

MAHAKAUSHAL UNIVERSITY JABALPUR

**As per model syllabus of U.G.C. New Delhi, drafted by
Central Board of Studies and Approved by Higher
Education and the Governor of M.P.**



**Faculty of Science
Syllabus & Prescribed Books
Subject- Botany
M.Sc. Semester Examination

I to IV Semester**

Department of Higher Education, Govt. of M.P.
Semester wise syllabus for Postgraduates
As recommended by Central Board of Studies and
Approved by H.E. the Governor of M.P

M. Sc. Botany (Semester System)

MBOT0101-T : Biology & Diversity of Viruses, Bacteria and Fungi

- UNIT I: Viruses: characteristics and ultrastructure of virions, isolation and purification of viruses; chemical nature, replication, transmission of viruses; economic importance.
- UNIT II: Archaeobacteria and Eubacteria: General account; ultrastructure, nutrition and reproduction; biology and economic importance; cyanobacteria – salient features and biological importance.
- UNIT III: Classification of bacteria, Actinomycetes, Mycoplasma, Rickettsiae, Chlamydiae and their significance.
- UNIT IV: Mycology: classification and general characters of fungi; substrate relationship in fungi; cell ultrastructure; unicellular and multicellular organization; cell wall composition; nutrition (saprobic, biotrophic, symbiotic); reproduction (vegetative, asexual, sexual), heterothallic; parasexuality; recent trends in classification.
- UNIT V: Phylogeny of Fungi: Phylogeny of fungi; general account of Mastigomycotina, Zygomycotina, Ascomycotina, Basidiomycotina, Deuteromycotina; fungi in industry, medicine and as food; fungul diseases in plants and humans; Mycorrhiza; fungi as biocontrol agents.

Suggested Readings

- Alexopoulos, C.J. Mims, C. W. and Blackwell, M; 1996: Introductory coO' Mycology, Jhon Wiley & Sons Inc.
- Clifton, A; 1958: Introduction to Bacteria, McGraw- Hills Book Co. New Delhi.
- Madigan, M T. Martinko, J. M and Parker Jack; 1997: Brock Biology Of Microorganisms, (8th edition) Prentice Hall, N.J. U.S.A
- Mandahar, C. L.; 1978: Introduction to Plant Viruses. Chand & Co.Ltd. Delhi.
- Mehrotra, RS. and Aneja, RS.; 1998: An Introduction to Mycology. New Age Intermediate Press.
- Rangaswamy, G. and Mahadevan, A; 1999: Diseases of Crop Plants in India (4th edition). Prentice Hall of India Ltd. New Delhi.
- Webster, J.; 1985: Introduction to Fungi Cambridge University Press. Dubey, R C. & Maheshwari, D. K.; 2005: A Text Book of Microbiology, S. Chand Publisher, New Delhi

Department of Higher Education, Govt. of M.P.
Semester wise syllabus for Postgraduates
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M. Sc. Botany (Semester System)

MBOT0102 - T : Biology & Diversity of Algae, Bryophytes and Pteridophytes

- UNIT I: Algae in diversified habitats; thallus organization; cell ultrastructure; reproduction; criteria for classification of algae, pigments, reserve foods, flagella; classification.
- UNIT II: Salient features of Protochlorophyta, charophyta, chlorophyta, xanthophyta, bacillariophyta, phaeophyta and rhodophyta; algal blooms; algal biofertilizers; algae as food, feed and industrial uses.
- UNIT III: Morphology, structure, reproduction and life history of bryophyta; distribution, classification, general accounts of marchantiales, jungermanniales, anthocerotales, sphagnales, funariales and polytrichales; ecological and economic importance.
- UNIT IV: Morphology, anatomy, reproduction and life history of pteridophyta; classification, evolution of stele, heterospory and origin of seed habits.
- UNIT V: Introduction to psilopsida, sphenopsida and pteropsida.

Suggested Readings

- Smith G. M.~ Cryptogamic Botany Vol I(2nd edition)~ TataMcGraw-Hill Publishing Company Ltd. Bombay -New Delhi.
- Kumar H. D. 1988: Introductory Phycology. Affiliated East-West Press Ltd. New Delhi.
- Paribar~ N.S. 1991: Bryophyta. Central Book Depot. Allahabad.
- Brower~ 1926: Primitive Land Plants~ Cambridge At the University Press.
- Kashyap~ 1972 LiveWorts of Western Himalayas and Punjab. Researchco Publication.
- Smith, G. M.~ Cryptogamic Botany Vol n (2nd edition)~ TataMc Graw -Hill Publishing Company~ Bombay -New Delhi.
- Puri P. 1980~ Bryophyta -Morphology, Growth & Differentiation. Atma Ram & Sons, Delhi.
- Chopra & Kumar~ 1988: Biology of Bryophyta; Wiley Eastern Ltd.
- Ram Udar; 1970: An Introduction to Bryophyta; Shashidhar Malviya Prakashan
- Watson; 1968: Structure and life of Bryophyta; Hutchinson & Co. Ltd. Campbell;
- 1939: The evolution of land plants; Stanford University.
- Spome, K.R. 1991. The Morphology of Pteridophytes.
- Parihar N.S. 1996 Biology and Morphology of Pteridophytes, CentralBook Depot. Allahabad.
- Smith G. M.; Cryptogamic Botany Vol. II; Tata Mc Graw -Hill Publishing Co. Bombay -New Delhi
- Arnold C. A; An Introduction to Paleobotany; Tata Mc Graw -Hill Publishing Co. New Delhi.
- Stewart, W. N. and Rathwell G. W. 1993. Paleobotany and the Evolution of Plants. Cambridge University Press.
- Eames A J.; Morphology of Vascular Plants-Lower Groups.Tata Mc Graw -Hill Publishing Co. New Delhi
- Rashid A. 1999; An introduction to Pteridophytes; Vikas Publishing House Pvt. Ltd..
- Parihar; 1965: Pteridophyta; Central Book Depot. Allahabad.

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Semester wise syllabus for Postgraduates
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M. Sc. Botany (Semester System)

First Semester

MBOT0103-T : Biology & Diversity of Gymnosperms

- UNIT I: Introduction: Gymnosperms, the vesseless and fruitless seed plants; evolution of gymnsperms; complexity of female gametophytes.
- UNIT II: Classification of gymnosperms and their distribution in India. Economic importance of gymnosperms
- UNIT III: Gerenal account of pteridospermales, cycadeoidales and cordaitales.
- UNIT IV: Structure, reproduction and interrelationships of cycadales, ginkgoales and coniferales.
- UNIT V: Structure, reproduction and interrelationships of ephedrales, welwitschiales and gnetales.

Suggested Readings

- Bhatnagar, S.P. and Moitra, A; 1996: Gymnosperms. New Age International Pvt. Ltd., New Delhi.
- Singh H.; 1978: Embryology of Gymnosperms, Encyclopedia of Plant Anatomy X. Gebruder Bortraeger, Berlin.
- Spome K R; 1991: The Morphology of Gymnosperms; Hutchinson Univ. Library; London.
- Foster A S. & Gifford E. M; Comparative morphology of vascular Plants; Vakils, Feffer, & Simons Private Ltd. Bombay. Chamberlain; Gymnosperms -Structure & Evolution; CBS Publishers & Distributors Delhi.
- Shukla A C. & Mishra S. P.; Essentials of Paleobotany; Vikas Publishing House Pvt. Ltd. Delhi-Bombay-:6angalore-Calcutta-Kanpur .

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M. Sc. Botany (Semester System)

First Semester

MBOT0104-T : Plant Ecology

- UNIT I: **Population Ecology:** Ecology & ecosystem: Definitions, Organization and components, Population & Environment; Population ecology, density & distribution, Natality, Mortality, Survivorship curves, Age structure & pyramids, Fecundity schedules, Life tables; Population growth – exponential and logistic curves; Intra specific competition and self regulation; r- and k-strategists.
- UNIT II: **Community organization:** Concepts of community and continuum; Analysis of community analytical and synthetic characters, Community coefficients and indices of diversity, interspecific association negative and positive associations; Concept of ecological niche; Concepts of biodiversity; evolution and differentiation of species – allopatric & sympatric speciation; ecads and ecotypes.
- UNIT III: **Ecosystem development and stability:** Temporal changes cyclic and non cyclic; Succession processes & types; Mechanism of succession facilitation, Tolerance and inhibition models; Concept of climax persistence resilience and resistance; Ecological perturbation natural and anthropogenic, Ecosystem restoration.
- UNIT IV: **Fate of energy in ecosystems:** Trophic organization and structure, Food chains & webs; energy flow pathways, Ecological efficiencies consumption, assimilation and production trophic; Primary production methods of measurement, Global patterns, Limiting factors.
- UNIT V: **Fate of matter in ecosystems:** Recycling pathways; Relationship between energy flow and recycling pathways; Nutrient exchange and cycling; Global biogeochemical cycles of C, N, P and S; Physical, chemical and Biological characteristics of soil.

Suggested Readings

- Smith. R.L. 1996. Ecology and Field Biology. Harper Collins. New York.
- Muller-Dombois. D. and Ellenberg. H. 1974. Aims and Methods of Vegetation Ecology, Wiley, New York
- Begon. M., Harper, J.L. and Townsend, C.R. 1996. Ecology. Blackwell Science. Cambridge.
- Ludwig. J. and Reynolds. J.F. 1988. Statistical Ecology. John Wiley & Sons.
- Odum. E.P. 1971. Fundamentals of Ecology. Saunders, Philadelphia.
- Odum, E.P. 1983. Basic Ecology. Saunders, Philadelphia.
- Barbour, M.G., Burk, J.H. and Pitts, W.O. 1987. Terrestrial Plant Ecology. Cummings Publication Company, California.
- Kormondy, E.J. 1996. Concepts of Ecology. Prentice-Hall of India Pvt. Ltd., New Delhi.
- Chapman, J.L. and Reiss, M.J. 1988. Ecology: Principles and Applications. Cambridge University Press, Cambridge, U.K.
- Moldan, B. and Billharz, S. 1997. Sustainability Indicators. John Wiley & Sons, New York.
- Treshow. M. 1985. Air Pollution and Plant Life. Wiley Interscience.
- Heywood, V.H. and Watson. R.T. 1995. Global Biodiversity Assessment. Cambridge University Press.
- Mason, C.F. 1991. Biology of Freshwater Pollution. Longman.
- Hill. M.K. 1997. Understanding Environmental Pollution. Cambridge University Press.
- Brady, N.C. 1990. The Nature and Properties of Soils. MacMillan.

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M. Sc. Botany (Semester System)

Second Semester MBOT0201-T : Plant Development & Reproduction

- UNIT I: Unique features of plant development; differences between animal and plant development. Organization of shoot apical meristem (SAM); control of tissue differentiation, especially xylem and phloem; secretory ducts and laticifers. Wood development in relation to environmental factors.
- UNIT II: Leaf growth and differentiation. Organization of root apical meristem (RAM); cell fates and lineages; vascular tissue differentiation; lateral roots; root hairs. Root – microbe interaction.
- UNIT III: Vegetative options and sexual reproduction; flower development; genetics of floral organ differentiation; homeotic mutants in *Arabidopsis* and *Antirrhinum*; sex determination. Structure of anthers, microsporogenesis, role of tapetum, pollen development and gene expression.
- UNIT IV: Male sterility; pollen germination, pollen tube growth and guidance. Pollen storage, pollen allergy and pollen embryos. Ovule development, megasporogenesis; organization of embryo sac; structure of embryo sac cells.
- UNIT V: Flora characteristics; pollination mechanisms and vectors; breeding systems; structure of pistil; pollen stigma interactions; sporophytic and gametophytic self-incompatibility. Double fertilization. Endosperm development during early, maturation and desiccation stages; embryogenesis; storage proteins of endosperms and embryo. Polyembryony, apomixis. Dynamics of fruit growth; biochemistry and molecular biology of fruit maturation.

Suggested Readings

- Bhojwani, S.S. and Bhatnagar, S.P. 2000. The Embryology of Angiosperms (4th revised and enlarged edition). Vikas Publishing House, New Delhi.
- Burgess, J. 1985. An introduction to Plant Cell Development. Cambridge University Press, Cambridge.
- Fageri, K. and Van der Pijl, L. 1979. The Principles of Pollination Ecology. Pergamon Press, Oxford.
- Fahn, A. 1982. Plant Anatomy. (3rd edition). Pergamon Press, Oxford.
- Fosket, D. E. 1994. Plant Growth and Development. A Molecular Approach. Academic Press, San Diego.
- Howell, S.H. 1998. Molecular Genetics of Plant Development, Cambridge University Press, Cambridge.
- Leins, P., Tucker, S.C. and Endress, P. K. 1988. Aspects of Floral Development. J. Cramer, Germany.
- Lyndon, R.F. 1990. Plant Development. The Cellular Basis. Unin Hyman. London.
- Murphy, T. M. and Thompson, W. E. 1988. Molecular Plant Development. Prentice Hall, New Jersey.
- Proctor, M. and Yeo, P. 1973. The Pollination of Flowers. William Collins Sons, London.
- Raghvan, V. 1997. Molecular Embryology of Flowering Plants. Cambridge University Press, Cambridge.
- Raghvan, V. 1999. Development Biology of Flowering Plants. Springer-verlag.
- 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.

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M. Sc. Botany (Semester System)

Second Semester

MBOT0202-T : Morphology & Taxonomy of Angiosperms

- UNIT I: Morphology of stamens and carpels; carpel evolution. Morphology of inferior ovary; placentation types and their origin.
- UNIT II: The species concept: taxonomic hierarchy; species, genus, family and other categories; principles used in assessing relationships, delimitation of taxa and attribution of rank. Salient features of International code of Botanical Nomenclature.
- UNIT III: Taxonomic evidence: morphology, anatomy, palynology, embryology, cytology, phytochemistry, genome analysis and nucleic acid hybridization. Relevance of taxonomy to conservation.
- UNIT IV: Taxonomic tools: herbarium, floras, histological, cytological, phytochemical, serological, biochemical and molecular techniques; Computers and GIS. Local plant diversity and its socio-economic importance.
- UNIT V: Systems of angiosperm classification: phenetic versus phylogenetic systems; cladistics in taxonomy; relative merits and demerits of major systems of classification. Endemism, hot spots, hottest hot spots; plant explorations; invasions and introductions.

Suggested Readings

- Heywood & Moore, D.M; 1984: CWTent concept *in* Plant Taxonomy Academic Press. Banson, L.B.; 1957: Plant Classification, Health & Co. Boston.
- Davis, P.R & Heywood, V.H 1973: Principles of Angiosperms and Taxonomy, Robert E. Kreiger Pub. Co. New York, USA
- Eames, A.I.; 1961: Morphology of Angiosperms, Mc-Graw Hill, New York. Jeffery, C.; 1968: An Introduction to Plant Taxonomy J. & H. Churchill Limited. Lawrence, G .H.M.; 1951: Taxonomy of Vascular Plants Macmillan, New York.
- Naik V. N.; 1984: Taxonomy of Angiosperms. Tata Mc-Graw Hill Pub. Co. Ltd. New Delhi. Porter, L.L.; 1959: Taxonomy of Flowering Plants. San Francisco. Radford~ A.E. Dickinson, W.C. Massey J.R and Ben. C.R: 1974: VQ-llar Plant SYstematics, Harper & Row, New York

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M. Sc. Botany (Semester System)

Second Semester

MBOT0203-T : Utilization & Conservation of Plant Resources

- UNIT I: **Plant Biodiversity:** Major Biomes of the world, Tropical rain & Seasonal Forests, Temperate rain & Seasonal forests, Boreal forests, Grasslands, Deserts; Aquatic Ecosystems, wetlands, Lakes & Ponds Streams & Rivers, Marine & Estuarine habitats.
- UNIT II: **Sustainable Development:** Resource utilization; Status & Utilization of Biodiversity; Sustainable development and utilization of resources from forest, Grassland and aquatic habitats; Food forage, Fodder, Timber & Non-wood forest products; Threats to quality & quantity of Resources due to overexploitation.
- UNIT III: **Strategies for conservation of resources:** Classifications of resources; Principles of conservation; *In-situ* conservation, sanctuaries, National parks, Biosphere reserves for wildlife conservation; Habitat conservation practices of conservation for forests, ranges, soil and water; Ex-situ conservation, botanical gardens, field gene banks, seed banks, in vitro repositories, cryo-banks.
- UNIT IV: **Pollution & Climate Change:** Air, Water and Soil pollution, Kinds, Sources, Quality parameters, Effects on structure & function of ecosystems; Management of pollution; Bioremediation; Climate changes sources, Trends & role of greenhouse gases, Effect of global warming on climate, Ecosystem processes & Biodiversity; Ozone layer & Ozone hole.
- UNIT V: **Resource monitoring:** Remote sensing concepts & Tools, Satellite remote sensing basics sensors, Visual & digital interpretation, EMR bands and their applications; Indian remote sensing program; Thematic mapping of resources; Application of remote sensing in Ecology & Forestry.

Suggested Readings

- Moldan, B. and Billharz, S. 1997. Sustainability Indicators. John Wiley & Sons, New York.
- Treshow, M. 1985. Air Pollution and Plant Life. Wiley Interscience.
- Heywood, V.H. and Watson, R.T. 1995. Global Biodiversity Assessment. Cambridge University Press.
- Mason, C.F. 1991. Biology of Freshwater Pollution. Longman.
- Hill, M.K. 1997. Understanding Environmental Pollution. Cambridge University Press. . Brady, N.C. 1990. The Nature and Properties of Soils. MacMillan.
- Kothari, A 1997. Understanding Biodiversity: Life'Sustainability and Equity. Orient Longman.
- Kohli, R., Arya, K.S., Singh, P.H. and Dhillon, H.S. 1994. Tree Directory of Chandigarh. Lovedale Educational, New Delhi.
- Nair, M.N.B. et. al (Eds) 1998. Sustainable Management of Non-wood Forest Products. Faculty of Forestry, Universiti Putra Malaysia. 434004 PM Serdang, Selangor, Malaysia.
- Paroda, R.S. and Arora, R.K. 1991. Plant Genetic Resources Conservation and Management. IPGRI (Publication) South Asia Office, C/o NBPGR, Pusa Campus, New Delhi. Pimentel, D. and Hall, C.W. (eds) 1989. Food and Natural Resources. Academic Press, London-New York. .
- Pinstrup-Anderson, P. et al. 1999. World Food Prospects: Critical Issues for the Early 21 st Century. International Food Policy Research Institute, Washington, D.C., USA.
- Plant Wealth of India 1997. Special Issue of Proceedings Indian National Science Academy B-63.
- Pulcknett, D.L., Smith, N.J.H., William, J.T. and Murti Annishetty, N. 1987. Gene Banks and Worlds Food. Princeton University Press, Princeton, New Jersey, USA.

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- Rodgers, N.A. and Panwar, H.S. 1988. Planning a Wildlife Protected Area Network in India. Vol. 1. The Report. Wildlife Institute of India, Dehradun.
- Sahni, K.C. 2000. The Book of Indian Trees, 2nd edition. Oxford University Press, Mumbai. Schery, R. W. 1972. Plants for Man. 2nd ed. Englewood Cliffs, New Jersey. Prentice Hall. Sharma, O.P. 1996. Hill's Economic Botany (late Dr. A.F. Hills, adapted by O.P. Sharma) Tata McGraw Hill Co. Ltd., New Delhi. .. Swaminathan, M.S. and Kocchar, S.L. (Eds) 1989. Plants and Society. Macmillan ,Publication Ltd., London.
- Thakur, R.S., Puri, H.S. and Husain, A.1989. Major Medicinal Plant of India. Central Institute of Medicinal and Anomatic Plants, CSIR, Lucknow.
- Thomas, P. 2000. Tress: Their Natiojal History. Cambridge University Press, Cambridge. Wagner, H., Hikino, Hand Farnswarth, N. 1989. Economic and Medicinal Plant Research. " Vols 1-3 Academic Press, London.
- Walter, K.S. and Gillett, H.J. 1998. 1997 IUCN Red List of Threatened Plants. IUCN, the World Conservation Union. IUCN, Gland, Switzerland, and Cambridge, U.K.

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Semester wise syllabus for Postgraduates
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M. Sc. Botany (Semester System)

Second Semester MBOT0204-T: Cell Biology of Plants

- UNIT I:** Structural organization of the plant cell; specialized plant cell types. Structure and functions of cell wall; biogenesis; growth. Cytoskeleton: organization and role of microtubules and microfilaments; motor movements.
- UNIT II:** Plasma membrane: structure, models and functions; sites for ATPases; ion carriers, channels and pumps; receptors. Structure of plasmodesmata, role in movement of molecules; comparison with gap junctions.
- UNIT III:** Chloroplast: structure, genome organization, gene expression, nucleochloroplastic interactions; mitochondria: structure, genome organization, biogenesis. Plant vacuoles: tonoplast membrane, ATPases, transporters, as storage organelle. Other cell organelles: golgi apparatus, lysosomes, endoplasmic reticulum.
- UNIT IV:** Nucleus: structure. Cell cycle: control mechanisms; role of cyclins and cyclin-dependent kinases; mechanisms of programmed cell death. Chromosome structure and packaging of DNA; euchromatin and heterochromatin; karyotype analysis and evolution; banding patterns; specialized types of chromosomes.
- UNIT V:** Origin, meiosis and breeding behaviour of duplication, deficiency, inversion and translocation heterozygotes; origin, occurrence, production and meiosis of haploids, aneuploids and euploids; Origin and production of autopolyploids. Allopolyploids; types, genome constitution and analysis.

Suggested Readings

Lewin, B. 2000, Genes VII Oxford University Press, New York.

Alberts, B., Bray, D., Lewis, J., Raff, M., Roberts, K., and Watson, J.D. Molecular Biology of the Cell. Garland Publishing: Inc., New York.

Wolfe, S.L. 1993. Molecular and Cellular Biology, Wadsworth Publishing Co., California, USA
Rost, T. et al. 1998. Plant Biology, Wadsworth Publishing Co., California, U.S.A
Krishanmurthy K V. 2000 Methods in Cell Wall Cytochemistry, CRC Press, Boca Raton, Florida U.S.A

Buchanan, B.B. Groissem, W. and Jones, R.L. 2000. Biochemistry And Molecular Biology of Plants. American Society of Plant Physiologists, Maryland, USA

De, D.N. 2000: Plant Cell Vacuoles: An Introduction. CSIRO Publication, Collingwood ~ Austral.

Department of Higher Education, Govt. of M.P.
Post Graduate Semester wise Syllabus
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उच्च शिक्षा विभाग, म.प्र. शासन
स्नातकोत्तर कक्षाओं के लिये सेमेस्टर अनुसार पाठ्यक्रम
केंद्रीय अध्ययन मण्डल द्वारा अनुशंसित तथा म. प्र. के राज्यपाल द्वारा अनुमोदित

Class / कक्षा	: M. Sc.
Semester / सेमेस्टर	: III semester
Subject / विषय	: Botany
Title of Subject Group	: Plant Physiology
विषय समूह का शीर्षक	:
Paper No. / प्रश्नपत्र क्रमांक	: MBOT0301-T
Compulsory / अनिवार्य या Optional / वैकल्पिक अनिवार्य	: Compulsory

Particulars / विवरण

Unit-1	Plant water relations, mechanisms of water transport through xylem, Transpiration, root-microbe interactions in facilitating nutrient uptake. Membrane transport proteins, Structure and functions of ATP.
Unit-2	Phloem transport; phloem loading and unloading, passive and active solute transport. Signal transduction; overview, receptors and proteins, phospholipids signaling, role of cyclic nucleotides, calcium-calmodulin cascade. Specific signaling mechanisms, for example, two-component sensor regulator system in bacteria and plants.
Unit-3	Plant growth regulators and elicitors: Physiological effects and mechanism of action of auxins, gibberellins, cytokinins, ethylene, abscisic acid, brassinosteroids, polyamines, jasmonic acid, and salicylic acid. Hormone receptors.
Unit-4	Flowering process: photoperiodism and its significance, endogenous clock and its regulation. Floral induction and development. Phytochromes and cryptochromes, their photochemical and biochemical properties, Role of vernalization.
Unit-5	Stress physiology: Plant responses to biotic and abiotic stress. Water deficit and drought resistance. Salinity stress and resistance. Concepts of freezing, heat and oxidative stresses.

Suggested Laboratory Exercise based on P.G 301 :

1. Radioisotope methodology, autoradiography, instrumentation (GM counter & scintillation counter) and principles involved.
2. Principles of colorimetry, Spectrophotometry and florimetry.
3. Determine rate of transpiration by Ganong's potometer.
4. Determine rate of respiration in germinating/young buds by Ganong's respirometer.

5. Determine effect of temperature / pH/Toxins on permeability of cell membrane.
6. Study of physiological apparatus.
7. Bioassay of plant hormones- auxins, ethylene, GA, ABA and Cytokinin.
8. To determine stomatal index, stomatal frequency and percentage of leaf area open through stomata. Also, to study the effect of ABA on stomatal closure.

Other experiments based on theory paper.

SUGGESTED READINGS

- **Hopkins, W.G. 1995.** Introduction to Plant Physiology. John Wiley & Sons, Inc., New York, USA.
- **Moore, T.C. 1989.** Biochemistry and Physiology of Plant Hormones (second edition). Springer -Verlag, New York. USA.
- **Nobel, P.S. 1999.** Physicochemical and Environmental Plant Physiology (second edition). Academic Press, San Diego, USA.
- **Salisbury FB and Ross CW 1991** Plant Physiology IV edition Wdsworth Publishing co. California USA.
- **Taiz I and Zeiger E1998** Plant Physiology II Edition. Sinauer Associates Inc. Publisher MS.
- **Dennis DT and Terpin DH Lefevre DD and Layzell DV 1997** Plant Metabolism II Ed. Longman England.
- **Buchanan, B.B.Gruissem, W. and Jones R.L. 2000.** Biochemistry and molecular Biology of plants. American Society of Plants Physiologist, Maryland USA.

Department of Higher Education, Govt. of M.P.
Post Graduate Semester wise Syllabus
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उच्च शिक्षा विभाग, म.प्र. शासन
स्नातकोत्तर कक्षाओं के लिये सेमेस्टर अनुसार पाठ्यक्रम
केंद्रीय अध्ययन मण्डल द्वारा अनुशंसित तथा म. प्र. के राज्यपाल द्वारा अनुमोदित

Class / कक्षा : M.Sc.
Semester / सेमेस्टर : III semester
Subject / विषय : Botany
Title of Subject Group : **Plant Biochemistry & Metabolism**
विषय समूह का शीर्षक :
Paper No. / प्रश्नपत्र क्रमांक : **MBOT0302-T**
Compulsory / अनिवार्य या Optional / वैकल्पिक : Compulsory

Particulars / विवरण

Unit-1	Fundamentals of enzymology: allosteric mechanism, regulatory and active sites, isozymes, kinetics of enzymatic catalysis, Michaelis- Menten equation and its significance, Mechanism of enzyme action.
Unit-2	Photochemistry and photosynthesis: General concepts, evolution of photosynthetic apparatus, photosynthetic pigments and light –harvesting complexes. Photooxidation of water, mechanism of electron and proton transport, Carbon assimilation; Calvin cycle, photorespiration and its significance, C ₄ -cycle, CAM pathway, physiological and ecological considerations.
Unit-3	Respiration: Overview of plant respiration, glycolysis, TCA cycle, electron transport and ATP synthesis. Oxidative pentose phosphate pathway, alternative oxidase system.
Unit-4	Lipid metabolism : Structure and functions of lipids, fatty acid biosynthesis, structural lipids and storage lipids and their catabolism. glyoxylate cycle, Sulphate uptake, transport and assimilation.
Unit-5	Nitrogen fixation, nitrogen and sulphur metabolism: Overview, biological nitrogen fixation, nodule formation. Mechanism of uptake and reduction, ammonium assimilation.

Suggested Laboratory Exercise based on P.G 302 :

1. Effect of time and enzyme concentration on the rate of reaction of enzyme C e.g. acid Phosphatase, nitrate reductase.
2. Effect of substrate concentration on activity of any enzyme C (catalase, Amylase)
3. Demonstration of the substrate inducibility of the enzyme nitrate reductase.
4. Determination of succinate dehydrogenase activity, Its kinetics and sensitivity to inhibitors.
5. Separation of isoenzymes of esterase, Peroxidases by native polyacrylamide gel electro pho resis.
6. To demonstrate photophosphorylation in intact chloroplasts, resolve the phosphoproteins by SDS-PAGE and perform autoradiography desalting of proteins by gel filtration chromatography embaying Sephadex G-25.

7. Extraction of seed proteins depending upon the solubility.
8. Desalting of proteins by gel filtration chromatography employing Sephadex G-25.
9. Preparation of standard curve of protein and estimation of protein contents in extracts of plant material by Lowry's Bradford's method.
10. Fractionation of proteins using gel filtration chromatography by Sephadex G-100 or Sephadex G-200.
11. Determine effect of light intensity/wave length on rate of photosynthesis.
12. Extraction of chloroplast pigments from leaves and preparation of the absorption spectrum of chlorophylls and carotenoids.
13. To determine the chlorophyll a/chlorophyll b ratio in C₃ and C₄ plants
14. Isolation of intact chloroplasts and estimation of chloroplast proteins by spot protein assay.

Other experiments based on theory paper.

Suggested readings

- **Lodish, H., Berk, A., Zipursky, S.L., Matsudaira, P., Baltimore, D. and Darnell, J.** 2000. Molecular cell Biology (fourth edition). W.H. Freeman and Company, New York USA.
- **Moore, T.C. 1989.** Biochemistry and Physiology of Plant Hormones (second edition). Springer -Verlag, New York. USA.
- **Nobel, P.S. 1999.** Physicochemical and Environmental Plant Physiology (second edition). Academic Press, San Diego, USA.
- **Salisbury FB and Ross CW 1991** Plant Physiology IV edition Wdsworth Publishing co. California usa.
- **Taiz I and Zeiger E 1998** Plant Physiology II Edition. Sinauer Associates Inc. Publisher MS.
- **Dennis DT and Terpin DH Lefevre DD and Layzell DV 1997** Plant Metabolism II Ed. Longman England.
- **Buchanan, B.B. Gruissem, W. and Jones R.L. 2000.** Biochemistry and Molecular Biology of plants. American Society of Plant Physiologists, Maryland USA.

Department of Higher Education, Govt. of M.P.
Post Graduate Semester wise Syllabus
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उच्च शिक्षा विभाग, म.प्र. शासन
स्नातकोत्तर कक्षाओं के लिये सेमेस्टर अनुसार पाठ्यक्रम
केंद्रीय अध्ययन मण्डल द्वारा अनुशासित तथा म. प्र. के राज्यपाल द्वारा अनुमोदित

Class / कक्षा	: M.Sc.
Semester / सेमेस्टर	: III semester
Subject / विषय	: Botany
Title of Subject Group	: Genetics & Cytogenetics
विषय समूह का शीर्षक	:
Paper No. / प्रश्नपत्र क्रमांक	: MBOT0303-T
Compulsory / अनिवार्य या Optional / वैकल्पिक अनिवार्य	: Compulsory

Particulars / विवरण

Unit-1	Genetics of prokaryotes and eukaryotes; genetic recombination in prokaryotes, genetic transformation, conjugation and transduction in bacteria. Genetics of mitochondria and chloroplasts; cytoplasmic male sterility.
Unit-2	Genetic recombination and genetic mapping in eukaryotes; Recombination, independent assortment and crossing-over, molecular mechanism of recombination. Chromosome mapping, linkage groups, genetic markers, construction of molecular maps, somatic cell genetics- an alternative approach to gene mapping.
Unit-3	Mutations: spontaneous and induced mutations, physical and chemical mutagens, molecular basis of gene mutations. Transposable elements in prokaryotes and eukaryotes. Mutations induced by transposons, DNA damage and repair mechanisms.
Unit-4	Cytogenetics of numerical and structural changes of chromosomes. Euploidy, aneuploidy: origin, meiosis and effect. Cytogenetics of deficiencies., duplication, inversions and translocation.
Unit-5	Molecular Cytogenetics; Nuclear DNA content, c-value paradox, <i>cot</i> curve and its significance, restriction mapping – concept and techniques, multigene families and their evolution. Transfer of whole genome, examples from wheat and <i>Brassica</i> , <i>Arachis</i> .

Suggested Laboratory Exercise based on P.G 303 :

1. Isolation of DNA & preparation of 'Cot' curve
2. Demonstration of SEM & TEM.
3. Isolation of Mitochondria and its marker enzyme, succinate dehydrogenase (SDH)
4. Demonstration of Mitosis/ Meiosis (Normal & abnormal)

5. To determine Miotic Index in onion root tips cells
6. Demonstration of special chromosomes.
7. Preparation of KARYO TYPE & IDIOGRAM.
8. Experiments on mutation.
9. Demonstration of aneuploidy, polyploidy etc.

Other experiments based on theory paper.

Suggested Readings:

- **Atherly, AG. Girton, J.R** and Mc Donald, J.E. 1999. The Science of Genetics: SaPosts College Publishing, Fort Worth, U.S.A.
- **Burnham, C.R 1962.** Discussions in Cytogenetics, Burgess Publishing Co. Minnesota.
- **Busch. H. and Rothblum. L. 1982.** Volume X. The Cell Nucleus rDNA Part A. Academic Press.
- **Hartl, D.L. and Jones, E. W. 1998.** Genetics: Principles and Analysis (4th edition). Jones & Bartlett Publishers, Massachusetts, USA
- **Hartl, D.L. and Jones, E. W. 2006.** Genetics: Principles and Analysis (5th edition). Jones & Bartlett Publishers, Massachusetts, USA
- **Khush, G.S. 1973.** Cytogenetics of Aneuploids. Academic Press, New York, London.
- **Lewin: B. 2000** Gene VII. Oxford University Press, New York, U.S.A
- **Lewis, R. 1997.** Human Genetics: Concepts and Applications. (2nd edition). WCB McGraw Hill, U.S.A
- **Russel, P.J. 1998.** Genetics (5th edition). The Benjamin / Cummings Publishing Company Inc., U. S. A
- **Snusted, D. P. and Simmons, M. J. 2000.** Principles of Genetics (2nd edition). Jhon Wiley & Sons Inc., U.S.A
- **Snusted, D. P. and Simmons, M. J. 2006.** Principles of Genetics (3rd edition). Jhon Wiley & Sons Inc., U.S.A
- **Lewin, B. 2006,** Genes VII, Oxford University Press, New York.

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स्नातकोत्तर कक्षाओं के लिये सेमेस्टर अनुसार पाठ्यक्रम
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Class / कक्षा	: M.Sc.
Semester / सेमेस्टर	: III semester
Subject / विषय	: Botany
Title of Subject Group	: Molecular Biology
विषय समूह का शीर्षक	:
Paper No. / प्रश्नपत्र क्रमांक	: MBOT0304-T
Compulsory / अनिवार्य या Optional / वैकल्पिक अनिवार्य :	Compulsory

Particulars / विवरण

Unit-1	DNA structure; A, B and Z forms; transcription; plant promoters and transcription factors; splicing; messenger RNA transport; ribosomal RNA biosynthesis.
Unit-2	Gene structure and expression; genetic fine structure; cis-trans test; fine structure analysis of eukaryotes; introns and their significance; RNA splicing; regulation of gene expression in prokaryotes and eukaryotes.
Unit-3	Ribosomes: structure and site of protein synthesis; mechanism of translation, initiation, elongation and termination; structure and role of transfer RNA; protein sorting; targeting of proteins to organelles.
Unit-4	Cell cycle and apoptosis, control mechanisms; role of cyclins and cyclin dependent kinases; cytokinesis and cell plate formation; mechanism of programmed cell death. DNA replication in prokaryotes and eukaryotes.
Unit-5	Immunotechniques, In situ hybridization – concepts and techniques, physical mapping of genes on chromosomes. In situ hybridization to locate transcript in cell types; FISH; Flow cytometry.

Suggested Laboratory based on PG 304:

1. Isolation of genomic DNA from plant tissue using CTAB (cetyetri methyl ammonium bromide) or any animal tissue.
2. Isolation of DNA & its quantitation by a spectrophotometric method.
3. Restriction digestion of plant DNA, its separation by Agrose gel electrophoresis and visualization by ethidium bromide staining.
4. Isolation of RNA and quantitation by a spectrophotometric method.
5. Separation of RNA by Agrose gel electrophoresis and visualization by Et. Br. staining.
6. Immunological techniques : Ouchterlony method, ELISA & western blotting.
7. Isolation of chloroplasts and SDS-PAGE. profile of proteins to demarcate the two subunits of Rubisco.

Other experiments based on theory paper.

Suggested Readings:

- **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. U. S. A.
- **Karp, G. 1999** Cells and Molecular Biology: Concepts and Experiments John Wiley & Sons, Inc. U. S.A
- **Malacinski, G. M. and Freifelder, D. 1998.** Essentials of Molecular Biology (3rd edition). Jones and Barlett Publishers, Inc. London.
- **Wolfe, S.L. 1993.** Molecular and Cellular Biology, Wadsworth Publishing Co., California, USA.
- **Alberts, B., Bray, D., Lewis, J., Raff, M., Roberts, K., and Watson, J.D. 1999.** Molecular Biology of the Cell. Garland Publishing: Inc., New York.
- **Rost, T. et al. 1998.** Plant Biology, Wadsworth Publishing Co., California, U.S.A
- **Krishanmurthy K. V. 2000** Methods in Cell Wall Cytochemistry, CRC Press, Boca Raton, Florida U.S.A
- **Buchanan, B.B. Gruissem, W. and Jones, R.L. 2000.** Biochemistry And Molecular Biology of Plants. American Society of Plant Physiologists, Maryland, USA
- **De, D.N. 2000** Plant Cell Vacuoles: An Introduction. CSIRO Publication, Collingwood, Australia.
- **Kleinsmith, L.J. and Kish, V.M. 1995.** Principles of Cell and Molecular Biology (2nd Edition). Harper Collins College Publishers, New York, USA
- **Lodish H. Bert, A., zipursky, S.L., Matsudaira, p., Baltimore, D. and Darnell, J. 2000.** Molecular Cell Biology, W.H. Freeman and Co., New York, U.S.A
- **Pollard, T. S. and EaJ-nshaw, W. C. 2002** Cell Biology. Sa Posts, Philadelphia, U.S.A
- **Twyman, R. M. 2003.** Advanced Molecular Biology. Viva Books Private Ltd. New Delhi.

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Class / कक्षा	:	M.Sc.
Semester / सेमेस्टर	:	III semester
Subject / विषय	:	Botany Practical -I
Title of Subject Group	:	Plant Physiology, Plant Biochemistry and Metabolism
विषय समूह का शीर्षक	:	
Paper No. / प्रश्नपत्र क्रमांक	:	MBOT0305-P
Compulsory / अनिवार्य या Optional / वैकल्पिक :		

Botany Practical-I Scheme (Practical based on PG 301 & 302)

Time : 4 hrs

Exercises

1. Exercise based on Major Physiology 10
2. Exercise based on Minor Physiology 05
3. Exercise based on Biochemistry..... 10
4. Spot 1 to 5 10
5. Viva-Voce 05
6. Sessionals and Record10

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Class / कक्षा : M.Sc.
Semester / सेमेस्टर : III semester
Subject / विषय : **Botany Practical -II**
Title of Subject Group : **Cytogenetics and Genetics, Molecular Biology**
विषय समूह का शीर्षक :
Paper No. / प्रश्नपत्र क्रमांक : **MBOT0306-P**
Compulsory / अनिवार्य या Optional / वैकल्पिक :

Botany Practical –II Scheme (Practical based on PG 303 & 304)

Time : 4 hrs

Exercises

1. Exercise based on Cytology 10
2. Exercise based on Genetics 05
3. Exercise based on Molecular Biology..... 10
4. Spot 1 to 510
5. Viva-Voce05
6. Sessionals and Record10

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Class / कक्षा	: M.Sc.
Semester / सेमेस्टर	: IV semester
Subject / विषय	: Botany
Title of Subject Group	: Plant Cell, Tissue & Organ Culture
विषय समूह का शीर्षक	:
Paper No. / प्रश्नपत्र क्रमांक	: MBOT0401-T
Compulsory / अनिवार्य या Optional / वैकल्पिक अनिवार्य	: Compulsory

Particulars / विवरण

Unit-1	Plant cell and tissue culture: general introduction, history, scope, concept of cellular differentiation and totipotency.
Unit-2	Techniques of tissue culture. Organ culture – meristem, anther and embryo. In vitro fertilization.
Unit-3	Organogenesis and adventive embryogenesis; fundamental aspects of morphogenesis, somatic embryogenesis and androgenesis. Mechanisms, techniques and utility.
Unit-4	Somatic hybridization, protoplast isolation, fusion and culture, hybrid selection and regeneration; possibilities and achievements and limitations of protoplast research.
Unit-5	Application of plant tissue culture; clonal propagation; artificial seeds; production of hybrids, somaclones and somaclonal variation; production of secondary metabolites/natural products; cryopreservation and germplasm storage.

Suggested Laboratory Exercise based on P.G 401 :

1. Sterilization techniques.
2. Preparation of culture medium.
3. Sterilization of medium.
4. To prepare tissue culture lab.
5. Sterilization of glassware.
6. Preparation of tissue culture medium.
7. Sterilization of Explants.
8. Study effect of plant growth hormones (PGR) on tissue culture.
9. To perform the techniques of micro propagation/ somatic embryogenesis /androgenesis.
10. To perform the techniques of organogenesis.

11. Study of applications of tissue culture.

Other experiments based on theory paper.

Suggested Reading

- **Butenko, R.G. 2000.** Plant Cell Culture. University Press of Pacific.
- **Collin, H.A. and Edwards, S. 1998.** Plant Cell Culture. Bios Scientific Publishers, Oxford, UK.
- **Dixon, R.A. (Ed.) 1987.** Plant Cell Culture: A Practical Approach. IRL Press, Oxford.
- **Gelvin, S.B. and Schilperoort, R.A. (Eds), 1994.** Plant Molecular Biology Manual, 2nd edition, Kluwer Academic Publishers, Dordrecht, The Netherlands.
- **George, E.F. 1993.** Plant Propagation by Tissue Culture. Part 1. The Technology, 2nd edition. Exegetics Ltd., Edington, UK.
- **George, E.F. 1993.** Plant Propagation by Tissue Culture. Part 2. In Practice, 2nd edition. Exegetics Ltd., Edington UK.
- **Glick, B.R. and Thompson, J.E. 1993.** Methods in Plant Molecular Biology and Biotechnology. GRC Press, Boca Raton, Florida.
- **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.
- **Brown T.A. 1999.** Genomes. John Wiley & sons, Singapore
- **Callow, J.A., Ford-Lloyd, B.V. and Newbury, H.J. 1997.** Biotechnology and Plant Genetics. Resources: Conservation and Use. CAB International, Oxon, U.K.
- **Jolles, O. and Jornvall, H. (eds.) 2000.** Proteomics in Functional Genomics. Birkhauser Verlag, Basel, Swizerland.
- **Primrose, S.B. 1995.** Principles of Genome Analysis. Blackwell Science Ltd. Oxford, UK.
- **Gupta P.K.,** Genetics, Rastogi Publication
- **De, Kalyan Kumar,** Plant tissue culture, New Central Book agencies, P. Ltd.
- **Rajdan,** Plant tissue culture
- **Lodish ,** Cell & Molecular Biology

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Class / कक्षा	: M.Sc.
Semester / सेमेस्टर	: IV semester
Subject / विषय	: Botany
Title of Subject Group	: Biotechnology & Genetic Engineering
विषय समूह का शीर्षक	:
Paper No. / प्रश्नपत्र क्रमांक	: MBOT0402-T
Compulsory / अनिवार्य या Optional / वैकल्पिक अनिवार्य	: Compulsory

Particulars / विवरण

Unit-1	Biotechnology; basic concepts, principles and scope. Intellectual Property Rights – possible ecological risks and ethical concerns.
Unit-2	Basic concepts of Recombinant DNA technology; gene cloning – principles and techniques; construction of genomic/ cDNA libraries; choice of vectors; DNA synthesis and sequencing, polymerase chain reaction. DNA fingerprinting
Unit-3	Genetic engineering of plants, aims, strategies for development of transgenics (with suitable examples); <i>Agrobacterium</i> – the natural genetic engineer; T-DNA and transposon mediated gene tagging; chloroplast transformation and its utility.
Unit-4	Microbial genetic manipulation; bacterial transformation; selection of recombinants and transformants; genetic improvements of industrial microbes and nitrogen fixers; fermentation technology.
Unit-5	Genomics and Proteomics; genetic and physical mapping of genes; molecular markers for introgression of useful traits; artificial chromosomes; high throughput sequencing; genome projects; bioinformatics; functional genomics; microarrays; protein profiling and its significance.

SUGGESTED LABORATORY EXERCISE BASED ON P.G 402 :

1. To prepare biotechnology lab.
2. To demonstrate growth characteristics of E.coli using plating method.
3. To demonstrate growth characteristics of E.coli by turbidimetric method.
4. Demonstration of DNA sequencing by Sanger's dideoxy method.
5. Isolation of DNA and preparation of 'Cot' curve.

6. Isolation of DNA & its quantitation by a spectrophometric methods.
7. Isolation of genomic DNA from plant or animal tissue using CTAB (cetyltri methyl ammonium bromide) method.
8. Isolation of chloroplasts & SDS-PAGE. Profile of demarcate the two subunits of Rubisco.
9. To study the effect of antibiotics on growth of microorganism.
10. To study fermentation techniques.
11. Study of nitrogen fixer & its applications.
12. Demonstration of Gel electrophoresis
13. Demonstration of molecular markers

Other experiments based on theory paper.

Suggested Reading

1. **Butenko, R.G. 2000.** Plant Cell Culture. University Press of Pacific.
2. Collin, H.A. and Edwards, S. 1998. Plant Cell Culture. Bios Scientific Publishers, Oxford, UK.
3. **Dixon, R.A. (Ed.) 1987.** Plant Cell Culture: A Practical Approach. IRL Press, Oxford.
4. **Gelvin, S.B. and Schilperoort, R.A. (Eds), 1994.** Plant Molecular Biology Manual, 2nd edition, Kluwer Academic Publishers, Dordrecht, The Netherlands.
5. **George, E.F. 1993.** Plant Propagation by Tissue Culture. Part 1. The Technology, 2nd edition. Exegetics Ltd., Edington, UK.
6. **George, E.F. 1993.** Plant Propagation by Tissue Culture. Part 2. In Practice, 2nd edition. Exegetics Ltd., Edington UK.
7. **Glick, B.R. and Thompson, J.E. 1993.** Methods in Plant Molecular Biology and Biotechnology. GRC Press, Boca Raton, Florida.
8. **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.
9. **Brown T.A. 1999.** Genomes. John Wiley & sons, Singapore
10. **Callow, J.A., Ford-Lloyd, B.V. and Newbury, H.J. 1997.** Biotechnology and Plant Genetics. Resources: Conservation and Use. CAB International, Oxon, U.K.

11. **Jolles, O. and Jornvall, H. (eds.) 2000.** Proteomics in Functional Genomics. Birkhauser Verlag, Basel, Swizerland.
12. **Primrose, S.B.1995.** Principles of Genome Analysis. Blackwell Science Ltd. Oxford, UK.
13. **Gupta P.K.,** Genetics, Rastogi Publication
14. **De, Kalyan Kumar,** Plant tissue culture, New Central Book agencies, P. Ltd.
15. **Rajdan,** Plant tissue culture
16. **Loddish ,** Cell & Molecular Biology

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Class / कक्षा	: M.Sc.
Semester / सेमेस्टर	: IV semester
Subject / विषय	: Botany
Title of Subject Group	: Industrial Microbiology
विषय समूह का शीर्षक	:
Paper No. / प्रश्नपत्र क्रमांक	: MBOT0403-T
Compulsory / अनिवार्य या Optional / वैकल्पिक अनिवार्य	: Compulsory

Particulars / विवरण

Unit-1	Basic techniques in microbiology - Microscopy, staining techniques, Culture, Nutrition and growth of microorganisms. Replication and structure of viruses & other a cellular microorganisms, prokaryotic microorganisms, classification and diversity of Bacteria, Eukaryotic microorganisms.
Unit-2	Food Microbiology: Food spoilage, Food preservation methods, Microbiological production of food such as fermented products, alcoholic beverages, vinegar. Fermented vegetables. Single cell protein production in industry, fermented dairy products and uses.
Unit-3	Fermentation Industry: Selection of micro-organisms, Techniques and quality control, Production of antibiotics, steroids, Human proteins, Vaccines and vitamins. Survey of microorganisms of industrial uses. Production of organic acids, amino acids, Enzymes, Solvents and fuels.
Unit-4	Recovery of minerals by using microbes, Oil recovery, Biodeterioration, Mushroom culture, Biotech products including human insulin, Microbial Growth-Environmental influences, Physical control, Chemical control & Antibiotic controls.
Unit-5	Water quality in industry: Bacteriological safety of potable water, water quality analysis, importance of BOD. Biodegradation of wastes and pollutants, Primary, Secondary, and Tertiary Sewage treatments.

PRACTICALS: Laboratory exercises corresponding to theory courses covering all Units.

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Class / कक्षा	: M.Sc.
Semester / सेमेस्टर	: IV semester
Subject / विषय	: Botany
Title of Subject Group	: Pollution Ecology
विषय समूह का शीर्षक	:
Paper No. / प्रश्नपत्र क्रमांक	: MBOT0404-T
Compulsory / अनिवार्य या Optional / वैकल्पिक अनिवार्य	: Compulsory

Particulars / विवरण

Unit-1	<p>Pollution: Status and Concerns</p> <ul style="list-style-type: none"> • Classification of contaminants and pollutants. • Brief account of major environmental disasters of the past. • Indicator concept-biological indicators of pollution.
Unit-2	<p>Air pollution</p> <ul style="list-style-type: none"> • Sources and causes of air pollution. • Effects of air pollution on flora and fauna, materials and structures, soil atmosphere, water bodies and on human health. • Transport and dispersion of pollutants.
Unit-3	<p>Water Pollution</p> <ul style="list-style-type: none"> • Sources and causes of water pollution • Status of water pollution in India and M.P. • Water harvesting and recharging of water resources-concerns and remedies.
Unit-4	<p>Soil pollution and other pollution types</p> <ul style="list-style-type: none"> • Causes and sources of soil pollution. • Pesticidal and heavy metal pollution-sources, causes and effects • Nuclear, thermal and noise pollution-sources, causes and effects
Unit-5	<p>Pollution: Monitoring and Control</p> <ul style="list-style-type: none"> • Monitoring systems and analytical methods for air, water and soil pollution. • Control and abatement measures for air, water and soil pollution. • Brief account of legislation and environmental protection acts in India.

PRACTICALS: Laboratory exercises corresponding to theory courses covering all Units.

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केंद्रीय अध्ययन मण्डल द्वारा अनुशंसित तथा म. प्र. के राज्यपाल द्वारा अनुमोदित

Class / कक्षा	:	M.Sc.
Semester / सेमेस्टर	:	IV semester
Subject / विषय	:	Botany Practical Part I
Title of Subject Group	:	Plant Cell, Tissue and Organ Culture and Biotechnology and Genetic Engineering
विषय समूह का शीर्षक	:	
Paper No. / प्रश्नपत्र क्रमांक	:	Practical based on PG 401 & 402
Compulsory / अनिवार्य या Optional / वैकल्पिक	:	MBOT0405-P
Max. Marks अधिकतम अंक	:	50

Botany Practical-I Scheme (Practical based on PG 401 & 402)

Time : 4 hrs

Exercises

1. Exercise based on Tissue culture 05
2. Perform sterilization technique 05
3. Practical based on biotechnology.....10
4. Exercise based on Genetic Engineering 05
5. Spot 1 to 5 10
6. Viva-Voce 05
7. Sessionals and Record 10

Department of Higher Education, Govt. of M.P.
Post Graduate Semester wise Syllabus
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Class / कक्षा	: M.Sc.
Semester / सेमेस्टर	: IV
Subject / विषय	: Botany Practical Part II
Title of Subject Group	: Elective I and II (any two from the list)
विषय समूह का शीर्षक	:
Paper No. / प्रश्नपत्र कमांक	: Practical based on PG 403 & 404
Compulsory / अनिवार्य या Optional / वैकल्पिक अनिवार्य	: Compulsory
Max. Marks अधिकतम अंक	: 50

Botany Practical –II Scheme (Practical based on PG 403 & 404)

Time : 4 hrs

MBOT0406-P

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M. Sc. Botany (Semester System)

List of suggested Project work/Dissertation work

The following is the list of the proposed areas of dissertation/ project work. The concerned university and college may encourage the students to undertake project work in collaboration with industrial and research organizations.

1. Plant Biodiversity Assessment
2. Conservation of Endangered Species
3. Inventorization of Unexplored Areas and Hotspots
4. Pollution Monitoring
5. Survey of Less-known Economic Plants of India
6. Chromosome Analysis and Indexing of Indian Flora
7. Bioremediation of Xenobiotics
8. Exploitation of Secondary Metabolites
9. Extraction of Allelochemicals
10. Tissue Culture of Economic Plants
11. Assessment of Pollution Toxicity by Bioassay
12. Microbial proteins
13. Enzymes
14. Cosmetic Products from microbes and plants
15. Nutraceuticals from microbes and plants
16. Pharmaceutical Products
17. Ethnobotany
18. Chemotaxonomy
19. Cladistics
20. Protein Profiling
21. DNA Fingerprinting
22. Microarrays
23. FISH (Fluorescent In Situ Hybridization)
24. Mutation
25. Plant Hormones and Growth promoters
26. Bioinformatics
27. Application of PCR
28. Somatic Hybridization
29. Biofertilizers and Bioinoculants
30. Transgenics
31. Exploitation of Rhizospheric microbes including mycorrhizae
32. Recycling of domestic, municipal and industrial wastes
33. Vermicomposting and Biomethanation
34. Environmental Monitoring
35. Assessment of Pollution in different habitats

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M. Sc Botany **List of Journals for M.Sc Students**

1. Indian journal of Multidisciplinary Research-CMRA Kerala.
2. National journal of Life Science.
3. International Journal of Biotechnology.
4. Journal of Biotechnology
5. Pollution Research.
6. Science Reporter.
7. University New- UGC.
8. Acta Botanica.
9. Acta Ecologica.
10. Tropical Ecology.
11. Annual Review of Plant Physiology and Molecular Biology.
12. Current Advance in Plant Science.
13. Nature Review: Molecular and Cell Biology.
14. Indian journal of Biotechnology (NISCAIR New Delhi).