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.



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Faculty of Science

Syllabus & Prescribed Books

Subject-Botany

M.Sc. Semester Examination

2016-18

I to IV Semester

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5. Total Practical

COURSEWISE SCHEME IST SEMESTER

- 1. Course Code: MSCBOT2. Course Name:M.Sc. Botany
- 3. Total Theory Subject
- 4. Total Theory Marks : 200
- 6. Total Practical Marks: 1007. Total Marks: 300

:2

8. Minimum Passing Percentage : 36

Sub		Theory								Practical		Total		
Code	Subject Name	Paper				CCE		Total Marks						
		1st	2nd	3rd	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
Compulso	ry													
MSCBOT 101	Biology & Diversity of Viruses, Bacteria & Fungi	42	0	0	42	15	8	3	50	18	0	0	50	18
MSCBOT 102	Biology Diversity of Algae, Bryophytes & Pteridophytes	42	0	0	42	15	8	3	50	18	0	0	50	18
MSCBOT 103	Biology & Diversity of Gymnosperms	42	0	0	42	15	8	3	50	18	0	0	50	18
MSCBOT 104	Plant Ecology	42	0	0	42	15	8	3	50	18	0	0	50	18
MSCBOT 105	Practical-I (i) Biology & Diversity of Viruses, Bacteria & Fungi (ii) Plant Ecology	0	0	0	0	0	0	0	0	0	50	18	50	18
MSCBOT 106	Practical-II (i) Biology Diversity of Algae, Bryophytes & Peridophytes (ii) Biology & Diversity of Gymnosperms	0	0	0	0	0	0	0	0	0	50	18	50	18





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)

MSCBOT101: Biology & Diversity of Viruses, Bacteria and Fungi

- UNIT I:Viruses: characteristics and ultrastructurte of virions, isolation and purification of viruses; chemical nature, replication, transmission of viruses; economic importance.
- UNIT II:Archaebacteria 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; Mycorriza; fungi as biocontrol agents.

Suggested Readings

Alexopoulus, C.J. Mims, C. W. and Blackwel, M; 1996: Introductory coO' Mycology, Jbon Wjley & Sons Inc.

Clifton, A; 1958: Introduction to Bacteria, Mcgraw-Hills Book Co.New Delhi.

Madigan, M T. Martinko, J. M and Parker Jack; I 997: 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 Indja (4th edjtjon).PrentjceHaJI ofInilia Ltd. New Delbj.

Webster, J.; 1985: Introduction to Fungi Cambridge University Press. Dubey, R C. & Maheshwari, D. K.; 2005: A Text Book of Microbjology, S. Chand Publisher, New Delhi



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)

MSCBOT102: Biology & Diversity of Algae, Bryophytes and Pteridophytes

- UNIT I: Algae in diversified habitats; thallus organization; cell ultrastructure; reproduction; criteria for classification of algae, pigments, researve 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.
- UNITIII: Morphology, structure, reproduction and life history of bryophyta; distribution, classification, general accounts of marchantiales, jungermeniales, 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 LivelWorts 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 ot Ptenaopnyres.

Parihar N.S. 1996 Biology and Morphology of Pteridophytes, CentralBook Depot. Allahabad. Smith G. M.; Cryptogamic Botany Vol. II; T ata Mc Graw –Hill Publishing Co. Bombay -New Delhi

Arnold C. A; An Introduction to Paleobotany; Tau 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.



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)

First Semester MSCBOT103: 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 .



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)

First Semester MSCBOT104: 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 & sypatric speciation; ecads and ecotypes.
- UNITIII: 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 01 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. t::ambridge 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.

COURSEWISE SCHEME IInd SEMESTER

1. Course Code	: MSCBOT	5. Total Practical	:2
2. Course Name	:M.Sc. Botany	6. Total Practical Marks	: 100
3. Total Theory Subject	: 4	7. Total Marks	: 300
4. Total Theory Marks	: 200	8. Minimum Passing Percentage	: 36

Sub		Theory								Practical		Total		
Code	Subject Name	Paper				CC Total E Marks								
		1st	2nd	3rd	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
Compulso	ry													
MSCBOT 201	Plant Development U & Reproduction	42	0	0	42	15	8	3	50	18	0	0	50	18
MSCBOT 202	Morphology & Taxonomy of Angio Sperms	42	0	0	42	15	8	3	50	18	0	0	50	18
MSCBOT 203	Utilization and Conservation of Plant resources	42	0	0	42	15	8	3	50	18	0	0	50	18
MSCBOT 204	Cell Biology of Plants	42	0	0	42	15	8	3	50	18	0	0	50	18
MSCBOT 205	Practical-I (i) Plant Development & Reproduction (ii) Morphology & Taxonomy of Angio Sperms	0	0	0	0	0	0	0	0	0	50	18	50	18
MSCBOT 206	Practical-II (i) Utilization and Conservation of Plant resources (ii) Cell Biology of Plants	0	0	0	0	0	0	0	0	0	50	18	50	18



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)

Second Semester MSCBOT201: 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.
- UNITIII: Vegetative options and sexual reproduction; flower development; genetics of floral organ differentiation; homeotic mutants in *Arabidiopsis* and *Antirrhinum*; sex determination. Structrue of anthers, microsporogenesis, role of tapetum, pollen development and gene expression.
- UNIT IV: Male sterility; pollen germination, pollen tube greet and guidance. Pollen storage, pollen allergy and pollen embryos. Ovule development, megasporogenesis; organization of embryo sac; structure of embryo sac cells.
- UNIT V: Flora characterisitics; 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 dessication stages; embryogenesis; storage proteins of endosperms and embryo. Polyembryoni, 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, L1979. The Principles of Pollination Ecology .Pergamon Press,

Oxford.

Fahn, A 1 982.Plant Anatomy.(3rd edition).Pergamon Press,Oxford.

F osket, 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 P Jants. Springer-verlag.

Atwell,B.J.,Kriedermann,P.E.and Jurnbull,C.G.N.(eds)1999.Plants in Action: Adaptation in Naturre, Perfonnance in Cultivation, MacMillan Education,Sydney,Australia.



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)

Second Semester MSCBOT202: 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 Interantional code of Botanical Nomenclature.
- UNITIII: 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, Al.; 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. Radfor~ *AE.* Dickinson,

W.C. MasseyJ.R and. Ben. C.R: 1974: VQ~Ilar Plant SYstematics, Harper & Row, New York



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)

Second Semester MSCBOT203: 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.
- UNITIII: **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 Serdong, Selangor, Malaysia.

Paroda, R.S. and Arora, R.K. 1991. Plant Genetic Resources Conservation and

Management. IPGRI (Publication) S0uth Asia Office, C/o NBPGR, Pusa Campus, New Delhi. Pjmentel, 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 Scienece Academy B-63.

Pulcknett, D.L., Smith, N.J.H., Wiliam, J.T. and Murti Annishetty, N. 1987. Gene Banks and Worlds Food. Princeton University Press, Princeton, New Jersey, USA.



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

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.



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)

Second Semester MSCBOT204: 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.
- **UNITIII:** Cholorplast: structure, genome organization, gene expression, nucleochloroplastic interactions; mitochondira: structure, genome organization, biogenesis. Plant vacuoles: tonoplast membrane, ATPases, trasporters, 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 heterzygotes; 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 VIL Oxford University Press, New York.

Alberts, B., Bray, D., Lewis, J., Ratf, 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, RL. 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, ColliJ18W~ Austral.

COURSEWISE SCHEME IIIrd SEMESTER

1. Course Code	: MSCBOT	5. Total Practical	: 2
2. Course Name	:M.Sc. Botany	6. Total Practical Marks	: 100
3. Total Theory Subject	: 4	7. Total Marks	: 300
4. Total Theory Marks	: 200	8. Minimum Passing Percentage	: 36

Sub. code	Subject Name	Theory							Practical		Total			
				Paper	ſ		CCE Total							
							Marks							
		1 st	2^{nd}	3 rd	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
Compusior	y paper Theory													
MSCBOT	Plant Physiology	42	0	0	42	15	8	3	50	18	0	0	50	18
301														
MSCBOT	Plant Biochemistry &	42	0	0	42	15	8	3	50	18	0	0	50	18
302	Metabolism													
MSCBOT	Cytogenetics & Genetics	42	0	0	42	15	8	3	50	18	0	0	50	18
303														
MSCBOT	Molecular Biology	42	0	0	42	15	8	3	50	18	0	0	50	18
304														
MSCBOT	Practical I – based on Course	0	0	0	0	0	0	0	0	0	50	18	50	18
305	PG 301 & 302													
MSCBOT	Practical II – based on	0	0	0	0	0	0	0	0	0	50	18	50	18
306	Course PG 303 & 304													



Department of Higher Education, Govt. of M.P. Post Graduate Semester wise Syllabus as recommended by Central Board of Studies and approved by the Governor of M.P. उच्च शिक्षा विभाग, म.प्र. शासन स्नातकोत्तर कक्षाओं के लिये सेमेस्टर अनुसार पाठ्यकम 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 कमांक	: PG 301
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 :

- 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 permiability of cell membrane.
- 6. Study of physiological apperatus.
- 7. Bioassay of plant hormones- auxins, ethylene, GA, ABA and Cytokinin.
- 8. To determine stomata! index, stomatal frequency and percentage of leaf area open through stomata. Also, to study the effect of ABA on stamatal 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. Physiochemical 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 Pant Physiology II Edition. Sinauer Associates Inc. Publisher MS.
- Dennis DT and Terpin DH Lefevere 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.





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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 कमांक	: PG 302
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, C4-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 cauve 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-1 00 or SephadexG-200.
- 11. Determine effect of light intersity/wave length on rate of photosynthesis.
- 12. Extraction of chloroplast pigments from leaves and preparation of the absorption spectrium of chlorophylls and carotenoids.
- 13. To determine the chlorophyil a/chlorophyll b ratio in C3 and C4 plants
- 14. Isolation of inlact 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. Physiochemical 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 l and Zeiger E1998** Pant Pysiology II Edition. Sinauer Associates Inc. Publisher MS.
- **Dennis DT and Terpin DH Lefevere 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.



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Class / कक्षा	: M.Sc.
Semester / सेमेस्टर	: III semester
Subject / विषय	: Botany
Title of Subject Group	: Genetics & Cytogenetics
विषय समूह का शीर्षक	:
Paper No. / प्रश्नपत्र कमांक	: PG 303
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, 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 lips 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. Acedemic 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 (3nd edition). Jhon Wiley & Sons Inc., U.S.A
- Lewin, B. 2006, Genes VII, Oxford University Press, New York.



Department of Higher Education, Govt. of M.P. Post Graduate Semester wise Syllabus as recommended by Central Board of Studies and approved by the Governor of M.P. उच्च शिक्षा विभाग, म.प्र. शासन स्नातकोत्तर कक्षाओं के लिये सेमेस्टर अनुसार पाठ्यकम 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	: Molecular Biology
विषय समूह का शीर्षक	:
Paper No. / प्रश्नपत्र कमांक	: PG 304
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	Ribsosomes: 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 spectrophometric 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 chloroplats 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 (*3M* edition). Jones and Barlett Publishers, Inc. London.
- Wolfe, S.L. 1993. Molecular and Cellular Biology, WadsworthPublishing 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. 1 998. Plant Biology, Wadsworth Publishing Co., California, U.S.A
- Krishanmurthy K. V. 2000 Methods in Cell Wall Cytochemistry, CRCPress, Boca Raton, Florida U.S.A
- Buchanan, B.B. Gruissem, W. and Jones, RL. 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., NewYork, U.S.A
- Pollard, T. S. and EaJ-nshaw, W. C. 2002 Cell Biology. SaPosts, 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 कमांक	:	Practical based on PG 301 & 302
Compulsory / अनिवार्य या Optional / वै	कल्पिक :	

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 Record	10



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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 कमांक	: Practical based on PG 303 & 304
Compulsory / अनिवार्य या Optiona	l / 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
3.	Exercise based on Molecular Biology 10
4.	Spot 1 to 510
5.	Viva-Voce05
6.	Sessionals and Record10





COURSEWISE SCHEME

IVrd SEMESTER

1. Course Code	: MSCBOT	6. Total Practical Marks	: 100
2. Course Name	:M.Sc. Botany	7. Project Marks	: 50
3. Total Theory Subject	: 4	8. Total Marks	: 350
4. Total Theory Marks	: 200	9. Minimum Passing Percentage	: 36
5. Total Practical	: 2		

Sub. code	Subject Name	Theory					Practical		Total					
				Pape	r		CC	CE	Total	Marks				
		1 st	2^{nd}	3 rd	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
Compusiory	paper Theory													
MSCBOT	Plant Cell Tissue & Organ	42	0	0	42	15	8	3	50	18	0	0	50	18
401	Culture													
MSCBOT	Biotechnology & Genetic	42	0	0	42	15	8	3	50	18	0	0	50	18
402	Engineering													
MSCBOT	Industrial Microbiology	42	0	0	42	15	8	3	50	18	0	0	50	18
403														
MSCBOT	Pollution Ecology	42	0	0	42	15	8	3	50	18	0	0	50	18
404														
MSCBOT	Practical I – based on Course	42	0	0	42	15	8	3	50	18	0	0	50	18
405	PG 401 & 402													
MSCBOT	Practical II – based on	0	0	0	0	0	0	0	0	0	50	18	50	18
406	Course PG 403 & 404													
MSCBOT	Project Work	0	0	0	0	0	0	0	50	18	0	0	50	18
407														





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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 कमांक	: PG 401
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. Stertization of Explants.
- 8. Study effect of plant growth hormones (PGR) on tissue culture.
- 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. ARL 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.Exeg.etics 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
- Loddish, Cell & Molecular Biology





Department of Higher Education, Govt. of M.P. Post Graduate Semester wise Syllabus as recommended by Central Board of Studies and approved by the Governor of M.P. उच्च शिक्षा विभाग, म.प्र. शासन स्नातकोत्तर कक्षाओं के लिये सेमेस्टर अनुसार पाठ्यकम केंद्रीय अध्ययन मण्डल द्वारा अनुशसित तथा म. प्र. के राज्यपाल द्वारा अनुमोदित

Class / कक्षा	: M.Sc.
Semester / सेमेस्टर	: IV semester
Subject / विषय	: Botany
Title of Subject Group	: Biotechnology & Genefic Engineering
विषय समूह का शीर्षक	
Paper No. / प्रेश्नपत्र कमांक	: PG 402
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 turbidiometric 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.
- 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.
- 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.Exeg.etics Ltd., Edington, UK.
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Department of Higher Education, Govt. of M.P. Post Graduate Semester wise Syllabus as recommended by Central Board of Studies and approved by the Governor of M.P. उच्च शिक्षा विभाग, म.प्र. शासन स्नातकोत्तर कक्षाओं के लिये सेमेस्टर अनुसार पाठ्यकम केंद्रीय अध्ययन मण्डल द्वारा अनुशंसित तथा म. प्र. के राज्यपाल द्वारा अनुमोदित

Class / कक्षा	: M.Sc.
Semester / सेमेस्टर	: IV semester
Subject / विषय	: Botany
Title of Subject Group	: Industrial Microbiology
विषय समूह का शीर्षक	:
Paper No. / प्रश्नपत्र कमांक	: 403
Compulsory / अनिवार्य या Optional / वैकल्पिक अनिवार्य	: Compulsory

Particulars / विवरण

	Basic techniques in microbiology - Microscopy, staining techniques, Culture, Nutrition and growth of microorganisms. Replication and
Unit-1	structure of viruses & other a cellular microorganisms, prokaryotic
	microorganisms, classification and diversity of Bacteria, Eukaryotic microorganisms.
	Food Microbiology: Food spoilage, Food preservation methods,
Unit 2	Microbiological production of food such as fermented products, alcoholic
Unit-2	beverages, vinegar. Fermented vegetables. Single cell protein production in industry, fermented dairy products and uses.
	Fermentation Industry: Selection of micro-organisms, Techniques and
	quality control, Production of antibiotics, steroids, Human proteins,
Unit-3	Vaccines and vitamins.
	Survey of microorganisms of industrial uses. Production of organic acids, amino
	acids, Enzymes, Solvents and fuels.
	Recovery of minerals by using microbes, Oil recovery, Biodeterioration,
Unit-4	Mushroom culture, Biotech products including human insulin,
Chit-4	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.





Department of Higher Education, Govt. of M.P.

Post Graduate Semester wise Syllabus as recommended by Central Board of Studies and approved by the Governor of M.P. उच्च शिक्षा विभाग, म.प्र. शासन स्नातकोत्तर कक्षाओं के लिये सेमेस्टर अनुसार पाठ्यकम केंद्रीय अध्ययन मण्डल द्वारा अनुशंसित तथा म. प्र. के राज्यपाल द्वारा अनुमोदित

Class / कक्षा	: M.Sc.
Semester / सेमेस्टर	: IV semester
Subject / विषय	: Botany
Title of Subject Group	: Pollution Ecology
विषय समूह का शीर्षक	:
Paper No. / प्रश्नपत्र कमांक	: 404
Compulsory / अनिवार्य या Optional / वैकल्पिक अनिवार्य	: Compulsory

Particulars / विवरण

-	Pollution: Status and Concerns		
Unit-1	Classification of contaminants and pollutants.		
	• Brief account of major environmental disasters of the past.		
	 Indicator concept-biological indicators of pollution. 		
	Air pollution		
	Sources and causes of air pollution.		
Unit-2	• Effects of air pollution on flora and fauna, materials and structures, soil		
	atmosphere, water bodies and on human health.		
	• Transport and dispersion of pollutants.		
	Water Pollution		
11.4.2	Sources and causes of water pollution		
Unit-3	• Status of water pollution in India and M.P.		
	• Water harvesting and recharging of water resources-concerns and remedies.		
	Soil pollution and other pollution types		
TI-14 4	Causes and sources of soil pollution.		
Unit-4	Pesticidal and heavy metal pollution-sources, causes and effects		
	• Nuclear, thermal and noise pollution-sources, causes and effects		
Unit-5	Pollution: Monitoring and Control		
	 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.





Department of Higher Education, Govt. of M.P. Post Graduate Semester wise Syllabus as recommended by Central Board of Studies and approved by the Governor of M.P. उच्च शिक्षा विभाग, म.प्र. शासन स्नातकोत्तर कक्षाओं के लिये सेमेस्टर अनुसार पाठ्यकम 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 कमांक	:	Practical based on PG 401 & 402
Compulsory / अनिवार्य या Optional / वैकल्पिक	:	
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





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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
Peters Breeting H C. L. (D.)	

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

Time: 4 hrs





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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. Inventroization 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.

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- 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).