

**GOVERNMENT COLLEGE FOR WOMEN,
PARADE GROUND, JAMMU
(An Autonomous College)**

**BOTANY SYLLABUS
B.Sc. SEMESTER I-IV
UNDER
CHOICE BASED CREDIT SYSTEM (CBCS)**

AND

B.Sc. SEMESTER V-VI

BOTANY (Semester-I)

(For examinations to be held in the years 2016, 2017, 2018)

Title: Diversity of Microbes & Cryptogams (Theory)

Duration of Exam: 3hrs

Maximum Marks: 100

Credits: 04

External Examination: 80 Marks

Internal Assessment: 20 Marks

Objectives: The course is designed to familiarize the students with microbes and cryptogams. These plant groups are of great human use in agriculture, horticulture, medical and biotechnology based industries. Therefore, students need to know about their structural diversity, biology and utilization.

Unit-I Microbes and Microbiology

1.1 General account of plant viruses (TMV), transmission and control; concept of viroids and prions.

1.2 Bacteria-Ultrastructure, nutrition and reproduction, general account of Mycoplasma and Cyanobacteria.

1.3 Genetic recombination in bacteria (transformation, transduction and conjugation).

1.4 Economic importance of bacteria and plant viruses.

Unit-II Algae

2.1 General characteristics and classification of algae (Parker, 1982) up to class level.

2.2 Important features of Chlorophyceae and Xanthophyceae; life histories of *Volvox*, *Oedogonium*, *Chara* and *Vaucheria*.

2.3 Important features of Phaeophyceae and Rhodophyceae; Life histories of *Ectocarpus* and *Polysiphonia*.

2.4 Economic importance of algae (as food and feed; algal blooms and toxins).

Unit-III Fungi

3.1 General characteristics and classification of fungi (Ainsworth 1971), Economic importance of fungi, General account of Lichens.

3.2 Important features of Mastigomycotina; Life histories of *Pythium* and *Allomyces*.

3.3 Important characteristics of Zygomycotina and Ascomycotina; Life histories of *Rhizopus*, *Eurotium* and *Morchella*.

3.4 Important characteristics of Basidiomycotina and Deuteromycotina; Life histories of *Puccinia*, *Agaricus*, *Colletotrichum* and *Cercospora*.

Unit-IV Bryophytes

4.1 Bryophytes as the earliest land dwellers; general characteristics, classification (Smith, 1955) and alternation of generations.

4.2 Structure and reproduction in Hepaticae with reference to *Marchantia*.

4.3 Structure and reproduction in Anthocerotae and Musci with reference to *Anthoceros* and *Funaria*.

4.4 Evolution of sporophyte in bryophytes; importance of bryophytes in preventing soil erosion; monitoring and controlling pollution; geobotanical prospecting; in horticulture and as source of antibiotics.

Unit-V Pteridophytes

5.1 General characteristics, classification (Sporne, 1975) and origin of pteridophytes (the first vascular plants); stelar system and alternation of generations.

5.2 Important characteristics of Psilopsida and Lycopsida; Structure and reproduction in *Psilotum*, *Lycopodium* and *Selaginella* (excluding development).

5.3 Important characteristics of Sphenopsida; structure and reproduction in *Equisetum* (excluding development).

5.4 Important characteristics of Pteropsida; structure and reproduction in *Pteris* and *Marsilea* (excluding development).

Note for paper setters

External End Semester Examination (Total marks: 80)

The question paper will have 2 sections. Section 'I' will be compulsory having ten questions of 2 marks each. The questions will be short answer type having answers not exceeding 20 to 50 words. Section II will have long answer type questions of 12 marks each, two from each unit. The candidates will be required to answer one question from each unit.

Internal Assessment (Total Marks: 20)

Suggested Readings

- 1. Bilgrami, K.S. and Saha L.C. 1992. A Textbook of Algae. CBS Publishers and Distributors, Delhi.**
- 2. Dube, H.C. 1990. An Introduction to Fungi. Vikas Publishing House Pvt. Ltd., Delhi.**
- 3. Parihar, N. S. 1996. The Biology and Morphology of Pteridophytes. Central Book Distributors, Allahabad.**

4. **4. Puri, P. 1980. Bryophyta: Broad prospectives. Atma Ram & Sons, Delhi.**
5. **5. Rashid A. 1976. An Introduction to Pteridophytes- Diversity and Differentiation. Vikas Publishing House.**
6. **6. Smith, G.M. 1971. Cryptogamic Botany. Vol-I: Algae & Fungi. Tata McGraw Hill Publishing Co., New Delhi.**
7. **7. Smith, G.M. 1971. Cryptogamic Botany. Vol. II; Bryophytes & Pteridophytes. Tata McGraw Hill Publishing Co., New Delhi.**
8. **8. Sporne, K. R. 1970. The Morphology of Pteridophytes. Hutchinson Univ. Library, London.**
9. **9. Sumbali, G. and Mehrotra, R. S. 2009. Principles of Microbiology. The McGraw Hill Education Pvt. Ltd. New Delhi.**
10. **10. Sumbali G. 2010. The Fungi. 2nd Edn. Narosa Publishing House, New Delhi.**

BOTANY (Semester-I)

(For examinations to be held in the years 2016, 2017, 2018)

Title: Diversity of Microbes & Cryptogams (Practical)

Duration of Exam: 3hrs.

Maximum Marks: 100 Credits: 02

External Examination: 50 Marks

Internal Assessment: 50 Marks

Suggested Laboratory Exercises

- 1. Study of the genera included under algae and fungi.**
- 2. Study of morphology, reproductive structures and anatomy of the examples cited in theory under Bryophyta and Pteridophyta.**
- 3. Observation of disease symptoms in hosts infected by fungi, viruses and mycoplasma. Section cutting of diseased materials and identification of the pathogens as per the theory syllabus.**
- 4. Gram staining of bacteria.**
- 5. Study of crustose, foliose and other types of lichen thalli.**

Note for distribution of 50 Marks in Practical Examination:

I. Internal Assessment

- 1. Day to Day performance in the laboratory: 12 Marks**
- 2. Test: 8 Marks**
- 3. Regularity of Attendance: 5 Marks**

II. External Assessment : 25 Marks

BOTANY (Semester-II)

(For examination to be held in the years 2016, 2017, 2018)

Title: Characteristics and Systematics of seed plants (Theory)

Duration of Exam: 3hrs

Maximum Marks: 100 Credits: 04

External Examination: 80 Marks

Internal Assessment: 20 Marks

Objectives: Gymnosperms and angiosperms represent the important botanical groups exhibiting great diversity. The course, therefore, is designed to study these groups for structural aspects and analyse these in a scientific manner for establishing their grouping.

UNIT-I: Seed Plants-Origin, Evolution and Characteristics

1.1 Fossilization –Processes and types, age of fossils and their importance.

1.2 Fossil gymnosperms - a general account; Benettiales (Cycadeoidales)- history and distribution.

1.3 Characteristic features, morphology, anatomy and reproduction in *Williamsonia* and *Cycadeoidea*.

1.4 Fossil angiosperms – a general account.

UNIT-II Classification, Morphology and Reproduction in Gymnosperms

2.1 General characters of gymnosperms; classification of gymnosperms as proposed by Sporne (1965).

2.2 Morphology, anatomy, reproduction and life cycle of *Cycas*

2.3 Morphology, anatomy, reproduction and life cycle of *Pinus*.

2.4 Morphology, anatomy, reproduction and life cycle of *Ephedra*.

UNIT-III Angiosperm-Origin and Nomenclature

3.1 Origin of angiosperms, characteristics of some primitive angiosperms with special reference to *Magnolia*.

3.2 History of angiosperm taxonomy - classical and modern, species concept and speciation.

3.3 Taxonomic identification: taxonomic keys and literature (floras, monographs and reviews).

3.4 Botanical nomenclature- principles and rules, taxonomic ranks, type concept and principle of priority.

UNIT-IV Classification and Tools in Angiosperm Taxonomy

4.1 Salient features of the classification of Bentham and Hooker; merits and demerits.

4.2 Salient features of the classification of Engler and Prantl; merits and demerits.

4.3. Contribution of anatomy and embryology to taxonomy.

4.4 Contribution of cytology and phytochemistry to taxonomy.

UNIT-V Diversity of Angiosperms

5.1 Morphological diversity of families: Ranunculaceae, Brassicaceae, Malvaceae and Asteraceae.

5.2 Morphological diversity of families: Fabaceae, Rosaceae, Apiaceae and Acanthaceae.

5.3 Morphological diversity of families: Apocyanaceae, Solanaceae, Lamiaceae and Euphorbiaceae.

5.4 Morphological diversity of families: Liliaceae, Amaryllidaceae and Poaceae.

Note for paper setters

External End Semester Examination (Total marks: 80)

The question paper will have 2 sections. Section 'I' will be compulsory having ten questions of 2 marks each. The questions will be short answer type having answers not exceeding 20 to 50 words. Section II will have long answer type questions of 12 marks each, two from each unit. The candidates will be required to answer one question from each unit.

Internal Assessment (Total Marks: 20) 20 marks for theory paper in a subject reserved for internal assessment

Suggested readings:

- 1. Bhatnagar, S.P. and Moitra, A. 1996. Gymnosperms. New Age International Limited, New Delhi.**
- 2. Davis, P.H. and Heywood, V.H. 1963. Principles of Angiosperm Taxonomy. Oliver and Boyd, London.**
- 3. Gifford, E.M. and Foster, A.S. 1988. Morphology and Evolution of Vascular Plants. W.H. Freeman and company, New York.**
- 4. Jeffery, C. 1982. An Introduction to Plant Taxonomy. Cambridge University Press, London.**

5. Jones, S.B. and Luchsinger, A.E. 1986. Plant Systematics. 2nd Edn. Mc Graw Hill Book Co., New York.

6. Radford, A.E.1986. Fundamentals of Plant Systematics. Harper and Row, New York.

7. Singh, G. 1999. Plant Systematics: Theory and Practice. Oxford and IBH Pvt. Ltd., New Delhi.

8. Sporne, K.R. 1965. The Morphology of Gymnosperms. Hutchinson and Co. Ltd., London.

9. Stace, C.A. 1989. Plant Taxonomy and Biosystematics. 2nd Edn., Edward Arnold, London.

10. Stewart, W.M. 1983. Paleobotany and the Evolution of Plants. Cambridge University Press, Cambridge.

BOTANY (Semester-II)

(For examinations to be held in the years 2016, 2017, 2018)

Title: Characteristics and Systematics of seed plants. (Practical)

Duration of Exam: 3hrs

Maximum Marks: 100

Credits: 02 External Examination: 50 Marks Internal Assessment: 50 Marks

ANGIOSPERMS Locally available genera/species of following families should be included. This list is only indicative. Teachers may select plants available in their locality.

- 1. Ranunculaceae: *Ranunculus, Delphinium***
- 2. Brassicaceae: *Brassica, Alyssum, Iberis, Coronopus***
- 3. Malvaceae: *Hibiscus, Abutilon***
- 4. Asteraceae: *Tagetes, Ageratum***
- 5. Fabaceae: Faboideae: *Lathyrus, Cajanus, Melilotus, Trigonella*, Caesalpinioideae; *Cassia, Caesalpinia*, Mimosoideae: *Prosopis, Mimosa, Acacia*.**
- 6. Apiaceae: *Coriandrum, Foeniculum, Anethum***
- 7. Acanthaceae: *Adhatoda, Peristrophe***
- 8. Apocynaceae: *Vinca, Thevetia, Nerium***
- 9. Asclepiadiaceae: *Calotropis***
- 10. Solanaceae: *Solanum, Withania, Datura, Petunia***
- 11. Euphorbiaceae: *Euphorbia, Phyllanthus***
- 12. Lamiaceae: *Ocimum, Salvia***
- 13. Chenopodiaceae: *Chenopodium, Beta***
- 14. Liliaceae: *Asphodelus, Asparagus, Allium***
- 15. Poaceae: *Zea mays, Triticum aestivum, Oryza sativa***

GYMNOSPERMS CYCAS

i. Habit, armour of leaf bases on the stem (if specimen is not available show photograph), very young (circinate venation) and old foliage leaves, scale leaves, bulbils, male cone (specimen), microsporophyll, megasporophyll, mature seed.

ii. Study through permanent slides-normal root (T.S), stem (T.S) (if sections are not available show photographs) and ovule (L.S.) iii. Study through hand sections or dissections- coralloid root (T.S), rachis (T.S), leaflet (V. S.) and Pollen grains (W.M).

PINUS

1. Habit, long and dwarf shoots showing cataphylls and scale leaves, T.S. Wood showing growth rings, male cones of 1st year, 2nd year and 3rd year, female cones, winged seeds.

2. Study through permanent slides-root (T.S), female cone (L.S), ovule (L.S) and embryo (WM) showing polycotyledonous conditions.

3. Study through hand sections or dissections-young stem (T.S), old stem (Wood) (T.L.S and R.L.S), needle (T.S), male cone (L.S and T.S) and Pollen grains (W.M.).

EPHEDRA

1. Habit and structure of whole male and female cones

2. Permanent slides-female cone (L.S)

3. Hand sections, dissections-node (L.S), internode (T.S), macerated stem to see vessel structure, epidermal peel mount of vegetative parts to study stomata; male cone (T.S and L.S) and pollen grains (W.M.)

In addition to laboratory exercises, study of plant diversity in nature is required, for which a field trip should be organized.

Note for distribution of 50Marks in Practical Examination:

I. Internal Assessment

1. Day to Day performance in the laboratory: 12 Marks

2. Test: 8 Marks

3. Regularity of Attendance: 5 Marks

II. External Assessment : 25 Marks

BOTANY (Semester-III)

(For examinations to be held in the years Dec 2017, 2018, 2019)

Title: Plant Anatomy, Embryology and Ecology (Theory)

Duration of Exam: 3.0 hrs

Maximum Marks: 100

Credits: 04

External Examination: 80 Marks

Internal Assessment: 20 Marks

Objectives: Seed bearing plants represent the most advanced groups of plant kingdom. Proper knowledge about their structure, functions, mechanisms of multiplication and their interactions with the biotic and abiotic components of the ecosystems will assist in manipulating these for better human utility. This course will create awareness among students about proper utilization of important plant parts.

UNIT-I: Plant, Structure and Organization.

1.1 Meristems: concept and types; structure and organization of RAM and SAM

1.2 Anatomy of primary root and primary stem (both monocots and dicots)

1.3 Vascularisation of primary shoot in monocotyledons and dicotyledons, leaf traces and leaf gaps; branch traces and branch gaps.

1.4 Epidermal modifications in monocots and dicots (trichomes and stomata), their structural organization and systematic value.

UNIT-II: Primary and Secondary Structures

2.1 Vascular and cork cambium: structure and derivatives; lenticels

2.2 Structure of secondary xylem and secondary phloem

2.3 Secondary growth – a general account; growth rings; heartwood, sapwood

2.4 Leaf : origin, development and vascularisation; Internal structure of monocot and dicot leaf, concept of senescence and abscission.

UNIT-III Embryology

3.1 Flower structure and functions; Structure of anther, male gametophyte and microsporogenesis; Structure of pistil, ovule, female gametophyte and megasporogenesis.

3.2 Pollination: Types, attractants and rewards for pollinators; pollen-pistil interaction; self-incompatibility.

3.3 Double fertilization, embryo and endosperm development, types, cytology and functions of endosperm; formation of fruit.

3.4 Seed formation and seed dispersal strategies.

Unit-IV Plants and Environment

4.1 Atmosphere- Stratification and gaseous composition; Carbon and hydrological cycle and their significance, greenhouse gases and climate change.

4.2 Soil structure, soil profiles and development; soil types in India.

4.3 Concept of ecology, ecosystem: structure, abiotic and biotic components, food chain, food web, ecological pyramids and energy flow.

4.4 Community ecology: Community characteristics, frequency, density cover, life forms, biological spectrum.

Unit-V Population, community and natural resources

5.1 Ecological succession: Concept, process and its types; climax communities.

5.2 Population ecology, growth curves; Ecotypes and ecads.

5.3 Ecotone and edge effect-concept and types.

5.4 Phytogeographical regions of India

Note for paper setters

External Semester Examination (Total marks: 80)

The question paper will have 2 sections. Section 'I' will be compulsory having ten questions of 2 marks each. The questions will be short answer type having answers not exceeding 20 to 50 words. Section II will have long answer type questions of 12 marks each, two from each unit. The candidates will be required to answer one question from each unit.

Internal Assessment (Total Marks: 20)

SUGGESTED READING 1. Bhojwani, S.S and Bhatnagar, S.P. 2000. The Embryology of Angiosperms. 4th Edn. Vikas Publishing House, Delhi.

2. Cutter, E.G. 1969. Plant Anatomy: Experiment and Interpretation. Part-I: Cells and Tissues. Edward Arnold, London

3. Cutter, E.G. 1970. Plant Anatomy: Experiment and Interpretation. Part-II: Organs. Edward Arnold London.

4. Esau, K. 1977. Anatomy of Seed Plants. 2nd Edn. John Wiley and Sons, New York.

- 5 Chapman, J.L. and Reiss, M.J. 2000. Ecology: Principles and Applications. 2nd Edn., Cambridge University Press , U.K.
6. Kebs, C.J. 1989. Ecological Methodology. Harper and Row, New York, USA.
7. Kormondy, E.J. 1996. Concepts of Ecology. Prentice- Hall of India Pvt. Ltd. New Delhi.
8. Ludwist. J.A. and Reynolds, J.F. 1988. Statistical Ecology. Wiley, New York.
9. Misra, R. 1988. Ecology Work Book. Oxford and IBH, New Delhi.
10. Moore. P.W. and Chapman, S.B. 1986. Methods in Plant Ecology. Blackwell Scientific Publications.
11. Odum, E.P. 1983. Basic Ecology. Saunders, Philadelphia.
12. Sharma, P. D. 2010. Ecology and Environment. 10th Edn. Rastogi Publications, Merut. India
13. Townsend, C.R., Begon, M. and Harper, J.L. 2008. Essentials of Ecology. 3rd Edn. Blackwell publishing. U.K.
14. Underwood, A.J. 1977. Experiments in Ecology: Their logical design and interpretation using analysis of variance. Cambridge University Press.
15. APHA-Standard methods for the examination of water and waste water, American Public Health Association, Washington.
16. Faegri, K and Vander Pijl. 1979. The Principles of Pollination Ecology. 2nd Edn. Pergamon Press, Oxford.
17. Fahn, A. 1974. Plant Anatomy. 2nd Edn. Pergamon Press.
18. Kind, J. 1997. Reaching for the sun: How Plants work. Cambridge University Press, Cambridge, U.K.
19. Mauseth, J.D. 1988. Plant Anatomy. The Benjamin Cummings Publishing Company, Menio Park, California, USA.
20. Proctor, M and Yeo, P. 1973. The Pollination of Flowers. William Collins Sons, London.
21. Raven, P.H., Evert, R.F. and Eichhorn, S.E. 1999. Biology of Plants, 5th Edn. W.H. Freeman and Co. Worth Publishers, New York.
22. Thomas, P. 2000. Trees: Their Natural History. Cambridge University Press, Cambridge.

BOTANY (Semester-III)

(For examinations to be held in the years Dec 2017, 2018, 2019)

Title: Plant Anatomy, Embryology and Ecology (Practical)

Duration of Exam: 3 hrs

Maximum Marks: 50

Credits: 02 External Examination: 25 Marks

Internal Assessment: 25 Marks

- 1. To study shoot and root tip with emphasis on cyto-histological zonation.**
 - 2. Anatomy of primary and secondary growth in monocots and dicots using hand sections and prepared slides. Structure of secondary phloem and xylem. Growth rings in wood, Microscopic study of wood in T.S., T.L.S., and R.L.S.**
 - 3. Study of diversity in leaf shape, size, thickness, surface properties; internal structure of leaf, structure and type of stomata and trichomes (using epidermal peels of leaf).**
 - 4. Anatomy of the root; primary and secondary structure.**
 - 5. Examination of wide range of flowers available in the locality and methods of their pollination.**
 - 6. Structure of anther, microsporogenesis (using slides) and pollen grains (using whole mounts). Pollen viability using in vitro pollen germination.**
 - 7. Structure and types of ovule.**
 - 8. Endosperm and embryo development in monocots and dicots (using slides and dissections).**
 - 9. To determine the minimum requisite size of the quadrat for phytosociological studies.**
 - 10. To determine the frequency, density, abundance, basal area and importance value index of herbaceous and tree flora.**
- 1. To determine the different life forms of the plant species of the grassland ecosystem and prepare a biological spectrum by comparing with Raunkiaer's normal spectrum.**
 - 2. To study the various soil horizons for drawing the soil profile diagram.**
 - 3. To determine the bulk density, water holding capacity and porosity of forest and grassland ecosystems.**
 - 4. To measure pH and dissolved oxygen contents in different water ecosystems.**

Internal Assessment

1. Day to Day performance in the laboratory: 12 Marks

2. Test: 8 Marks

3. Regularity of Attendance: 5 Marks

II. External Assessment : 25 Marks

BOTANY (Semester-IV)

(For examinations to be held in the years May 2018, 2019, 2020)

Title: Plant Physiology and Metabolism (Theory)

Duration of Exam: 3.0 hrs

Maximum Marks: 100

Credits: 04

External Examination: 80 Marks

Internal Assessment: 20 Marks

Objectives: The course is designed to make students appreciate the various mechanisms underlying the important activities of plants as absorption of water and minerals, solute transport, transpiration, flowering, nitrogen metabolism etc. Another aim is to impart students knowledge regarding the stresses that plants face and methods adopted by them to tackle/overcome these stresses.

Unit-I Enzymes and water relations in plants

1.1 Discovery and nomenclature of enzymes, characteristics of enzymes, concept of holoenzyme, apoenzyme, co-enzyme and co-factors.

1.2 Regulation of enzyme activity; mechanism of enzyme action.

1.3 Diffusion of water, osmosis, water potential, absorption and transport of water through xylem.

1.4 Types and mechanism of transpiration and mechanism of opening and closing of stomata.

Unit-II Mineral nutrition and phloem translocation

1.3 Concept of macro-and micro-elements and mineral uptake; Importance of Ca, N, P, K, Mg to the plants and their deficiency symptoms.

1.4 Transport of ions across cell membrane, active and passive transport, carriers, channels and pumps.

1.5 Translocation in phloem; composition of phloem sap; girdling experiment, pressure flow model, phloem loading and unloading.

1.6 Source-Sink relationship, factors affecting phloem translocation.

Unit-III Photosynthesis and Respiration

3.1 Photosynthesis – a general account of photosynthetic pigments, red drop and enhancement effect; concept of photosystems, PSI and PSII; cyclic and non cyclic photophosphorylation.

3.2 Carbon fixation- Calvin cycle, C₄, Crassulacean Acid Metabolism and photorespiratory pathways and their significance.

3.3 Respiration- Glycolytic pathway, Kreb's cycle, Pentose phosphate pathway.

3.4 Electron transport mechanism and oxidative phosphorylation, mechanism of synthesis of ATP (Chemi-osmotic theory).

Unit-IV Nitrogen fixation, secondary metabolism and abiotic stress

4.1 Biological nitrogen fixation-symbiotic and asymbiotic nitrogen fixation; nitrate and ammonium assimilation.

4.2 Biosynthesis and functions of phospholipids; β -oxidation pathway.

4.3 Secondary metabolism, concept and role; Phenylpropanoid pathway, Shikimic acid pathway. 4.4 Abiotic stress – types of stresses (drought, heavy metal, pH and salinity); reactive oxygen species (production and management); physiological responses to drought, heavy metal and salinity stress.

Unit-V Physiology of growth and flowering

5.1 Plant growth and development - phases and kinetics of growth; seed dormancy and germination - general account, factors affecting seed dormancy and germination.

5.2 Physiology of flowering - florigen concept, photoperiodism, vernalization.

5.3 Phytochromes - their discovery, physiological role and mechanism of action.

5.4 Plant hormones - auxins, gibberellins, cytokinins, abscissic acid and ethylene, their role and mode of action

Note for paper setters External End Semester Examination (Total marks: 80) Time duration: 2 hrs 30 min

External Semester Examination (Total marks: 80)

The question paper will have 2 sections. Section 'I' will be compulsory having ten questions of 2 marks each. The questions will be short answer type having answers not exceeding 20 to 50 words. Section II will have long answer type questions of 12 marks each, two from each unit. The candidates will be required to answer one question from each unit.

Internal Assessment (Total Marks: 20)

Suggested Reading

1. Buchanan, B.B., Gruissen, W. and James, R.L. 2000. Biochemistry and Molecular Biology of Plants. I.K. International Pvt. Ltd. New Delhi.

2. Galston, A.W. 1989. Life Process in Plants. Scientific American Library, Springer-Verlag, New York, USA.

3. Hopkins, W.G. 2008. Introduction to Plant Physiology. John Wiley and Sons, Inc. New York, USA. 4. Taiz, L and Zeiger, E. 2006. Plant Physiology. 4th Edn., Sinauer Associates, Inc Publishers, Massachusetts, USA.

BOTANY (Semester-IV)

(For examinations to be held in the years May 2018, 2019, 2020)

Title: Plant Physiology and Metabolism (Practical)

Duration of Exam: 3 hrs Maximum Marks: 50 Credits:
02 External Examination: 25 Marks Internal Assessment: 25 Marks

- 1. Estimation of inorganic phosphate in plant tissue.**
- 2. To study the permeability of plasma membrane using different concentrations of organic solvents.**
- 3. To study the effect of temperature on permeability of plasma membrane.**
- 4. To prepare the standard curve of protein and determine the protein content in unknown samples by Lowry's and methods.**
- 5. To study the enzyme activity of catalase and peroxidase as influenced by pH and temperature.**
- 6. Comparison of the rate of respiration in germinating seeds.**
- 7. Separation of chloroplast pigments by solvent partitioning/paper chromatography/TLC methods.**
- 8. Determining the osmotic potential of vacuolar sap by plasmolytic method.**
- 9. Determining the water potential of potato tubers.**
- 10. Separation of amino acids in a mixture by paper chromatography and their identification by comparison with standards.**
- 11. Demonstration of rate of transpiration by cobalt chloride method.**
- 12. Demonstration of stomatal movements.**
- 13. Demonstration of osmosis by using potato tuber.**
- 14. Demonstration of plasmolysis and deplasmolysis.**

Internal Assessment

- 1. Day to Day performance in the laboratory: 12 Marks**
- 2. Test: 8 Marks**
- 3. Regularity of Attendance: 5 Marks**

II. External Assessment : 25 Marks

BOTANY (Semester-V)

(For examinations to be held in the year 2017)

Title: Plant Physiology and Ecology (Theory)

Duration of Exam: 3.0hrs

Maximum Marks: 100

Credits: 04 External Examination: 80 Marks Internal Assessment: 20 Marks

Unit I: Plant water relationships and adaptations of Plants to Environment

- 1.1 Water: Diffusion, osmosis, water potential, absorption and transport through xylem.
- 1.2 Transpiration: Types, mechanism, importance and mechanism of opening and closing of stomata.
- 1.3 Account of morphological, anatomical and physiological responses of plants to water (hydrophytes and xerophytes) and salinity (halophytes).
- 1.4 Account of morphological, anatomical and physiological responses of plants to light (heliophytes and sciophytes).

Unit II: Mineral nutrition and fixation of carbon and Nitrogen

- 2.1 Essential minerals: Criteria for essentiality, importance, mechanism of uptake from the soil.
- 2.2 Mechanism of transport of organic substances in phloem, source-sink relationship.
- 2.3 Photosynthesis: Importance, general account of light reactions (Red drop, Emerson enhancement effect). Photosynthetic pigments, concept of photosystems, cyclic and non-cyclic photophosphorylation.
- 2.4 Carbon fixation: Calvin cycle, Hatch & Slack cycle, CAM pathway and photorespiration.

UNIT III: Respiration and Fixation of Nitrogen

- 3.1 Respiration: glycolytic pathway, krebs cycle, pentose phosphate pathway.
- 3.2 Redox potential, electron transport chain and oxidative phosphorylation, chemiosmotic theory.
- 3.3 Lipid metabolism: biosynthesis and functions of phospholipids and β oxidation.
- 3.4 Nitrogen Fixation: Importance and mechanism, ammonium Assimilation.

Unit IV: Plant growth and development and Phytohormones

- 4.1 Plant growth and development: concept, phases and kinetics of growth, seed germination, factors affecting seed germination.
- 4.2 Physiology of Flowering: Florigen concept, photoperiodism and vernalization.
- 4.3 Plant hormones: Auxins, gibberellins and cytokinins , their biosynthesis, physiological importance and mode of action.
- 4.4 Plant hormones: Abscisic acid and ethylene, biosynthesis, physiological importance and mode of action. Phytochromes a general account.

Unit V: Plants and Environment

- 5.1 Atmosphere: Stratifications and gaseous composition. Greenhouse gases, Climate change.
- 5.2 Soil: Structure and development, soil profile and soil types of India.
- 5.3 Concept of Ecology, ecosystem, structure, abiotic and biotic components, food chain, food web, ecological pyramids and energy flow.
- 5.4 Ecological succession: concept, processes and its types, population characteristics.

Guidelines for paper setter:

The question paper will be of two sections. Section 'I' will be compulsory having 10 questions of 2 marks each. These questions will be short answer type, where the students are required to write their answers briefly (not exceeding twenty words). Section 'II' long answer type questions of 12 marks each, two from each unit. The candidates will be required to answer one question from each unit.

Internal Assessment (Total Marks: 20)

Suggested Readings

1. Chapman, J. L. Reiss, M.J.2000. Ecology: Principals and applications Cambridge Uni. Press O.K.
2. Trivedi, R.K. 1995. Advances in Environmental Sciences and Technology, Ashish Publishing House, New Delhi.
3. Agarwal, K.C. 2001. Environmental Biology, Nidhi Publication Ltd, Bikaner.
4. Asthana, D. K.and Asthana, Meera. 2013. A text book of Environmental studies, S. Chand and Company Pvt. Ltd., New Delhi.
5. Wegnaev, K.D. 1998. Environmental Management, W.B Saunders Co. Philadelphia
6. Hopkins, W. G. 2008 introduction to Plant Physiology, John Wiley and Sons,Inc. New York, USA
7. Mohrj and Schopfer,P 1995 Plant Physiology, Spring-Verlag Berlin Germany.

8. Salisbury, F.B and Ross, C.W 1992, Plant Physiology , Wadsworth publication Co. California USA
9. Mackenzie, Instant Notes in Ecology, Viva Books Pvt. Ltd. New Delhi.
10. Odum, E.D 1983, Basic Ecology, Saunders, Philadelphia CRC Press Waghinton.
11. Lea, P. J. And Leegood, R. C. 1999. Plant Biochemistry and molecular Biology, John Wiley and Sons, Chichester, England.
12. Townsend, C.R., Begon, M. and Harper, J.L 2008 Essentials of Ecology, Black Well Publishing U.K.
13. Odum E. P. 1983. Basic Ecology, Saunders Philadelphia.
14. Kormondy, E. J. 1996. Concepts of Ecology, Prentice- Hall of India pvt. Ltd. New Delhi.

Practical exercises

1. To study the effect of different concentrations of organic solvents on the permeability of plasma membrane.
2. To study the effect of temperature on the permeability of plasma membrane.
3. To estimate bulk density and porosity of grass land and wood land soils.
4. To determine the moisture content of grass land or wood land soils.
5. To determine the water holding capacity of grass land or wood land soils.
6. To determine the osmotic potential of vacuolar sap by plasmolytic method.
7. To determine the water potential of potato tuber.
8. To demonstrate rate of respiration by various plant parts.
9. To demonstrate the separation of chloroplast pigments by solvent partitioning method.
10. To determine size of the quadrat required for reliable estimate of biomass in grassland.
11. To study the frequency of herbaceous species in grassland and to compare the frequency distribution with Raunkiaer's Standard Frequency Diagram.
12. To estimate importance value index of grassland species on the basis of relative frequency, relative density and the relative biomass in protected and grazed grassland.
13. To study effect of cytokinins on plant growth responses using appropriate plant material.
14. To study effect of auxins on plant growth responses using appropriate plant material.
15. To study the effect of ABA on plant growth responses using appropriate plant material.

16. To study the effect of ethylene on plant growth responses using appropriate plant material

Internal Assessment

1. Day to Day performance in the laboratory: 12 Marks

2. Test: 8 Marks

3. Regularity of Attendance: 5 Marks

II. External Assessment : 25 Marks

BOTANY (Semester-VI)

(For examinations to be held in the year 2018)

**Title: Molecular Biology, Biotechnology and Conservation Ecology
(Theory)**

Duration of Exam: 3.0hrs

Maximum Marks: 100

Credits: 04

External Examination: 80 Marks

Internal Assessment: 20 Marks

Unit I: Molecular biology

- 1.1 DNA: structure and replication, satellite and repetitive DNA.
- 1.2 Organization of DNA in prokaryotic and eukaryotic genomes, nucleosome model.
- 1.3 Concept of gene, genetic code, structure and function of mRNA and tRNA.
- 1.4 Concept of gene expression, regulation of gene expression in prokaryotes (Lac operon model) and eukaryotes (Britten and Davidson Model).

Unit II: Gene to protein and alteration in the basic unit of inheritance

- 2.1 Protein synthesis: transcription and translation
- 2.2 Transposable elements: concept and salient features.
- 2.3 Is and Tn elements in prokaryotes and Ac-Ds in eukaryotes.
- 2.4 Point mutations, spontaneous and induced, mechanism of induction and importance.

Unit III: Enzymes and Microbial Technology

- 3.1 Enzymes: discovery, nomenclature, characteristics, concept of holoenzyme, apoenzyme, co-enzyme and co-factor.
- 3.2 Enzyme activity: concept of activation energy, mechanism of action and regulation of activity.
- 3.3 Microbial biotechnology: Introduction, importance, microbial processes in food technology (fermented foods and beverages).
- 3.4 Microbial processes in industrial technology (vinegar Production, ethyl alcohol production, penicillin production).

UNIT IV: Biotechnology

- 4.1 Concept and scope of biotechnology, process and importance of recombinant DNA technology.
- 4.2 Restriction endonucleases, Southern Blotting technique, genomic and cDNA libraries.
- 4.3 Salient features of cloning vectors, plasmids, cosmids, phagmids, bacteriophages as vectors for gene delivery.
- 4.4 Biology of *Agrobacterium tumifaciens*, Ti plasmid as vector for gene delivery.

UNIT V: Conservation Ecology

- 5.1 Basic concept of ecological management, water conservation, rain water harvesting and water shed management.
- 5.2 Biodiversity: Importance and causes of dwindling biodiversity.
- 5.3 Ex-situ and in-situ conservation of plant resources: National parks, sanctuaries, bio reserves, role of seed and gene bank. Concept of rare, endangered and threatened (RET) plants.
- 5.4 Role of remote sensing and GIS in environment management.

Guidelines for paper setters:-

The question paper will be of two sections. Section 'I' will be compulsory having 10 questions of 2 marks each. These questions will be short answer type, where the students are required to write their answers briefly (not exceeding twenty words). Section 'II' long answer type questions of 12 marks each, two from each unit. The candidates will be required to answer one question from each unit.

Internal Assessment (Total Marks: 20)

Suggested readings

- 1 Gupta, P.K 1999; A Text Book of Cell and Molecular Biology; Rastogi Publication, Meerut, India.
2. Kleinsmith, L.J and Kishl,V.M. 1995; Principles of Cell and Molecular Biology(2nd. edition) Harper Collins College, Publishers, New York, USA.

3. Wolfe, S.L.1993. Molecular and Cell Biology, Wadsworth publishing Co. California, USA
4. Galston, A.W.1989. Life processes in plants, Scientific American library, Spring-Verlag, New York, USA. Ramawat,
5. K.G and Goyal ,Shaily, 2010. Molecular Biology and Biotechnology, S. Chand and Company Pvt. Ltd. New Delhi.
5. Postgate. J. 2000. Microbes and Man 4th Edition Cambridge, University, Press.
6. Prescott. and Dunn. 1999 Industrial Microbiology 4th Edition, By S. K Jain for CBS Publishers and Distributors
7. R.W. Old and S.B Primrode (1989) : Principles of Gene Manipulation: An Introduction to Genetic Engineering. Black Well Scientific Publications.
8. Ramawat K. G. And Goyal,S. 2010. Molecular biology and Biotechnology. S. Chand and company Pvt. Ltd., New Delhi.
9. Townsend, C.R., Begon, M. and Harper, J.L 2008 Essentials of Ecology, Black Well Publishing U.K.
10. Odum E. P. 1983. Basic Ecology, Saunders Philadelphia.
11. Kormondy, E. J. 1996. Concepts of Ecology, Prenlice- Hall of India pvt. Ltd. New Delhi.

Practical exercises

1. To prepare the standard curve of protein and determine the protein content in the unknown samples.
2. Isolation of yeast from sugary sources.
3. Isolation of yeast from non sugary sources.
4. To demonstrate the ethanol production by yeast.
5. To study acetic acid production.
6. To study conversion of acetic acid to vinegar.
7. Demonstrate the technique of gel electrophoresis.
8. To study effect of temperature on the activity of catalase enzyme.
9. To study effect of pH on the activity of catalase enzyme.
10. To study effect of temperature on the activity of peroxidase enzyme.
11. To study effect of pH on the activity of peroxidase enzyme.
12. To estimate transparency and temperature of different water bodies.
13. To measure dissolved oxygen content of polluted and unpolluted water samples.
14. To estimate salinity of different water samples.

15. To prepare inventory of industrial products containing enzymes.
16. To demonstrate the technique of in situ and ex situ conservation.
17. Water harvesting methods/techniques.

Internal Assessment

1. Day to Day performance in the laboratory: 12 Marks

2. Test: 8 Marks

3. Regularity of Attendance: 5 Marks

II. External Assessment : 25 Marks