

GOVT. BILASA GIRLS P.G. COLLEGE

(Accredited by 'A' NAAC)

BILASPUR



M.Sc.

BOTANY

Semester - I & II

2019-2020

SEMESTER - I
PAPER - I
MOLECULAR BIOLOGY, CYTOLOGY

The dynamic cell:- Structural organization of the plant cell; specialized plant cell types; chemical foundation; biochemical energetics.

<https://www.ncbi.nlm.nih.gov/books/NBK21566>

<https://www.plantcell.us/specialized-plant-cell-types.html>

<https://byjus.com/biology/plant-ce>

Cell wall:- Structure and functions; biogenesis; growth.

<https://www.psu.edu/dept/cellwall/cellwall.pdf> · PDF file

www.biologydiscussion.com/plants/cell-wall/cell-wall-of-plant-cell-formation-growth.

Plasma membrane:- Structure, models and functions ,sites for ATPases ion carriers channels and pumps receptors.

www.yourarticlelibrary.com/science/plasma-membrane-structure-and-functions-of-plasma...

<https://www.golifescience.com/the-plasma-membrane>

<https://www.researchgate.net/publication/226944225> **Plasma membrane ATPases**

Chloroplast:- Structure, genome organization; gene expression; RNA editing; nucleo-chloroplastic interactions.

<https://www.researchgate.net/publication/326325389> **Chloroplasts Structure and..**

<https://link.springer.com/article/10.1007/BF00039388>

Mitochondria:- Structure; genome organization; biogenesis.

https://en.m.wikipedia.org/wiki/Mitochondrial_biogenesis

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4443496>

<https://themedicalbiochemistrypage.org/mitochondria.php>

Nucleus:- Structure, nuclear pores; nucleosome organizations; DNA structural, A, B and Z forms: replication, damage and repair, transcription, plant promoters and transcription factors; splicing; mRNA transport; nucleolus, r RNA biosynthesis.

<https://www.thoughtco.com/the-cell-nucleus-373362>

Ribosomes:- Structure, site of protein synthesis, mechanism of translation, initiation, elongation and termination, structure and role of t RNA.

<https://www.microscopemaster.com/ribosomes.html>

Other cellular organelles:- Structure and functions of micro bodies, Golgi apparatus, lysosomes, endoplasmic reticulum and vacuole.

<https://www.microscopemaster.com/organelles.html>

<https://www.khanacademy.org/test-prep/mcat/cells/eukaryotic-cells/a/organelles-article>

Chromatin Organization:- Chromosome structure and packaging of DNA, molecular organization of Centromere and telomere, nucleolus, karyotype evolution, special types of chromosomes; polytene, lampbrush, B-chromosomes and sex chromosomes, molecular basis of chromosome pairing.

<https://en.wikipedia.org/wiki/Chromatin>

www.biologydiscussion.com/chromosomes/3-special-types-of-chromosomes...

[https://www.sciencedirect.com/topics/biochemistry-genetics-and-molecular-](https://www.sciencedirect.com/topics/biochemistry-genetics-and-molecular-biology/chromatin)

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[biology/chromatin](http://biology.chromatin)

Suggested Laboratory Exercises:

1. Isolation of mitochondria and the activity of its marker enzyme, succinate dehydrogenase (SDH).
2. Isolation of Chloroplasts and SDS-PAGE profile of proteins to demarcate the two subunits of Rubisco.
3. Isolation of nuclei and identification of histones by SDS-PAGE.
4. Isolation of plant DNA and its qualification by a spectrophotometric method.
5. Isolation of DNA and preparation of cot curve.
6. Restriction digestion of plant DNA, its separation by agarose gel electrophoresis and visualization by Ethidium bromide staining.
7. Isolation of RNA and quantitation by a spectrophotometric method.
8. Isolation of giant chromosomes.
9. Mitosis and meiosis.

Suggested Books:

1. Glick, B.R. and Thompson, J.E. 1993. Methods in Plant Molecular Biology and Biotechnology. CRC Press, Boca Raton, Florida.
2. Glover, D.M. and Hames, B. D. (Eds), 1995. DNA Cloning 1: A Practical Approach; Core Techniques. 2nd edition. PAS, IRL Press at Oxford University Press, Oxford.
3. Gunning, B.E.S. and Steer, M.W. 1996. Plant Cell Biology. Structure and Function, Jones and Bartlett Publishers, Boston, Massachusetts.
4. Hackett, P.B., Fuchs, J.A. and Messing, J.W. 1988. An Introduction to Recombinant DNA Techniques. Basic Experiment in Gene Manipulation. The Benjamin Cummings Publishing Co., Inc Menlo Park, California.
5. Hall, J.L. and Moore, A.L. 1983. Isolation of Membranes and Organelles from Plant Cells. Academic Press. London UK.
6. P.K. Gupta-Cytology Genetics & Molecular Biology.
7. C.B. Powar- Cell Biology
8. R.C. Dubey & D.K. Maheshwari – Microbiology.

SEMESTER – I PAPER – II BIOLOGY AND DIVERSITY OF MICRO ORGANISMS, ALGAE AND FUNGI

- A. **Archaeobacteria and Eubacteria:** General account ultrastructure, nutrition, reproduction and economic importance, Cyanobacteria-salient features and biological importance.

<https://biologydictionary.net> › Cell Biology

<https://brainly.in/question/5109795>

B. **Viruses:** Characteristics and ultrastructures of virions, isolation and purification of viruses, chemical nature replication, transmission of viruses, economic importance.

<https://micro.magnet.fsu.edu/cells/virus.html>

<https://www.gktoday.in/gk/virus-importance-in-economy-and-environment/>

C. **Mycoplasma:** General characteristic and role in causing plant diseases.

<https://www.tandfonline.com/doi/pdf/10.1080/09670877209413983>

PHYCOLOGY:

Algae in diversified habitats(terrestrials, freshwater and marine) thallus organizations, cell ultrastructure, reproduction (vegetative, asexual and sexual) criteria for classification of algae, pigments, reserve food, flagella, classification of salient features of Protochlorophyta, Chlorophyta, Charophyta, Xanthophyta, Bacillariophyta, Phaeophyta and Rhodophyta, algal blooms, algal biofertilizers, algae as food, uses in industry.

jalgalbiomass.com/paper14vol3no4.pdf

MYCOLOGY:

General characters of fungi, substrate relationship in Fungi, Cell Ultrastructure; Unicellular and multicellular organization, Cell wall composition, nutrition (saprobic biotrophic symbiotic) reproduction (vegetative, asexual and sexual) heterothallism, heterokaryosis, para sexuality, recent trends in classification, phylogeny of fungi general account of Mastigomycotina, Zygomycotina, Ascomycotina, Basidiomycotina, Deuteromycotina, Fungi in Industry, medicine and as food, fungal diseases in plants and humans, Mycorrhizae, Fungi as biocontrol agents.

cec.nic.in/wpresources/module/BOTANY/PaperI/22/content/downloads/file1.pdf

Suggested Laboratory Exercise:

1. Collection, isolation and identification of Micro-organism.

2. Preparation of culture media and sterilization techniques.
3. Study of Gram Staining of Bacteria.
4. Morphological study of representative members of algae – Microcystis, Lyngbya, Oscillatoria, Nostoc, Anabina, Rivularia, Gleotrachia, Scytonema, Stigonema, Volvox, Ulothrix, Padiastrum, Hydrodictyon, Ulva, Pithophora, Cladophora, Oedogonium, Bulbochaete, Spirogyra, Zygnema, Coleochaete, Stigeoclonium, Drapernaldia, Drapranaldiopsis, Closterium, Cosmarium, Chara, Caulerpa, Vaucheria, Ectocarpus, Laminaria, Dictyota, Sargassum, Batracospermum, Polysiphonia.
5. Morphological study of representative members of fungi – Stemonitis, Pernospora, Albugo, Mucor, Pilobolus, Saccharomyces, Peziza, Uncinula, Phylactinia, Emericella, Chaetomium, pleospora, Morchella, Puccinia, Melampsora, Polyporas, Drechslera, Phoma, Penicillium, Aspergillus, Cercospora, Alternaria, Colletotrichum.
6. Symptomology of some diseased specimens: White rust, downy mildew, powdery mildew, rusts, smuts, ergot, groundnut leaf spot, red rot of sugarcane, wilts, paddy blast, citrus canker, bacterial blight of paddy, angular leaf spot of cotton, tobacco mosaic, little leaf of brinjal, sesame phyllody, mango malformation
7. Camera Lucida diagrams (Micrometry).

Suggested Books:

1. Alexopoulos, C.J., Mims, C.W. and Blackwell, M. 1996. Introductory Mycology. John Wiley & Sons Inc.
2. Clifton, A. 1958. Introduction to the Bacteria. McGraw-Hill BOOK Co., New York.
3. Kumar, H. D. 1988. Introductory Phycology. Affiliated East-West Press Ltd., New Delhi.
4. Mandahar, C.L. 1978. Introduction to Plant Viruses. Chand & Co. Ltd, Delhi.
5. Mehrotra, P. S. and Aneja, R. S. 1998. An Introduction to Mycology. New Age Intermediate Press.
6. Morris, I. 1986. An Introduction to the Algae. Cambridge Univ. Press, U.K.
7. Rangaswamy G. and Mahadevan. A. 1999. Diseases of Crop Plants in India (4th edition) Prentice Hall of India Pvt. Ltd., New Delhi.
8. Round. F. E. 1986. The Biology of Algae. Cambridge University Press. Cambridge.
9. B.R. Vasistha, A. K. Sinha, V. P. Singh – Algae.
10. B.R. Vasistha, A. K. Sinha, V. P. Singh – Fungi.

SEMESTER - I
PAPER - III
TAXONOMY AND DIVERSITY OF ANGIOSPERMS

Origin of Intrapopulation Variation: Population and the environment, ecads and ecotypes, evolution and differentiation of species-various models.

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2792934/>

<https://www.sciencedirect.com/topics/medicine-and-dentistry/species-differentiation>

The Species Concept: Taxonomic hierarchy, species, genus, family and other categories, principles used in assessing relationship, delimitation of taxas and attribution of rank.

Salient features of the international code of Botanical nomenclature.

<https://biologydictionary.net/taxonomy/>

Taxonomic Evidence: Morphology, anatomy, palynology, embryology, cytology, phytochemistry.

Taxonomic tools: Herbarium, floras, histological cytological, phytochemical, serological, biochemical and molecular techniques.

www.upov.int/about/en/pdf/upov_structure_bmt.pdf

Systems of angiosperm classification: Phenetic versus phylogenetic systems, cladistics in taxonomy to conservation, sustainable Utilization of bio-resources and ecosystem research.

www.biologydiscussion.com/angiosperm/taxonomy.../phenetic-versus...in.../34767

<https://onlinelibrary.wiley.com/doi/pdf/10.1111/j.1558-5646.1965.tb01715.x>

Concepts of Phytogeography: Endemism, hotspots and hottest hotspots, plant explorations, invasion and introductions, local plant diversity and its socio- economic importance.

<https://biologydictionary.net/endemism/>

www.biologydiscussion.com/india/hot-spots-in-india/34820

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Suggested Laboratory Exercises:

Angiosperms

1. Description of a specimen from representative, locally available families.
2. Description of a species based on various specimens to study intra-specific variation: a collective exercise.
3. Description of various species of a genus; location of key characters and preparation of keys at generic level.
4. Location of key characters and use of keys at family level.
5. Field trips within and around the campus, compilation of field notes and preparation of herbarium sheets of such plants, wild or cultivated, as are abundant, through excursion.
6. Training is using floras and herbaria for identification of specimens described in the class.
7. Demonstration of the utility of secondary metabolites in the taxonomy of some appropriate genera.
8. Comparison of different species of a genus and different genera of a family to calculate similarity coefficients and preparation of dendrograms.

Suggested Books:

1. Davis, P.H. and Heywood, V.H. 1973. Principles of Angiosperms Taxonomy. Robert E. Kreiger pub. Co., New York.
 2. Grant, W.F. 1984. Plant Biosystematics. Academic Press, London.
 3. Harrison, H.J. 1971. New Concepts in Flowering plant Taxonomy. Hieman Educational Books Ltd., London.
 4. Hesiop-Harrison, J. 1967. Plant Taxonomy. English Language Book Ltd., London.
 5. Jones, S.B. Jr. and Luchsinger, A.E. 1986. Plant Systematics (2nd edition). McGraw-Hill Book Co., New York.
 6. Nordenstam. B. El Gazaly. G. and Kassas. M. 2000 Plant Systematics for 21st century. Portland Press Ltd., London
 7. Radford, A.E. 1986. Fundamentals of Plant Systematics. Harpar & Row Publications, USA.
 8. P. C. Vashista – Taxonomy of Angiosperm.
 9. Tyagi and Khetrapal- – Taxonomy of Angiosperm.
 - 10.R. C. Mathur— Taxonomy of Angiosperm.
 - 11.D. K. Jain and V. Singh — Taxonomy of Angiosperm.
 - 12.V. N. Naik– Taxonomy of Angiosperm.
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- 13.S.C. Dutta- Systemic Botany.
 - 14.A.B. Randle – Angiosperm.

SEMESTER - I
PAPER – IV
PLANT BIOCHEMISTRY & ENZYMOLOGY

Energy Flow: Principles of Thermodynamics, free energy and chemical potential, redox reactions, structure and functions of ATP.

- <http://lifeofplant.blogspot.com/2011/04/energy-flow-in-plant-cells.html>
- <https://www2.estrellamountain.edu/faculty/farabee/biobk/BioBookEner1.html>
- <https://www.boundless.com/chemistry/textbooks/boundless-chemistry-textbook/thermodynamics-17/the-laws-of-thermodynamics-123/the-three-laws-of-thermodynamics-496-3601/>
- <https://www.tutorvista.com/biology/redox-reactions-in-photosynthesis?view=simple>
- <https://study.com/academy/lesson/chemical-potential-energy-definition-examples-quiz.html>

Fundamentals of enzymology: General aspects allosteric mechanism, regulatory and active sites, isozymes, kinetics of enzymatic catalysis, Michaelis-mentan equation and its significance.

- <http://www.biology-online.org/dictionary/Isoenzyme>
- <http://www.biologydiscussion.com/metabolism/microbial-metabolism/allosteric-enzymes-properties-and-mechanism-microbiology/65531>

Membrane transport and translocation of water and solutes: Plant water relations, mechanism of water transport through xylem, root-microbe interaction in facilitating nutrient uptake, comparison of xylem and phloem transport, phloem loading and unloading, passive and active solute transport, membrane transport proteins.

- <http://www2.yvcc.edu/Biology/109Modules/Modules/MembraneTransport/membranetransport.htm>
- <http://www.biologydiscussion.com/plants/translocation/phloem-transport-mechanism-and-factors-affecting-plants/25681>
- <http://www.biologydiscussion.com/plants/translocation/phloem-loading-and-unloading-in-plants/23280>

Signal transduction: Overview, receptors and G. Proteins, phospholipids signaling, Calcium- calmodulin cascade, diversity in proteins kinesis and phosphates, specific signaling mechanisms, e.g. two-component sensor regulator system in bacteria and plants, sucrose-sensor mechanism.

https://en.wikipedia.org/wiki/Signal_transduction

https://en.wikipedia.org/wiki/Two-component_regulatory_system

<https://molbio.mgh.harvard.edu/sheenweb/reprints/ARPB06sugar.pdf>

Phytochorm & regulators : Physiological effects and mechanism of action of auxins gibberellins, cytokinins, ethylene, abscisic acid, brassinosteroids, polyamines, jasmonic acid and salicylic acid, hormone receptors, gene expression.

<https://untamedscience.com/biology/plants/plant-growth-hormones/>

<https://en.wikipedia.org/wiki/Brassinosteroid>

<http://www.biologydiscussion.com/plants/growth-hormones/polyamines-in-plants-with-diagram/23524>

https://en.wikipedia.org/wiki/Jasmonic_acid

https://en.wikipedia.org/wiki/Salicylic_acid

<https://www.sciencedirect.com/topics/biochemistry-genetics-and-molecular-biology/gene-expression-in-plant>

Photochemistry and photosynthesis: General Concept and historical background, evolution of photosynthetic apparatus, photosynthetic pigments and light harvesting complexes, photo oxidation of water, mechanisms of electron and proton transport carbon assimilation – The Calvin cycle, photo

respiration and its significance, the C₄ cycle, the CAM pathway, biosynthesis of starch and sucrose, physiological and ecological considerations.

<https://en.wikipedia.org/wiki/Photosynthesis>

Suggested Laboratory Exercise:

1. Effect of time and enzyme concentration on the rate of reaction of enzyme.
2. Effect of substrate concentration, pH and temperature on activity of enzyme.
3. To determine the plasmolysis of plant tissue.
4. To determine the diffusion pressure deficit of plant tissue.
5. To determine the rate of transpiration by Darwin's potometer.
6. To observe the antagonistic effect on plant pigments.
7. To demonstration of effect of light intensity, wind velocity and humidity on the rate of transpiration by Genong's potometer.
8. To measure the rate of transpiration by Genong's potometer.
9. To determine the chlorophyll a/ Chlorophyll b ratio in C₃ & C₄ plant.
10. To separate amino acid mixture by silica gel method (TLC) and calculate 'R_f' values.
11. To separate amino acid mixture by circular disc chromatography techniques.
12. To separate amino acid mixture by descending paper chromatography techniques and calculate 'R_f' values.
13. To determine ion exchange chromatography.

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Suggested Books:

1. Buchanan, B.B. Gruissem, W. and Jonco, R.L. 2000, Biochemistry and Molecular Biology of Plants, American Society of Plant Physiologists, Maryland; USA.
2. Dennis, D.T. Turpin, D.H., Lefebvre, D.D. and Layzell, D.B. (eds) 1997. Plant Metabolism (second edition), Longman, Essex, England.
3. Hopkins, W.G. 1995, Introduction to plant physiology, John Wiley & sons. Inc., New York, USA.
4. J. 2000. Molecular Cell Biology (fourth edition) W.H. Freeman and ompany, New York, USA.
5. Salisbury, F.B. and Rose C.W. 1992. Plant physiology (4th edition). Wadsworth Publishing Co., California, USA.

6. Singhal, G.S. Renger, G., Sopory, S.K. Irrang, K.D. and Govindjee 1999. Concepts in photobiology: Photosynthesis and Photomorphogenesis.

7. Westhoff, P. (1998) Molecular Plant Development: from Gene to

Paper	Topic	Marks of Internal Assessment	Seminar Test	Marks of Practical	Marks of Theory
I	Cytology & Genetics	10	10	}100	80
II	Bryophyta & Pteridophyta	10	10		80
III	Taxonomy & Diversity of Gymnosperms	10	10	}100	80
IV	Plant Physiology and Metabolism	10	10		80

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Plant. Oxford University Press, Oxford, UK.

8. Verma V. Plant physiology.

9. Malic & Shrivastava Plant physiology.

10. Sarabhai B.P. Plant physiology.

M. Sc. BOTANY 2019-2020 SEMESTER –II

There will be four papers of 80 marks each in every semester.

100 marks have been divided into two parts.

1. First part consists of an external examination of 80 marks.
2. Second part consists of an internal assessment of 20 marks.

The marks of internal assessment are redistributed as follows

(A). Seminar – 10 marks

There will be only one seminar in each paper consisting of 10 marks each.

(B). Test – 10marks

There will be two test examinations in each papers consisting of 10 marks each.

Marks of one best test examination will be considered for annual examination.

There will be two practical examinations of 100 marks in each semester.

SEMESTER - II PAPER - I CYTOLOGY AND GENETICS

Structural & numerical alterations in chromosomes: Origin of meiosis & breeding behavior of duplication deficiency, inversion & translocation heterozygote; origin occurrence production & meiosis of haploids , anuploid& euploid; origin & production of aoutopolyploids.chromospome& chromatid saggregation,allopolyploids ,types, evolution of major crop plants, induction & characterization of trisomic&monosomics.

www.brainkart.com/article/Numerical-and-Structural-chromosomal-aberrations_1041

PLB143: Evolution of Crop Plants

www.authorstream.com/Presentation/mahanteshbiradar45405-2371774-

monosomics

www.biologydiscussion.com/chromosomes/chromosome-number/5-main-types-of-trisomics/36330

Cell cycle and apoptosis: Mitosis and meiosis cell division, Control mechanism, role of cycline and cycline dependent kinases retinoblastoma and E2F proteins cytokinensis and cell plate formation, mechanism of programmed cell death.

<https://byjus.com/biology/cell-division>

<https://en.wikipedia.org/wiki/Apoptosis>

Genetics of prokaryotic organelles: Mapping the bacteriophage genome genetic recombination in phage, genetic transformation, conjugation & transduction in bacteria, genetics of mitochondria & chloroplast, cytoplasmic male sterility.

www.rapidlearningcenter.com/.../genetics/07-Genetics-of-Mitochondria-and-Chloroplasts.html

www.biologydiscussion.com/.../genomes-in-chloroplast-and-mitochondria-dna-genetics/67765

<https://www.khanacademy.org/.../a/mitochondrial-and-chloroplast-dna-inheritance>

<https://plantlet.org/cytoplasmic-male-sterility>

Gene structure and expression: Genetic fine structure, cis- trans test, fine structure analysis of eukaryotes ,introns and their significance, RNA splicing.

<https://www.britannica.com/science/gene>

www.biologydiscussion.com/.../exam-questions-on-molecular-biology-biology/71694

https://en.wikipedia.org/wiki/RNA_splicing

Mutations: Spontaneous and induced mutations; physical and chemical mutagens, molecular basis of gene mutations transposable elements in prokaryotes and eukaryotes, mutations induced by transposons, site directed mutagenesis.

<https://www.britannica.com/science/mutation-genetics>

<https://ghr.nlm.nih.gov/primer/mutationsanddisorders/genemutation>

www.biologydiscussion.com/cell/prokaryotes/transposable-genetic-elements-in-prokaryotes-2/12001

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[www.biologydiscussion.com/eukaryotic-cell/transposable-elements-in-eukaryotes-3.](http://www.biologydiscussion.com/eukaryotic-cell/transposable-elements-in-eukaryotes-3)

Suggested Laboratory Exercises:

1. Characteristics and behavior of B chromosomes using Maize.
2. Working out the effect of mono and tri-somy on plant phenotype, fertility and meiotic behavior.
3. Induction of polyploidy using colchicines.
4. Effect of induced and spontaneous polyploidy on plant phenotype, Meiosis, pollen and seed fertility and fruit set.

5. Mitosis and Meiosis.

Suggested Books:

1. Alberts, b. Bray, D. Lewis J., Raff, M. Roberts, K. and Watson. J.D. 1989. Molecular Biology of the cell. 2nd edition. Garland Publishing Inc., New York.
2. Atherly. A.G. Girton, J.R. and McDonald, J.F. 1999. The Science of Genetics. Saunders College Publishing fortworth, USA.
3. Burnham, C.R. 1962. Discussions in Cytogenetics. Burgess Publishing Co., Minnesota.
4. Busch, H. and Rothblum, L. 1982. Volume X. The Cell Nucleus rDNA Part A. Academic Press.
5. Hartl, D.L. and Jones, E.W. 1998. Genetics: Principles and Analysis 4th edition). Jones & Bartlett Publishers. Massachusetts, USA.
6. Khush, G.S. 1973. Cytogenetics of Aneuploids. Academic Press. New York, London.
7. Lewin, B. 2000 Gene VII. Oxford University Press. New York, USA.
8. Lewis, R. 1997. Human Genetics: Concepts and Application 2nd edition).
9. P.K. Gupta-Molecular Biology & Genetics.
10. C.B. Pawar- Genetics part I, II.

**SEMESTER – II
PAPER – II
BRYOPHYTA AND PTERIDOPHYTA**

Bryophyta: Morphology, Structure, reproduction and life history, distribution, classification, general account of Marchantiales Junger-

manniales, Anthocerotales, Sphagnales, Funariales and polytrichales, economic and ecological importance.

www.biologydiscussion.com/bryophyta/classification-bryophyta/classificati...

www.biologydiscussion.com/.../bryophytes/economic-importance-of-bryo...

Pteridophyta: Morphology, anatomy and reproduction, classification, evolution of stele, heterospory and origin of seed habit, general account of fossil pteridophyta, introduction to Psilopsida, Lycopsidea, Sphenopsida and Pteropsida.

www.biologydiscussion.com/pteridophytes/classification-pteridophytes/clas...

Suggested Laboratory Exercises:

Morphological study of representative members of bryophytes:-Riccia, Marchantia, Targionia, Plagiochasma, Pella, Anthoceros, Notothylus, Sphagnum, Polytrichum, and pteridophytes:- Psilotum, Lycopodium, Selaginella, Equisetum, Gleichenia, Pteris, Marsilia, Azolla, Ophioglossum Isoetes.

Collection & study of morphology, anatomy and reproductive structure of bryophytes and pteridophytes through excursion in our locality.

Suggested Books:

1. Parihar N.S. – Bryophyta central book deptt. Allahabad
2. Parihar N.S. –Biology & morphology of pteridophytes
3. Negi S.S. – Introduction of Science & Recent Studies on Indian Bryophytes.
4. Smith G.M. – Bryophytes & Pteridophytes.
5. Kashyap S.R. – Bryophytes of the Himalayan regions.
6. Sporne K.K. – The morphology of Pteridophytes.
7. Stewart W.N. – Paleobotany and evolution of plants.
8. Vashishta, Sinha & Kumar – Bryophyta.
9. Vashishta, Sinha & Kumar – Pteridophyta.

PAPER – III

TAXONOMY AND DIVERSITY OF GYMNOSPERMS

Introduction: Gymnosperms, the vessel-less and fruitless seed plants varying in the structure of their sperms, pollen grains germination, and the complexity of their female gametophyte, evolution of gymnosperms.

www-plb.ucdavis.edu/courses/bis/1c/text/Chapter24nf.pdf

www.ijarse.com/images/fullpdf/1524849048_JK1688IJARSE.pdf

Classification of Gymnosperms and their distribution in India.

https://www.researchgate.net/.../290433388_Gymnosperms_of_Northeast_India_distri...

Brief account of the families of Pteridospermales: (Lyginopteridaceae, Medullosaceae, Caytoniaceae, and Glossopteridaceae)

General account of Cycadeoidales and Cordaitales.

www.biologydiscussion.com/gymnosperm/cycadeoidea-history-features.../22142

www.biologydiscussion.com/gymnosperm/cordaitales-distribution-features.../22312

Structure & reproduction: Cycadales, Ginkgoales Coniferales, Ephedrales, Welwitschiales, and Gnetales.

<https://en.wikipedia.org/wiki/Welwitschia>

Suggested Laboratory Exercises:

1. Comparative study of the anatomy of vegetative and reproductive parts of Cycas, Ginkgo, Cedrus, Abies, Picea, Cupressus, Araucaria, Cryptomeria, Taxodium, Podocarpus, Agathis, Taxus, Ephedra and Gnetum.
2. Study of important fossil gymnosperms from prepared slides and specimens.

Suggested Books:

1. Chamber Lain, C.J., Kochar, P. C., Vashishta, P.C. – Gymnosperm

2. Bhatnagar, S.P. and Moitra, A. 1996. Gymnosperms. New Age International. Pvt. Ltd., New Delhi
- Cole, A.J. 1969. Numerical Taxonomy, Academic Press, London.
3. Kar & Ganguli – College Botany.
4. Singh, H. 1978. Embryology of Gymnosperms. Encyclopædia of Plant Anatomy X. Gebrüder Borntraeger, Berlin.
5. Solbrig, O.T. and Solbrig, D.J. 1979. Population Biology and Evolution Addison. Wesley Publishing Co. Inc., USA.
6. Stebbins, G.L. 1974. Flowering Plant – Evolution Above species level. Edward Arnold Ltd., London.
7. Vashishta, Sinha & Kumar – Gymnosperm.
8. Sporne K.K. – Gymnosperm.

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SEMESTER – II

PAPER - IV

PLANT PHYSIOLOGY & METABOLISM

Respiration: Overview of plant respiration, glycolysis, TCA cycle, electron transport and ATP synthesis pentose-phosphate pathway, glyoxylate cycle, alternative oxidase system.

- <http://www.biologydiscussion.com/plants/lipid-metabolism/glyoxylate-cycle-steps-and-significance-with-diagram-lipid-metabolism/23204>
- <http://www.biologydiscussion.com/experiments/respiration-in-plants/cyanide-resistant-respiration-and-its-significance/23330>
- <http://www.biologydiscussion.com/experiments/respiration-in-plants/cyanide-resistant-respiration-and-its-significance/23330>

Lipid metabolism: structure and function of Lipids, fatty acid biosynthesis, synthesis of membrane lipids, structural lipids and storage lipids and their catabolism.

Nitrogen fixation & metabolism: Overview biological nitrogen fixation, nodule formation and nod factors, mechanism of nitrate uptake and reduction, ammonium assimilation.

- <https://www.nature.com/scitable/knowledge/library/biological-nitrogen-fixation-23570419>
- <https://academic.oup.com/glycob/article/12/6/79R/719765>
- https://en.m.wikipedia.org/wiki/Nitrogen_assimilation

Transpiration: Overview mechanism and its significance factor affecting transpiration.

- <https://en.m.wikipedia.org/wiki/Transpiration>
- <https://www.toppr.com/guides/biology/transport-in-plants/transpiration/>

Sensory photobiology: History of discovery of phytochromes and cryptochromes their photochemical and biochemical properties, photophysiology of light-induced responses, cellular localization, molecular mechanism of action of photomorphogenics.

Flowering Process: Photoperiodism and its significance, endogenous clock and its regulation, floral induction and development – genetic and molecular analysis, role of vernalization.

Stress Physiology: Plant responses to biotic and abiotic stress, mechanisms of biotic and abiotic stress tolerance, HR and SAR, water deficit and drought resistance, salinity stress, metal toxicity, freezing and heat stress, oxidative stress.

Suggested Laboratory Exercise:

1. To determine the RQ of the different respiratory substrate.
2. Demonstration of Avena Strength growth test for the activity of growth hormones (Auxin)
3. Demonstration of Avena root inhabitation test for the activity of IAA.
4. Experiment to measure growth in Plants by arc auxanometer.
5. Experiment to show phototropism in plants.
6. Extraction of seed proteins depending upon the solubility.

7. Preparation of the standard curve of protein and estimation of the protein content in extras of plant material by lowry's or Bradford's method.
8. Radioisotope methodology, autoradiography, instrumentation (GM counter and Scintillation counter) and principles involved.
9. Principle of Colorimetry, spectrophotometry and fluorimetry.
10. To separate chlorophyll pigments by paper chromatography techniques.
11. To separate Anthocyanin pigments by paper chromatography techniques.
12. To separate amino acid mixture by ascending paper Chromatography techniques and calculate Rf value.

Suggested Books:

1. Dennid, D.T., Turpin, D.H., Lefebvre, D.D. and Layzell, D.B. (eds) 1997. Plant Metabolism (second edition). Longman, Essex, England.
2. Hopkins, W.G. 1995. Introduction to plant Physiology, John Wiley and Sons, Inc., New York, USA.
3. Moore, T.C. 1989. Biochemistry and physiology of Plant Hormones (second edition). Springer-verlag, New York, USA.
4. Nobel, P.S. 1999. Physiochemical and Environmental Plant Physiology (second edition). Academic Press, San Diego, USA.
5. Shrivastava H.L. Plant physiology & Metabolism.
6. Street H.S. Plant Physiology.
7. Bidwell R.G.S. Plant Physiology.
8. Verma S.K. Plant Physiology.

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9. Kochar P.L. Plant Physiology.

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