

JECRC UNIVERSITY

B. Sc. Botany

I semester

CELL BIOLOGY AND THALLOPHYTES

[Contact hrs. 60]

[4 hrs./week]

Credit I

Evolutionary history of biological diversity: early earth and its origin of life. Major events in the history of life, phylogeny and the tree of life. General structure of Bacteria. Cell membrane and cell wall: the function of membrane, models of membrane structure, membrane protein and their function, carbohydrate in the membrane and cell wall.

Credit II

Cell theory, cell size and shape, eukaryotic cell components. Nucleus- nuclear envelop, structure of nuclear pore complex, chromatin structure, DNA packaging in eukaryotes, euchromatin, heterochromatin, nucleolus and ribosome structure, mitosis, meiosis.

Cell organelles: Mitochondria structure, composition, semiautonomous nature, symbiont hypothesis mitochondrial nature.

Chloroplast- structure, composition, semiautonomous nature and chloroplast DNA. ER, Golgi body and lysosome structure and role. Peroxisome and glyoxisome: structure.

Credit III

Algae- General characteristics; Ecology and distribution, Range of thallus organization and reproduction; Basic criteria used in classification (Fritsch, and Smith)

Important classes in relation to applied Phycology listed below

Cyanophyceae- *Nostoc*

Chlorophyceae- *Volvox, Chara*

Xanthophyceae – *Vaucheria*

Phaeophyceae- *Ectocarpus*

Rhodophyceae – *Polysiphonia*

Credit IV

Fungi- General characteristics; Ecology and distribution; Range of thallus organization; Cell structure; Wall composition; Nutrition; Growth; Reproduction and spores; Heterokaryosis and parasexuality; Basic criteria used in classification.

Life cycle of *Sclerospora*, *Aspergillus Claviceps*, *Ustilago* and *Alternaria*.

Suggested Reading

1. Rastogi V.B. Organic Evolution. Rastogi Publication.
2. Clifton A., Introduction of Bacteria, McGrawHill Co. Ltd. New York 1985.
3. Kaushik P. Microbiology, Emkay Publication, 2001.
4. Pelczer, Chan and Kruig. Microbiology. McGraw Hill Co., London, 1995.
5. De Robertis & De Robertis Cell and Molecular Biology. Lippincott Williams and Wilkins.
6. P.K. Gupta, Cell and Molecular Biology. Rastogi Publication.
7. C.B. Powar – Cell Biology, Himalaya Publishing House.
8. V.B. Rastogi – Cell Biology. Rastogi Publications.
9. Gilbert, M. Smith Cryptogamic Botany Vol I and II, 2nd Ed. Tata McGraw Hill Publishing Company Ltd. N.Delhi. 1985.
10. Ghemawat M.S., Kapoor, J.N. and Narayan H.S. : A text book of Algae. Ramesh Book Depot. Jaipur 1976.
11. Kumar. H.D. Introductory Phycology. Affiliated East-West Press Ltd., New York 1988.
12. Singh V., Pande P.C. and Jain D.K. A Text Book of Botany Rastogi and Co. Merrut, 2001.
13. Alexopolous, C.J. and Mims : Introductory Mycology, John Wiley and Sons, New York, 2000.
14. Dube, H.C. Fungi, Rastogi Publication, Merrut, 1989.
15. Sharma O.P. Fungi Today and Tomorrow Publication, 2000.

Laboratory Exercises

1. Study of different morphological forms of bacteria, Cocci, Bacilli.
2. Gram staining of Bacteria.
3. Study of specimen. Citrus Canker, Little Leaf of Brinjal, Crown Gall.
4. Instrumentation : Microscope, Various parts.
5. Study of cell structure from onion
6. Study of electron microphotographs of eukaryotic cell for various cell organelles.
7. Study of different stages of mitosis in root tips of onion.
8. Study of different stages of Meiosis in flower bud on Onion.
9. Study of classwork material by making suitable temporary slides and *Nostoc*, *Volvox*, *Vaucheria*, *Ectocarpus*, *Polysiphonia*.
10. Study of classwork material by making suitable temporary slides of *Sclerospora*, *Aspergillus*
11. Study of material by making slides of vegetative and sexual stages of *Ustilago* and *Alternaria*.

II semester
BRYOPHYTA PTERIDOPHYTA
AND LICHENS

[Contact hrs. 60]

[4 hrs./week]

Credit I

Bryophyta: general characters, origin, affinities and classification. Marchantiales- Life cycle of *Riccia*, *Marchantia*. Jungermanniales- *Pellia*. Anthocerotopsida- *Anthoceros*, Bryopsida- *Sphagnum*

Credit II

Evolution of sporophyte in bryophytes, Economic Importance of Bryophyta. General character of pteridophyta, classification by Smith and Sporne, Stejar system in pteridophyta, Alteration of generation.

Credit III

Distribution, Structure and life history of *Rhynia* and *Psilotum*. Distribution, Structure and life history of *Lycopodium*, *Equisetum* and *Selaginella*. Distribution, Structure and life history of *Adiantum* and *Marsilea*.

Credit IV

Lichens- distribution, nature of association of phycobiont and mycobiont, classification of lichens, structure and reproduction of lichens.

Ecological Indicators of pollution and economic importance of lichens. Mycorrhiza – General account and its significance

Suggested Reading

1. Puri P. Bryophytes Atma Ram and Sons, Delhi, Lucknow 1985.
2. Sarabhai R.C. and Saxena R.C. Text Book of Botany Vol. I and II, Ratan Prakashan Mandir, Merrut, 1980.
3. Singh, Pandey and Jain. A text book of Botany, Rastogi and Co. Merrut 2001.

4. Vashishta B.R. : Botany for degree students (Bryophyta.) S. Chand & Co. New Delhi 2002.
5. Kumar H.D. Introductory Phycology Affiliated East-West Press Ltd., New York 1988.
6. Sarabhai & Saxena, Text Book of Botany, Rastogi Publications. Merrut 1990.
7. Sporne, K.R. Morphology of Pteridophytes B.I. Publication Pvt. Mumbai (2002).
8. Vashishta P.C. Pteridophyta. S. Chand and Co. New Delhi

Laboratory Exercises

1. Study of external morphology and preparation of suitable sections of vegetative / reproductive parts *Riccia*, *Marchantia*, *Pellia*.
2. Study of external morphology and preparation of suitable sections of *Anthoceros* and *Sphagnum*.
3. Morphological study of various type of lichens.
4. Study of extend morphology, anatomy of vegetative and reproductive parts of –
Rhynia, *Psilotum*, *Lycopodium*, *Equisetum*, *Selaginella*, *Adiantum*, *Marsilea*

III semester

GENETICS AND PLANT BREEDING

[Contact hrs. 60]

[4 hrs./week]

Credit I

Mendel work, (Terminologies, Laws of inheritance, Modified Mendelian Ratios, Chi square, Pedigree analysis, Cytoplasmic Inheritance, Multiple allelism, Pleiotropism,)

Credit II

Sex determination in human, Drosophila and plants, Sex linked inheritance.

Linkage: concept & history, complete & incomplete linkage, Bridges experiment, Crossing over : concept and significance, cytological proof of crossing over.

Credit III

Numerical chromosomal changes, euploidy, polyploidy and aneuploidy.

Structural chromosomal changes : deletions, duplications, inversions and translocations.

Types of mutations, effects of physical and chemical mutagens.

Credit IV

Introduction and objectives of plant breeding, general methods of plant breeding, Conventional and non conventional methods of plant breeding, hybrid vigour, inbreeding depression, role of mutation and polyploidy in plant breeding. Introduction to the concept of Recombinant DNA Technology, Cloning vectors, Restriction and modifying enzymes, Transformation techniques (brief introduction).

Suggested Reading

1. Rastogi V.B. Genetics. Rastogi Publications.
2. Gupta P.K. Classical to Modern Genetics. Rastogi Publications.
3. Sandu and Arora, Genetics. Himalaya Publishing House
4. Miglani G.S. Advanced Genetics, Narosa Publishing House, New Delhi (2000).
5. Gardner, Principles of Genetics. Wiley India
6. Choudhary H.K. Elementary Principles of Plant Breeding, Oxford and IBH Publishing Co. N.D. 1989.

7. Shukla R.S. and Chandel P.S. Cytogenetics, Evolution and Plant Breedings S Chand and Co. Ltd. New Delhi (2000).
8. Singh R.B. Text Book of Plant Breeding Kalyani Publishers. Ludhiana.

Laboratory Exercises

1. To solve genetic problems based upon mendel's law of inheritance.
2. Bar body study.
3. Emasculation of anther in a cross pollinated flower.
4. Vegetative propogation parts of plants.
5. To study hand cut section of t.s of anther.

IV semester

MORPHOLOGY ANATOMY AND PLANT PHYSIOLOGY

[Contact hrs. 60]

[4hrs./week]

Credit I

Different types of tissues, their organization into root, stem and leaf (monocot & dicot), Concept of stele and its evolution, meristematic, simple and complex secretory tissue.

Basic Body plan of flowering plants, modular type of growth, diversity of plant forms: annual, biennials and perennials.

Credit II

Shoot and root system: shoot and root apical meristem and its histological organization, vascularisation of primary shoot and root in monocot and dicots, monopodial and sympodial growth .

Morphology and anatomy of seed (monocot and dicot), significance of seed, seed dispersal, vegetative reproduction: vegetative propagation, grafting.

Credit III

Plant water relationship: Significance of water, water potential, water absorption and transport, transpiration, mechanism of opening and closing to stomata.

Mineral Nutrition: Essential elements, micro and macro nutrients, soil factors affecting their availability, Physiological basis of deficiency, symptoms, ion uptake. Transport of inorganic and organic component, transport pathway Xylem and Phloem.

Credit IV

Role of physical factors in growth of plants: Response to light, photomorphogenesis, Role of growth regulators: Auxin, Gibberelins, Cytokinins, ABA, Ethylene

Photosynthesis: Brief history, pigments, mechanism of light, absorption and energy transfer PSI and PSII e-transport, ATP synthesis C3, C4 and CAM photorespiration.

Suggested Reading

1. Cutter E.G. 1969. Part I Cells and Tissues ,Edward Arnold, London.
2. Cutter E.G. 1971. Plant Anatomy: Experiment and Interpretation Part-II, Organs, Educated Arnold. London.
3. Esau. K. 1977. Anatomy of seed Plants 2nd Eds. John Wiley & Sons, New York.
4. Fahn A. 1985. Plant Anatomy, Pergamon Press, Oxford.
5. Salisbury and Ross. Plant Physiology.
6. Teiz and Zeiger Plant Physiology.
7. V. Verma. Plant Physiology.

Laboratory Exercises

1. Study of any commonly occurring dicotyledonous plant to understand the body plan and modular type of growth.
- 2.L.S. of shoot tip to study the organization of meristem.
3. Monopodial and sympodial types of branching.
4. Anatomy of primary and secondary growth in monocot and dicot using hand cut sections of sunflower, nerium, maize, cucurbit stem and roots.
5. Examination of seed (monocot and dicot) structure.
6. Specimen study for modifications of plant parts for vegetative reproduction.
7. To study the permeability of plasma membrane using different concentration of solvent.
8. To separate chlorophyll pigment by solvent method.
9. Measurement of growth using Auxanometer.
10. Photosynthesis by inverted funnel method and Moll's half leaf method.

V semester

GYMNOSPERM ANGIOSPERM AND PALEOBOTANY

[Contact hrs. 60]

[4 hrs./week]

Credit I

Classification and characteristic features of different groups of Gymnosperm. Distribution, morphology, vegetative and reproductive parts, anatomy and life cycle of *Cycas*.

Distribution, Morphology of vegetative and reproductive parts, anatomy, reproduction and life cycle of *Pinus* and *Ephedra*, Economic Importance of Gymnosperm.

Credit II

Angiosperm – origin and evolution. Some examples of primitive angiosperm.

Introduction, Principles of taxonomy, units of classification, Concept of Genus and species, Binomial nomenclature, ICBN, Botanical gardens and Herbaria.

Classification of angiosperm Linnaeus, Bentham and Hooker's system, Engler and Prantle system of classification.

Credit III

Diversity of flowering plants as illustrated by members of the families, Brassicaceae, Malvaceae, Fabaceae, Solanaceae, Apocynaceae, Asclepiadaceae, Euphorbiaceae, Liliaceae and Poaceae, Asteraceae.

Credit IV

Fossilization, types of fossils, technique to study fossils, geological time scale, Applied aspect of Paleobotany (use in coal and petroleum exploration).

Fossil Pteridophyta – *Lepidodendron*, *Calamites*

Fossil Gymnosperms – *Williamsonia*

Suggested Reading

1. Vashishtha P.C. Gymnosperm, S. Chand Company.
2. Singh Pandey Jain, A text Book of Botany, Rastogi Publication.
3. Biswas C and Johari B M .The Gymnosperm.Narosa Publishing house.

4. Wilson N.S., Rothwell G.W. Paleobotany and Evolution of Plants. IInd Ed. Cambridge. Univ. Press, U.K. (1990).
5. Willis K.J and McElwain J.C. The Evolution of Land Plants. Oxford University Press.
6. V.V. Shivrajan, Introduction to Principles to the Plant Taxonomy, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
7. Angiosperm Taxonomy, Singh, Pandey, Jain Rastogi Publishers, Meerut.
8. Gurucharan Singh, Plant Systematics (2001). Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

Laboratory Exercises

1. Following genera are suitable for the study of families.

Brassicaceae	–	<i>Brassica campestris</i>
Malvaceae	–	<i>Hibiscus rosasinensis, Abutilon</i>
Fabaceae	–	<i>Pisum sativum, Cassia, Acaccia</i>
Solavaceae	–	Datura, Withania
Apocynaceae	–	Vinca rosea, Thevetia
Asclepeideaceae	–	Calotropis
Euphorbiaceae	–	<i>Euphorbia, Ricinus</i>
Liliaceae	–	<i>Onion, Asphodelus</i>
Poaceae	–	<i>Triticum</i>
Esteraceae	–	<i>Heliahthus, Tridax</i>

2. Study of fossils and slides of fossils.
3. Study of External Morphology, anatomy of vegetative and reproductive part of
 - (i) *Cycas*
 - (ii) *Pinus* and
 - (iii) *Ephedra*

VI semester

ENVIRONMENTAL MANAGEMENT AND ECONOMIC BOTANY

[Contact hrs. 60]

[4 hrs./week]

Credit I

Introduction to Ecology, Community and Ecosystem Inter-relationships between living world and environment, Biosphere, biomes, ecosystem and its components (abiotic and biotic) Bioenergetics. Biogeochemical cycles, Hydrologic cycle. Concept of habitat and niche.

Credit II

Population and Community Ecology (Part Population attributes, density, natality, mortality, age ratio, sex ratio, dispersal and dispersion of population, exponential and logistic growth, life history strategies, population interactions,

Credit III

Unit IV – Biodiversity and regional conservation strategies success stories with reference to India and sustainable utilization. Principles of wildlife management, wildlife sanctuaries, parks and biosphere reserves in India, endangered and threatened species of plants and animals in India, germplasm banks.

Credit IV

Basic concept of center of origin of cultivated plants . Food plants – rice, wheat , maize , potato and sugarcane . Vegetable oils: coconut , groundnut and mustard . Spices: General account with an emphasize on those cultivated in Rajasthan (cumin , capsicum , coriander .) Beverages: tea and coffee. Fibers: cotton and jute.

Medicinal plants : General account with an emphasize on those cultivated in Rajasthan (senna , isabgol , safed musli). Wood : General account of sources of firewood, timber and bamboos ; Rubber . Legumes or pulses, starch or sugar yielding plants. Ethnobotany : a general account.

Suggested Reading

1. P.D. Sharma, Ecology and utilization of plants. Rastogi publication.
2. Odum E P., and Barrett G.W., Fundamentals of Ecology. Thomson Asia Pvt. Ltd.

3. Rajagopalan R, Environmental Studies Oxford University Press.
4. P.D. Sharma. Ecology and utilization of plants.Rastogi Publication.
5. S.L. Kochar., Economic Botany in Tropics.McMillan Publishing House.
6. B.P. Pandey Economic Botany in Tropics.
7. Sambhamurthy. Economy Botany.

Laboratory Exercises

1. Study the frequency and density of plant sp. by quadrat method.
2. Estimate bulk density of grassland soil.
3. Estimate the porosity of grassland and wood land soil sample.
4. Determine moisture content of grassland.
5. To measure dissolved oxygen (D.O.) in given water sample.
6. To measure water holding capacity of soil.
7. Visit to any national park or sanctuary.