GOVT. BILASA GIRLS P.G. COLLEGE

(Accredited by 'A' NAAC)

BILASPUR

SYLLABUS

M.Sc.

BOTANY

Semester - I & II

2019-2020

M.Sc. BOTANY 2019-2020
SEMESTER – I

Paper	Topic	Marks of Internal Assessment	Seminar Test	Marks of Practical	Marks of Theory
I	Molecular Biology & Cytology	10	10	}100	80
II	Biology and Diversity of Micro-Organisms, Algae and Fungi	10	10		80
III	Taxonomy and Diversity of Angiosperms	10	10	}100	80
IV	Plant Biochemistry & Enzymology	10	10		80

- **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 - I
PAPER - I
MOLECULAR BIOLOGY, CYTOLOGY

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

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

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

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

Mitochondria:- Structure; genome organization; biogenesis.

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.

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

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

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.

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

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

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

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.

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.

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, seasame phyllody, mango malformation
7. Camera Lucida diagrams (Micrometry).

Suggested Books:

1. Alexopoulus, C.J., Mims, C.W. and Blackwel, 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.Introdutory Phycology. Affiliated East-West Press Lid., 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 (4^{th} 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.

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.

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

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

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

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

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.
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.

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

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.

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.

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.

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.

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 'Rf' 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 'Rf' values.
13. To determine ion exchange chromatography.

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 (4^{th} 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 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

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

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 & breading 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.

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.

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.

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

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 Vll. Oxford University Press. New York, USA.
8. Lewis, R. 1997. Human Genetics: Concepts and Application 2nd edition).
9. P.K. Gupta-Molecular Biology & Genetices.
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 Jungermanniales, Anthocerotales, Sphagnales, Funariales and polytrichales, economic and ecological importance.

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

Suggested Laboratory Exercises:

Morphological study of representative members of bryophytes:-Riccia, Marchantia, Targionia, Plagiochasma, Pellea, 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. – Bryophyla 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 reasons.
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.

SEMESTER – II
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.

Classification of Gymnosperms and their distribution in India.

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

General account of Cycadeoidales and Cordaitales.

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

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. Encyclopadeia of Plant Anatomy X. Gebruder Bortrager, Berlin.
5. Solbrig. OT. And Solbrig, D.J. 1979. Population Biology and Evolution Addison. Wesley Publicating Co. Inc., USA.
6. Stebbins, G.L. 1974. Flowering Plant – Evolution Anove species level. Edward Arnolds Ltd., London.
7. Vashishta, Sinha & Kumar – Gymnosperm.
8. Sporne K.K. – Gymnosperm.

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.

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 nodefactors, mechanism of nitrate uptake and reduction, ammonium assimilation.

Transpiration: Overview mechanism and its significance factor affecting 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. Biochemisrty 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.
9. Kochar P.L. Plant Physiology.

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BILASPUR

SYLLABUS

M.Sc.

BOTANY

Semester - III & VI

2019-2020

M.Sc. BOTANY 2019-2020
SEMESTER – III

Paper	Topic	Marks of Internal Assessment	Seminar Test	Marks of Practical	Marks of Theory
I	Plant Development & Growth	10	10	}100	80
II	Plant Ecology	10	10		80
III	Biotechnology & Tissue Culture	10	10	}100	80
IV	Plant Pathology & Physiology of Parasitism	10	10		80

Note: There will be four theory papers of 80 marks in each 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 – 10 marks.
There will be two test examinations in each paper consisting of 10 marks each.
Marks of one best test examination will be considered for annual examination.

SEMESTER – III
PAPER – I
PLANT DEVELOPMENT AND GROWTH

Introduction:- Unique features of plant development differences between animal and plant cell.

Seed germination and seedling growth:- Metabolism of nucleic acid, proteins and mobilization of food reserves; tropisms; hormonal control of seedling growth; gene expression, use of mutants in understanding seeding development.

Latent life:– Dormancy:- Importance and types of dormancy; seed dormancy; overcoming seed dormancy; bud dormancy.

Root development:- Organization of root apical meristem (RAM); cell fats and lineages; vascular tissue differentiation; lateral roots; root hairs; root microbe interactions.

Shoot development:- Organization of the shoot apical meristem (SAM); Cytological and molecular analysis of SAM; Control of tissue differentiation, especially xylem and Phloem, secretory ducts and laticifers wood development in relation to environmental factors.

Leaf growth and differentiation:- Determination; phyllotaxy; control of leaf form; differentiation of epidermis (with special reference to stomata and trichomes) and mesophyll.

Senescence and programed cell death (PCD):-Basic concepts, types of cell death, PCD in the life cycle of plants, metabolic changes associated with senescence and its regulation influence of hormones and environmental factors on senescence.

Suggested laboratory Exercises:

1. Effect of gravity, unilateral light & plant growth regulators on the growth of young seedlings.
2. Role of dark and red light/far-red on the expansion of cotyledons and epicotylar hook opening in pea.
3. Study of living shoot apices by dissections using aquatic plants such as Certaophyllum and Hydrilla.
4. Study of cytohistological zonation in the shoot apical meristem (SAM) in sectioned and double stained permanent slides of a suitable plants such as Coleus, Kalanchoe, Tobacco. Examination of shoot apices in a monocotyledon in both T.S. and L.S. to show the origin and arrangement of leaf primordial.

5. Study of whole roots in monocots and dicots. Examination of L.S. of root from a permanent preparation to understand the organization of root apical meristem and its derivatives. (Use maize, aerial roots of banyan, Pistia, Jussieua etc.).Origin of lateral roots. Study of leguminous roots with different types of nodules.

Suggested Books:

1. Atwell, B.J., Kriedermann, P.E. and Jurnbull, C.G.N. (eds) 1999. Plants in Action; Adaptation in Nature, Performance in Cultivation. Macmillan education, Sydney, Australia.
2. Bewley, J.D & Black,M.1994.seeds: physiology of development & germination. Plenum press, new york.
3. Burgess,J.1985. An introduction to plant development, Cambridge university press, Cambridge.
4. Fahn, A 1982.plant anatomy (3rd edition) pergamon press, oxford.
5. Howell S.H 1998 Molecular genetics of plant development. Cambridge university press, Cambridge.
6. Lynden, R.F. 1990. The plant development. The cellular basis. Unnin Hyman. London.
7. Vashista P.C. Plant anatomy.
8. Eams & Macdanials Anatomy of plants.
9. Pandey B.P. Anatomy.
10. Tayal & Tayal Plant Anatomy.

SEMESTER – III
PAPER – II
PLANT – ECOLOGY

Climate, soil and vegetation patterns of the world:- Life zones, major biomes and major vegetation and soil types of the world.

Vegetation Organization:- Concepts of community and continuum, analysis of communities (analytical and synthetic characters); Community Coefficients; inter specific association, concepts of ecological niche.

Ecosystem Organization:- Structure and functions; primary production (methods of measurement, global pattern, controlling factors); energy dynamics (tropic organization energy flow pathway, ecological efficiencies); litter fall and decomposition (mechanism, substrate quality and climate factors); global biogeochemical cycles (pathways, processes budgets) in terrestrial and aquatic ecosystems.

Climate Change:- Greenhouse Gases (CO_2, CH_4 CFCS; sources, trends and role); Ozone layer (CO_2 concentration, global warming, sea level rise, UV radiation).

Green Revolution:-Benefits and adverse consequences.

Suggested Laboratory Exercises:

1. To calculate mean variance, standard derivation, standard error, coefficient of variation and to use t-test for comparing two means related to ecological data.
2. To prepare ombrothermic diagram for different sites on the basis of given data set and to comment on climate.
3. To find out the relationship between two ecological variable using correlation and regression analysis.
4. To determine minimum size and number of quadrants required for reliable estimate of biomass in grasslands.
5. To find out association between important grassland species using Chi-square test.
6. To compare protected and unprotected grassland stands community coefficients (similarity indices).

7. To determine diversity indices (Shannon-Wiener, concentration of dominance, species richness, equitability and B-diversity) for protected and unprotected grassland stands.
8. To estimate IVI of species in a woodland using point centred quarter method.
9. To determine gross and net phytoplankton productivity by light and dark bottle method.
10. To determine soil moisture content, porosity and bulk density of soil collected from varying depths at different locations.
11. To study leaf area and leaf area index of a species in a grassland or forest vegetation.
12. Study of ecological adaptation of different plant species.

Suggested Books:

1. Odum E.P. - Fundamentals of Ecology.
2. Odum E.P. - Basic Ecology.
3. Mason C.F. - Biology of fresh water pollution.
4. Brady N.C. - The nature and properties of soil.
5. Heywood V.H. and Watson R.T. – Global Bio – Diversity.
6. Ambast - Principles of Ecology.
7. Mishra R. - Concepts of Ecology.
8. Sharma P.D.- Environmental Ecology
9. Mullar,Dembois D. and Ellenberg H. – Aims and method of negctation ecology.
10. Macanjgee and Bill Virdee Ecology.
11. Shukla and Chandel- Plant Ecology.
12. K.N. Bhatia – Plant Ecology.

SEMESTER – III
PAPER – III
BIOTECHNOLOGY AND TISSUE CULTURE

Biotechnology: Basic concepts, principles and scope.

Plant cell and tissue culture: General introduction, history, scope, concepts of cellular differentiation, totipotency.

Organogenesis and adventive embryogenesis: Fundamental aspects of morphogenesis, somatic embryogenesis and androgenesis, mechanisms, techniques and utility.

Somatic Hybridization: Protoplast isolation, fusion and culture, hybrid selection and regeneration, possibilities, achievements and limitations of protoplasts research.

Applications of plant tissue culture: Clonal propagation, artificial seed; production of hybrids and somaclones, production of secondary metabolites/natural products, cryopreservation and germplasm storage.

Suggested Laboratory Exercise:

1. To study different types of culture and their preparation method.
2. Preparation of nutrient culture medium.
3. To prepare a culture of E.coli in nutrient broth-medium.
4. Isolation of Rhizobia from root nodules of Lathyrus sativa.
5. Root clearing to show VAM colonization.
6. Study of leaf surface microbe by leaf clearing method.
7. Study of leaf surface by cello tape method.
8. Study of leaf surface by leaf washing method.
9. Separation of amino acid from a mixture by paper chromatography.
10. Fertility test of pollen grain by staining method.
11. Fertility test of pollen grain by germination of pollen grain.
12. Fertility test of pollen grain by germination of pollen grain.
13. Growth characteristics of E. coli using of planting and turbidimetric methods.
14. Isolation of plasmid from E. coli by alkaline lysis method and its quantitation spectrophotometrically.

15. Isolation of protoplasts from various plant tissues and testing their viability.
16. Effect of physical (e.g. temperature) and chemical (e.g. osmoticum) factors on protoplast yield.
17. Demonstration of protoplast fusion employing PEG.
18. Culture of E. coli in nutrient broth medium.
19. Culture E. coli on solid nutrient agar media.

Suggested Books:

1. Bhojwani, S.S. and Razdan, M.K. 1996. Plant Tissue Culture: Theory and Practice (a revised edition). Elsevier Science Publishers, New York, USA.
2. Bhojwani, S.S. 1990. Plant Tissue Culture: Application and Limitations. Elsevier Science Publishers, New York, USA.
3. Glazer, A.N. and Nikaido, H. 1995. Microbial Biotechnology. W.H. Freeman & Company, New York,USA.
4. Henry, R.J. 1997. Practical Application of Plant Molecular Biology. Chapman & Hall, London, UK.
5. Shantharam, S. and Montgomery, J.F. 1999. Biotechnology, Biosafety, and Biodiversity. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
6. De Kalyan Kumar – Plant tissue culture.
7. Ramawat K. G. Plant Biotechnology.
8. Gupta P.K. – Elements of Biotecnology.
9. Dubey R. C. – A Text Book of Biotechnology.
10. Purohit S.S. - Plant tissue culture.
11. Kumarsan V. - Biotechnology.

SEMESTER – III
PAPER – IV
(SPECIAL PAPER)
PLANT PATHOLOGY – PHYSIOLOGY OF PARASITISM

General characteristic of fungi, bacteria and viruses: their heterotriction behavior with emphasis on parasitism parasitic ability and virulence.

Symptomatology: General symptoms of plant disease varieties , pathogenic and nonpathogenic diseases.

Pathogenicity: Distribution of plant pathogens, mode of infection, Inoculum and Inoculum potential, Koch's postulate.

Pathogens attack and defense mechanisms: Physical, Physiological, biochemical and molecular aspects, resistance and susceptibility, phytotoxic effect, disease and syndrome.

Suggested Practicals:

1. Collection of materials from different sources.
2. Preparation of different types of culture media.
3. Isolation, Inoculation and identification of pathogens.
4. Koch's Postulation.
5. Camera Lucida diagrams (micrometry)

Suggested Books:

1. Plant Pathology - R.S. Singh
   - G.N. Agrios
   - Bilgrami & Dubey
   - B.P. Pandey

2. Disease of Crop plants- Rangaswami & Mahadevan

M.Sc. BOTANY 2019-2020
SEMESTER – IV

Paper	Topic	Marks of Internal Assessment	Seminar Test	Marks of Practical	Marks of Theory
I	Embryology & Plant Resources	10	10	}100	80
II	Pollution & Conservation of Plant	10	10		80
III	Biotechnology & Genetic Engineering	10	10	}100	80
IV	Pathology Diseases of crop plants	10	10		80

- **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 – IV
PAPER – I
EMBROYOLOGY & PLANT RESOURCES

Male gametophyte: Structure of anthers microsporogenesis, role of tapetum pollen development and gene expression; male sterility; sperm dimorphism and hybrid seed production; pollen germination, pollen tube growth and guidance; pollen storage; pollen allergy.

Female gametophyte: Ovule development; megasporogenesis; organization and structure of the embryo sac.

Pollen-pistil interaction and fertilization: Structure of pistil; pollen-stigma interaction; sporophytic and gametophytic self-incompatibility (Cytological, biochemical and molecular aspects); double fertilization; in-vitro fertilization.

Seed development and fruit growth: Endosperm development during early, maturation and desiccation stages, embryogenesis, poly-embryony, apomixis, embryo culture, fruit growth and maturation.

Plant resources with special reference to Chhattisgarh:

(A) Origin, evolution, botanical cultivation and uses of:

(i) Food, forage and fodder crops.
(ii) Fiber crops.
(iii) Medicinal and aromatic plants.
(iv) Vegetable oil- yielding crops.

(B) Important firewood and timber yielding plants and non-wood forest products (NWFPs): such as bamboo's rattans, raw materials for paper-making, gums, tannins, dyes, resins.

Suggested Laboratory Exercises:

1. Microscopic examination of vertical sections of leaves such as Cannabis, Tobacco, Nerium, Maize and Wheat to understand the internal structure of leaf tissues and trichomes, glands etc. Study the C3 and C4 leaf anatomy of plants.
2. Study of epidermal peels of leaves such as Coccinia, Gaillardia, Tradescantia. Notonea, etc. to study the development and final structure of stomata and prepare stomatal index. Demonstration of the effect of ABA on stomatal closure.
3. Study of microsporogenesis and gametogenesis in sections of anthers.
4. Examination of modes of anther dehiscence and collection of pollen grains for microscopic examination (Maize, Grasses, Cannabis, Sativa, Crotolaria, Tradescantia, Brassica, Petunia, Solanum Melongena, etc)
5. Study of ovules by slide preparations; study of monosporic, bisporic and tetrasporic types of embryo sac development through examination of permanent stained serial sections.
6. Isolation of zygotic globular endosperm through sections and staining.

Suggested Books:

1. Bhojwani, S.S. and Bhatnagar, S.P. 2000. The Embryology of Angiosperms (4^{th} revised and enlarged edition). Vikas Publishing House, New Delhi.
2. Fageri, K. and Van der piji, L. 1979. The principles of Pollination Ecology. Pergamon Press, Oxford.
3. Howell, S.H. 1998. Molecular Genetics of Plant Development. Cambridge University Press, Cambridge.
4. Raghavan, V. 1997. Molecular Embryology of Flowering Plants. Cambridge University Press, Cambridge.
5. Raghavan, V. 1999. Development Biology of Flowering Plants. Springer-Verlag, New York.
6. Shivanna, K.R. and Sawhney, V.K. (eds) 1997. Pollen Biotechnology for Crop Production and Improvmen. Cambridge University Press, Cambridge.
7. Shivanna, K.R. and Rangaswamy, N.S. 1992. Pollen Biology: A Laboratory Manual. Springer-Verlag, Berlin.
8. Shivanna, K.R. and Johri, B.M. 1985. The Angiosperm Pollen: Structure and Function. Wiley Eastern Ltd., New York.

SEMESTER – IV
PAPER – II
POLLUTION & CONSERVATION OF PLANTS

Biological diversity: Concepts and levels; role of biodiversity in ecosystem functions and stability; speciation and extinctions; IUCN categories of threat; distribution and global patterns; terrestrial biodiversity; hot spots; inventory.

Principles of conservation: Extinction's environmental status of plants based on international union for conservation of nature.

Strategies for conservation: -in situ conservation: International efforts and Indian initiatives; protected areas in India sanctuaries, national parks biosphere reserves, wetlands, mangroves.

Strategies for conservation: -ex situ conservation: Principles and practices, botanical gardens, gene bank, seed bank, in vitro repositories, cryobanks.

Air water and soil pollution: Kinds sources quality parameters, effects on plants and ecosystems.

Suggested Laboratory Exercises:

1. To analysis plant communities using Bra-Curtis ordination method.
2. To determine the water holding capacity of soils collected from different locations.
3. To determine percent organic carbon and organic matter in the soils of cropland, grassland and forest.
4. To estimate the dissolved oxygen content in eutropic and oligotropic water samples by azide modifications of Winker's method.
5. To estimate chlorophyll content in SO_2 fumigated plant leaves.
6. To estimate rate of carbon dioxide evolution from different soils using soda lime or alkali absorption method.
7. To study environmental impact of a given development activity using checklist as a EIA method.
8. To determine diversity indices (Shannon-Wiener, concentration of dominance, specie richness, equitably and B-diversity) for protected and unprotected grassland stands.
9. To estimate IVI of the species in a woodland using point centred quarter method.
10. To determine the percent leaf area injury of different samples collected around polluted sites.
11. To estimate dust holding capacity of different plant species .
12. Biochemical analysis of soil sample.

Suggested Books:

1. Smith, R.L. 1996. Ecology and Field Biology. Harper Collins, New York.
2. Ludwig, J. and Reynolds, J.F. 1988. Statistical Ecology. John Wiley & Sons.
3. Odum, E.P. 1971. Fundamentals of Ecology. Saunders, Philadelphia.
4. Odum, E.P. 1983. Basic Ecology. Saunders, Philadelphia,
5. Barbour, M.G., Burk, J.H. and Pitts, W.D. 1987. Terrestial Plant Ecology. Benjamin/Cummings Publication Company, California.
6. Heywood, V.H. and Watson, R.T. 1995. Global Biodiversity Assessment. Cambridge University Press.
7. Hill, M.K. 1997. Understanding Environmental Pollution. Cambridge University Press.

SEMESTER – IV
PAPER – III
BIOTECHNOLOGY – GENETIC ENGINEERING

Recombinant D.N.A. technology: Gene cloning, principles and techniques, construction of genomic D.N.A. libraries, choice of vectors, D.N.A. synthesis and sequencing, polymerase chain reaction, D.N.A. finger printing.

Genetic Engineering of plants: Aims strategies for development of transgenic [with suitable example], Agrobacterium – the natural genetic engineer, T-D.N.A. and transposon medicated gene tagging, chloroplast transformation and its utility, intellectual property right, possible ecological risks and ethical concerns.

Microbial genetic manipulation: Bacterial transformation, selection of recombinants and transformants;/genetic improvement of industrial microbes and nitrogen fixers, fermentation technology.

Suggested Laboratory Exercises:

1. Determination of growth characteristics of E.coli in spectro-photometric method.
2. Isolation of VAM fungi and their identification.
3. Study the soil micro-flora by direct method.
4. Study the soil fungi by indirect method.
5. To estimate the soil chlorophyll.
6. To study soil micro-flora by soil dilution method.
7. Restriction digestion of the plasmid and estimation of the size of various DNA fragments.
8. Cloning of a DNA fragment in a plasmid vector, transformation of the given bacterial population and selection of recombinants.
9. Demonstration of DNA sequencing by Sanger's dideoxy method.
10. Organogenesis and somatic embryogenesis using appropriate explants and preparation of artificial seed.
11. Demonstration of androgenesis in Datura.
12. Electroporation of protoplasts and checking of transient expression of reporter gene.
13. Co-cultivation of the plant material (e.g. Leaf discs) with Agrobacterium and study GUS activity histochemical.
14. Culture of E. coli in nutrient broth medium.
15. Culture of E. coli on solid nutrient agar medium.

16.Separation of amino acid from a mixture by thin layer chromatography.
17.Separation of amino acid from a mixture by circular disc chromatography

Suggested Books:

1. Brown, T. A. 1999. Genomes. John Wiley & Sons (Asia) Pvt. Ltd , Singapore.
2. Callow, J. A. Ford- Lloyd, B. V. and Newbury, H. J. 1997. Biotechnology and Plant Genetic Resources: Conservation and Use. CAB International, Oxon, U. K.
3. Chrispeels, M. J. and Sadava, D.E. 1994. Plants, Genes and Agriculture. Jones & Barnett Publishers, Boston, USA.
4. Glazer, A.N. amd Nikaido, H.1995. Microbial Biotechnology. W.H. Freeman & Company, New York, USA.
5. Henry, R.J. 1997. Practical Applications of Plant Molecular Biology. Chapman & Hall, London, UK.
6. Jolles, O. and Jornvall, H. (eds) 2000. Proteomics in Functional Genomics. Birkhauser Verlag, Basel, Switzerland.
7. kartha, K.K. 1985. Cryopreservation of Plant Cells and Organs. CRC Press, Boca Raton, Florida, USA.
8. Old, R.W. and Primrose, S.B. 1989. Principles of Gene Manipulation. Blackwell Scientific Publications, Oxford, UK.
9. Shantharun, S. and Montgomery, J.F. 1999. Biotechnology, Biosafety, and Biodiversity. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
10. S. N Jogdand- Gene Technology.
11. Arora & Sandhu- Genetics.
12. U. Satyanarayana- Biotechnology.
13. P.K. Gupta- Biotechnology and Genome.

SEMESTER – IV
PAPER – IV
PATHOLOGY – DISEASES OF CROP PLANTS

Effect of environment on disease: Predisposition and stress epidemiology and disease forecasting, sources of infection i.e. seed, soil, water and air borns diseases of plant, significance of phyllosphere and rhizosphere.

Control of plant disease: Principle of plant disease control, method of control e.g. regulatory, chemical, biological and breeding of resistant varieties of host plants, plant quarantine, bio pesticides.

Details of diseases: Recommended control for the important disease caused by fungi, bacteria, viruses, mycoplasma or nematodes in the following crop plants.

1. Wheat, Rice, Maize, Sugarcane and Bajra.
2. Arhar, gram and pea.
3. Ground nut, Till, Linseed and Cotton.
4. Chilies, Tomato, Potato, Brinjal and Coriander.
5. Citrus, Papaya and Banana.

Suggested Practicals for Pathology:

1. Study of host-Parasite relationship of different crop plants.
2. Study of phyllosphere and Rhizosphere.
3. Study of sources of infection i.e. seed, soil, air and water born.
4. Diseases of crop plants.

Suggested Books:

1. Rangaswami G.- Disease of crop plants.
2. Dubey H.C. –Plant Pathology.
3. Singh R.S. – Plant Pathology.
4. Ali S.S. & Kulshreshtha Preeti-Plant Pathology.

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