. Hopkins. 1999, Introduction to Plant Physiology. 2<sup>nd</sup> Ed. John Wiley& sons New York.

## ECOLOGY

### 1. Concepts of Ecology

### 2. Brief history of Ecology

### 3. Ecophysiology

- a. Light and temperature responses
  - i. Quantity of light
  - ii. Quality of light
  - iii. Duration of light
  - iv. Variation in temperature
  - v. Ecophysiological responses
- b. Edaphology
  - i. Brief introduction of soil forming process
  - ii. Texture. Structure and water
  - iii. Chemical Prosperities
  - iv. Biological components: Soil Organisms. Organic matters
- c. Water
  - i. Precipitation: Kinds and affectivity.
  - ii. Distribution of vegetation in relation to moisture.
- d. Wind-Ecological importance of wind

### 4. Population Ecology:

A brief introduction, history and background. Seed dispersal. Seed bank. Demography, productive strategy.

### 5. Community Ecology:

- a. Concept of plant community attributes
- b. Sampling method
- c. Succession history, concept. Development and modern theories of succession.
- d. Brief concept of productivity.
- e. Local vegetation

### 6. Ecosystem:

- i. Definition and background
- ii. Ecological energetic
- iii. Biogeochemical cycle (Hydrologic and nitrogen cycle).

### 7. Applied Ecology

Aridity, biodiversity, conservation, water logging and salinity. pollution, orosio. desertification. management.

## Practical

1. Measurement of light and temperature.
2. Effect of light and temperature on seed germination
3. Determination of soil texture by hydrometer method
4. Determination of maximum water holding capacity.

5. Determination of carbonates. Electrical conductivity and pH in Soil and Water.
6. Measurement of wind velocity.
7. Population demographic technique.
8. Measurement of vegetation by Quadrat Bisect and transect methods.
9. Determination of productivity by harvest method
10. Several trips to ecologically diverse vegetations.

### Recommended Books

1. Ricklefs. R.E. 2000 Ecology. W.H. Freeman & Co. U.K.
2. Ricklefs. E.R. 2001. The Economy of Nature W.H. Freeman & Co. U.K
3. Barbour, M. G., I.H. Burke and W.D. Pitts. 1999. Terrestrial Plan Ecology, the Benjamin. Gumming Publishing Co. Palo Alto California. U.S.A.
4. Chapman. J.L. and Rciss M.J. Ecology: principles and application. Cambridge University Press,
5. Hussain F. 1989. Field and Laboratory Manual of Plan Ecology National Academy of Higher Education, Islamabad
6. Krebs. C.J. 1997. Ecology. Harper and Row Publishers.
7. Moore, P.D. and S. B. Chapman. 1986. Methods in Plant Ecology Blackwell Scientific Publication Oxford.
8. Smith, R. 1996. Ecology and Field Biology. Addison. Wesley Longman Inc., New York.
9. Smith. R.L. 1998. Ecology of Elements. Harper & Rew Publisher New York.
10. Stiling O.D. 1996. Ecology: Theories and applications. Prentice Hall. New Jersey.
11. Subrahmanyam. N.S. and Sambamurthy, A.V.S.S. 2000. Ecology Narosa Publishing Hoese. New Delhi.
12. Townsend. C.R. Harperx, J.L. and Begon M.E. 2000. Essentials Ecology. Blackwell Scientific Publications, UK.