

UNIVERSITY OF KOTA

SEMESTER SCHEME

Academic year 2017-18



M.Sc. (Botany)

MBS Marg, Near Kabir Circle, KOTA (Rajasthan)-324 005

Syllabus of M.Sc. Botany

Semester-I

Paper I . Biology and Diversity of Lower Plant

II. Pteridophyta, Gymnosperm and Paleobotany

III. Plant Physiology

IV. Microbiology and Plant Pathology

V. Practical

Semester-II

Paper VI . Plant Ecology

VII. Plant Resource Utilization & Conservation

VIII. Cell and Molecular Biology

IX. Biochemistry

X. Practical

Semester-III

Paper X I. Plant Development and Reproduction

XII. Cytogenetics

XIII. Taxonomy of Angiosperms

XIV. Elective paper-(a) Adv. Plant Pathology / (b) Adv.Plant Ecology.

XV. Practical

Semester-IV

Paper XVI . Biotechnology and Biometrics

XVII. Plant Morphology and Anatomy

XVIII. Seed Biology and Plant Breeding

XIX. Elective paper-(a) Adv. Plant Pathology/(b) Adv. Plant Ecology

XX. Practical

M.Sc. Botany

Semester-II

Paper VI	Plant Ecology
Paper VII	Plant Resource Utilization and Conservation
Paper VIII	Cell and Molecular Biology
Paper IX	Biochemistry
Paper X	Practical

Paper VI- Plant Ecology

Duration of Examination: 3 Hours	Maximum Marks	: 100 Marks
	Semester Assessment	: 70 Marks
	Continuous (Internal) Assessment	: 30 Marks

Note: The syllabus is divided into five independent units and question paper will be divided into three sections.

- **Section-A** will carry 10 marks with 01 compulsory question comprising 10 short answer type questions (maximum 20 words answer) taking two questions from each unit. Each question shall be of one mark.
- **Section-B** will carry 25 marks with equally divided into five long answer type questions (answer about in 250 words). Paper setter shall be advised to set two questions from each unit and students are instructed to attempt five questions by selecting one question from each unit.
- **Section-C** will carry 35 marks with five long answer type questions comprising one compulsory question of 15 marks and four questions of 10 marks each. Students are instructed to attempt total three questions with one compulsory question (answer about in 500 words) and any two more questions (answer about in 400 words) out of remaining four questions. Paper setter shall be advised to design question paper covering from all five units.

Note: Contents of each unit may be completed into 15-18 lectures or contact hours which also include revisions, seminars, internal assessments, etc. Contact Hours will be 4 Hours per week for the faculty.

UNIT – I

Climate, soil and vegetation patterns of the world : Life zones, major biomes, and major vegetation and soil types of the world. Environment – Holistic environment, factors and their interactions, animals and man.

UNIT - II

Vegetation organization: Concepts of community and continuum, analysis of communities (analytical and synthetic characters), community coefficients, interspecific associations, ordination, concept of ecological niche.

Vegetation development: Temporal changes (cyclic and non-cyclic), mechanism of ecological succession (relay floristic and initial floristic composition, facilitation, tolerance and inhibition models), changes in ecosystem, properties during succession.

UNIT – III

Ecosystem organization: Structure and functions, primary production (methods of measurement, global pattern, controlling factors), energy dynamics (trophic organization, energy flow pathways, ecological efficiencies), litter fall and decomposition (mechanism, substrate quality and climatic factors), Concept of global biogeochemical cycles.

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

UNIT – IV

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

Climate change : Greenhouse gases (CO₂, CH₄, N₂O, CFCs : sources, trends and role), ozone layer and ozone hole, consequence of climate change (CO₂ utilization, global warming, sea level rise, UV radiation), carbon sequestration.

UNIT – V

Ecosystem stability : Concept (resistance and resilience), ecological perturbations (natural and anthropogenic) and their impact on plants and ecosystems, ecology of plant invasion, environmental impact assessment, ecosystem restoration.

Ecological management : Concepts, sustainable development, sustainability indicators, role of International Union for Conservation of Nature & Natural

Resources (IUCN), World Wide Fund for Nature (WWF), UNEP, UNESCO, IGBP etc.

Suggested Readings:

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

Suggested Laboratory Exercises :

1. To calculate mean, variance, standard deviation, standard error, coefficient of variation and to use t-test for comparing two means related to ecological data.
2. To prepare ombrothermic diagram for different sites on the basis of given data set and to comment on climate.
3. To find out the relationship between two ecological variables using correlation and regression analysis.

4. To determine minimum size and number of quadrats required for community study.
5. To find out association between important grassland species using chisquare test.
6. To compare protected and unprotected grassland stand using community coefficients (similarity indices).
7. To analyze plant communities using Bra-Curtis ordination method.
8. To determine diversity indices (Shannon – Wiener, concentration of dominance, species richness, equitability and biodiversity) for protected and unprotected grassland stands.
9. To estimate IVI of the species in a woodland using point centered quarter method.
- 10.To determine gross and net phytoplankton productivity by light and dark bottle method.
- 11.To determine soil moisture content, porosity and bulk density of soils collected from varying depths at different locations.
- 12.To determine the Water holding capacity of soils collected from different locations.
- 13.To determine percent organic carbon and organic matter in the soils of cropland, grassland and forest.
- 14.To estimate the dissolved oxygen content in eutrophic and oligotrophic water samples by azide modification of Wrinkler's method.
- 15.To estimate chlorophyll content in SO₂ fumigated and unfumigated plants leaves.
- 16.To estimate rate of carbon dioxide evolution from different soils using soda lime or alkali absorption method.
- 17.To study environmental impact of a given developmental activity using checklist as a EIA method.

Paper VII-Plant Resource Utilization and Conservation

Duration of Examination: 3 Hours	Maximum Marks : 100 Marks
	Semester Assessment : 70 Marks
	Continuous (Internal) Assessment : 30 Marks

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- **Section-C** will carry 35 marks with five long answer type questions comprising one compulsory question of 15 marks and four questions of 10 marks each. Students are instructed to attempt total three questions with one compulsory question (answer about in 500 words) and any two more questions (answer about in 400 words) out of remaining four questions. Paper setter shall be advised to design question paper covering from all five units.

Note: Contents of each unit may be completed into 15-18 lectures or contact hours which also include revisions, seminars, internal assessments, etc. Contact Hours will be 4 Hours per week for the faculty.

UNIT – I

Plant Diversity: Concept, status in India, utilization and concerns.

Sustainable Development: Basic Concepts, origin of agriculture.

World Centers of primary diversity of domesticated plants: The Indo-Burmese center, plant introduction and secondary centers.

UNIT – II

Origin, evolution, botany, cultivation and uses of (i) Food and fodder crops (ii) fiber crops (iii) medicinal and aromatic plants (iv) Vegetable oil yielding crops.

Important firewood and timber yielding plants and non wood forest products (NWFPs) such as bamboos, rattans, raw materials for paper making, gums, tannins, dyes, resins and fruits.

UNIT – III

Green revolution: Benefits and adverse consequences, innovations for meeting world food demands.

Plants used as avenue trees for shade, pollution control and aesthetics: Principles of conservation, environmental status of plants based on IUCN.

UNIT – IV

Strategies for conservation – in situ conservation: International efforts and Indian initiatives, protected areas in India – sanctuaries, national parks, biosphere reserves, wetlands, mangroves and coral reefs conservation of wild biodiversity.

UNIT – V

Strategies for conservation – ex situ conservation: Principles and practices, botanical gardens, field gene banks, seed banks, in vitro repositories, cryobanks, general account of the activities of Botanical Survey of India (BSI), National Bureau of Plant Genetic Resources [NBPGR], Indian Council of Agricultural Research (ICAR), Council of Scientific and Industrial Research (CSIR) and the Department of Biotechnology (DBT) for conservation.

1. Anonymous 1997. National Gene Bank : Indian Heritage on Plant Genetic Resources (Booklet). National Bureau of Plant Genetic Resources, New Delhi.
2. Arora, R.K. and Nayar, E.R. 1984. Wild Relatives of Crop Plants in India. NBPGR Science Monograph No.-7.
3. Baker, H.G. 1978. Plants and Civilization (3rd edn.) C.A. Wadsworth, Belmont.
4. Bole, P.V. and Vaghani, Y. 1986. Field Guide to Common Indian Trees. Oxford University Press, Mumbai.
5. Chandel, K.P.S., Shukla, G. and Sharma, N. 1996. Biodiversity in Medicinal and Aromatic Plants in India : Conservation and Utilization. National Bureau of Plant Genetic Resources, New Delhi.
6. Chrispeels, M.J. and Sadava, D. 1977. Plants, Food and People, W.H. Freeman and Co., San Francisco.
7. Cristi, B.R. (ed.) 1999. CRC Handbook of Plant Sciences and Agriculture. Vol. I. In-situ conservation. CRC Press, Boca Raton, Florida, USA.
8. Conway, G. 1999. The Doubly Green Revolution : Food for All in the 21st Century. Penguin Books.
9. Conway, G. and Barbier, E. 1990. After the Green Revolution. Earthscan Press, London.
10. Conway, G. and Barbier, E. 1994. Plant. Genes and Agriculture. Jones and Bartlett Publishers, Boston.
11. Council of Scientific and Industrial Research 1986. The Useful Plants of India. Publications and Information Directorate, CSIR, New Delhi.
12. Council of Scientific and Industrial Research (1948 - 1976). The Wealth of India. A Dictionary of Indian Raw Materials and Industrial Products. New Delhi. Raw Materials I-XII, Revised Vol. I-III (1985-1992) Supplement (200).
13. Cronquist, A. 1981. An Integrated System of Classification of Flowering Plants. Columbia University Press, New York, USA.

14. Directory of Indian Wetlands, 1993. WWF INDIA, New Delhi and AWB, Kuala Lumpur.
15. Falk, D.A., Olwel, M. and Millan C. 1996. Restoring Diversity, Island Press. Columbia, USA.
16. FAO/IBPGR 1989. Technical Guidelines for the Safe Movement of Germplasm. FAO/IBPGR, Rome.
17. Frankel, O.H., Brown, A.H.D. and Burdon, J.J. 1995. The Conservation of Plant Diversity. Cambridge University Press, Cambridge, U.K.
18. Gadgil, M. and Guha, R. 1996. Ecology and Equity : Use and Abuse of Nature in Contemporary India. Penguin, New Delhi.
19. Gaston, K.J. (Ed.) Biodiversity : a Biology of Numbers and Differences. Blackwell Science Ltd., Oxford, U.K.
20. Heywood, V. (Ed). 1995 Global Biodiversity Assessment. United Nations Environment Programme. Cambridge University Press, Cambridge, U.K.
21. Heywood, V.H, and Wyse lackn, P.S. (Eds) 1991. Tropical Botanical Gardens. Their Role in Conservation and Development. Academic Press, San Diego.
22. Kocchar, S.L. 1998. Economic Botany of the Tropics, 2nd edition. Macmillian India Ltd., Deihi.
23. Kothari, A. 1997. Understanding Biodiversity : Life Sustainability and Equity. Orient Longman.
24. Kohli, R., Arya, K.S., Singh, P.H. and Dhillon, H.S. 1994. Tree Directory of Chandigarh. Lovdale Educational, New Delhi.
25. Nair, M.N.B. et. al. (Eds.) 1988. Sustainable Management of Nonwood Forest Products. Faculty of Forestry, University Putra Malaysia. 43004 PM Serdong. Selangor, Malaysia.
26. Paroda, R.S. and Arora, R.K. 1991. Plant Genetic Resources Conservation and Management. IPGRI (Pubiication) South Asia Office, C/o NBPGR. Pusa Campus, New Delhi.

27. Pimentel, D. and Hall, C.W. (Eds.) 1989. Food and Natural Resources, Academic Press, London, New York.
28. Pinstup-Anderson, P. et. al. 1999. World Food Prospects :Critical Issues for the Early 21st Century. International Food Policy Research Institute. Washington, D.C., USA.
29. Plant Wealth of India 1997. Special Issue of Proceedings Indian National Science Academy B-63.
30. Plucknett, D.L., Smith, N.J.H., William, J.T. and Murti Annishetty, N. 1987. Gene Banks and Worlds Food. Princeton Univrersity Press, Princeton, New Jersey, USA.
31. Rodgrs, N.A. and Panwar, H.S. 1988. Planning a Wildlife Protected Area Network in India. Vol. I. The Report. Wildlife Institute of India, Dehradun.
32. Sahni, K.C. 2000. The Book of Indian Trees. 2nd edition. Oxford University Press, Mumbai.
33. Schery, R.W. 1972. Plants for Man. 2nd ed. Englewood Cliffs, New Jersey. Prentice Hall.
34. Sharma, O.P. 1996. Hill's Economic Botany (Late Dr. A.F. Hill, adapted by O.P. Sharma). Tata McGraw Hill Co. Ltd., New Delhi.
35. Swaminathan, M.S. and Kocchar, S.L. (Eds.) 1989. Plants and Society. Macmillan Publication Ltd., London.
36. Thakur, R.S., Puri, H.S. and Husain, A. 1989. Major Medicinal Plants of India. Central Institute of Medicinal and Aromatic Plants, CSIR, Lucknow.
37. Thomas, P. 2000. Trees: Their National History. Cambridge University Press, Cambridge.
38. Wanger, H., Hikino, H. and Farnswarth, N. 1989. Economic and Medicinal Plant Research. Vols. 1-3. Academic Press, London.
39. 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.

Suggested Laboratory Exercises The Practical course is divided into three units :
(1) Laboratory work, (2) Field survey and (3) Scientific visits.

Laboratory Work

1. Food crops : Wheat, rice maize, chickpea (Bengal gram), potato, tapioca, sweet potato, sugarcane. morphology, anatomy, Microchemical tests for stored food materials.
2. Forge/fodder crops : Study of any five important crops of the locality (for example fodder sorghum, bajra, berseem, clove, guar bean, gram, *Ficus* sp.)
3. Plant fibers :
 - (a) Textile fibres : cotton, jute, linen, sunn hemp, *Cannabis*.
 - (b) Cordage fibres : coir
 - (c) Fibres for stuffing : silk cotton or kapok.

Morphology, anatomy, (microscopic) study of whole fibres using-appropriate staining procedures.

4. Medicinal and aromatic plants : Depending on the geographical location college/university select five medicinal and aromatic plants each from a garden crop field (or from the wild only if they are abundantly available).

Papaver somniferum, *Atropa belladonna*, *Catharanthus roseus*. *Adhatoda Zeylanica*, (syn *A. vasaca*) *Allum sativum*, *Rauwolfra serpentina*, *Withania somnifera*, *Phyllanthus amarus*, (*P. fraternus*), *Andrographis paniculata*, *Aloe barbadens*, *Mentha arvensis*. *Rosa* sp., *Pogostemon cablin*, *Origanum vulgare*, *Vetiveria zizanioides*. *Jasminum grandiflorum*, *Cymbopogon* sp., *Pandanus odoratissimus*.

Study of live or herbarium specimens or other visual materials, to become familiar with these resources.

5. Vegetable oils : Mustard, groundnut, soyabean, coconut, sunflower, castor, Morphology, microscopic structure of the oil-yielding tissues, tests for oil and iodine number.

6. Gums, resins, tannins, dyes : Perform simple tests for gums and resins. Prepare a water extract of vegetable tannins (*Acacia*, *Terminalia*, *mangroves*, *tea*, *Cassia spp.*, *Myrobalans*) and dyes (*Curcuma lonsa*, *Bixa orellana*, *Indigofera sp.*, *Butea monosperma*, *Lawsonia inermis*) and perform tests to understand their chemical nature.

Field Survey

7. Firewood and timber yielding plants and NWF's :

- a. Prepare a short of 10 most important sources of firewood and timber in your locality. Give their local names, scientific names, and families to which they belong. Mention, their properties.
- b. Prepare an inventory of the bamboos and rattans of your area giving their scientific and local names and their various uses with appropriate illustrations.
- c. A survey of a part of the town or city should be carried out by the entire class, In batches, Individual students will select one avenue/road and locate the trees planted on a graph paper. They will identify the trees, mention their size, canopy shape, blossoming and fruiting period and their status (healthy, diseased, infested, mutilated, misused or dying) and report whether or not the conditions in which they are surviving are satisfactory. The individual reports will be combined to prepare a larger map of the area, which can be used for subsequent monitoring either by the next batch of students/teachers/local communities/NGOs/or civic authorities. The purpose of exercise in item C above is to make the students aware of the kinds of trees and value in urban ecosystems and ecological services.

Scientific Visits*

The students should be taken to one of the following :

- i. A protected area (biosphere reserve, national park, or a sanctuary)
- ii. A wetland
- iii. A mangrove
- iv. National Bureau of Plant Genetic Resources, New Delhi-110012 or one of its field stations.
- v. Head Quarters of the Botanical Survey of India or one of its Regional Circles.
- vi. A CSIR Laboratory doing research on plants and their utilization.
- vii. An ICAR Research Institute or a field station dealing with one major crop or crops.
- viii. A recognised botanical garden or a museum (such as those at the Forest Research Institute, Dehradun, National Botanical Institute, Lucknow, Tropical Botanical Garden and Research Institute, Trivendram), which has collection of plant products.

Note : The students are expected to prepare a brief illustrated narrative of the field survey and scientific visits. After evaluation, the grades awarded to the students by the teachers should be added to the field assessment of the practical examination.

Paper VIII-Cell and Molecular Biology of Plants

Duration of Examination: 3 Hours	Maximum Marks	: 100 Marks
	Semester Assessment	: 70 Marks
	Continuous (Internal) Assessment	: 30 Marks

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- **Section-C** will carry 35 marks with five long answer type questions comprising one compulsory question of 15 marks and four questions of 10 marks each. Students are instructed to attempt total three questions with one compulsory question (answer about in 500 words) and any two more questions (answer about in 400 words) out of remaining four questions. Paper setter shall be advised to design question paper covering from all five units.

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Unit-I

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

Cell wall : Structure and functions, biogenesis, growth.

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

Plasmodesmata : Structure, role in movement of molecules.

Unit-II

Chloroplast : Structure, genome organization, gene expression, RNA editing, nucleochloroplastic interactions.

Mitochondria : Structure, genome organisation, biogenesis.

Plant vacuole : Tonoplast membrane, ATPase, transporters as storage organelle.

Nucleus : Structure, nuclear pores, nucleosome organization, DNA structure- A, B and Z forms, DNA replication, damage and repair, transcription, plant promoters and transcription factors, mRNA transport nucleolus, rRNA biosynthesis.

Unit-III

Restriction enzymes : Cleavage of DNA into specific fragments, construction of a restriction map from the fragments, restriction sites as genetic markers, RFLP and their use in plant breeding.

Ribosomes : Structure, Protein synthesis, mechanism of translation, initiation, elongation and termination, structure and role of tRNA.

Unit-IV

Protein sorting : Targeting of proteins to organelles.

Cell shape and motility : The cytoskeleton, organization and role of microtubules and microfilaments, motor movements, implications in flagellar and other movements.

Cell cycle and apoptosis: Control mechanisms, role of cyclins and cyclin-dependent kinases, retinoblastoma and E2F proteins. Cytokinesis and cell plate formation, mechanisms of programmed cell.

Unit-V

Other Cellular organelles : Structure and functions of microbodies, Golgi apparatus, Lysosomes, Endoplasmic Reticulum:

Techniques in cell biology : Immunotechniques, in situ hybridization to locate transcripts in cell types, (FISH, GISH), confocal microscopy.

Suggested Readings :

1. Lewis, B. 2000 Genes VII. Oxford University Press, New York.
2. Alberts, B., Bray, D. Lewis, J., Raff, M., Roberts, K and Watson, J., 1999. Molecular Biology of the Cell. Garland Publishing, Inc., New York.

3. Wolfe, S.L. 1993. Molecular and Cellular Biology. Wadsworth Publishing USA.
4. Rost, T, etal. 1998. Plant Biology. Wadsworth Publishing Co., California USA.
5. Krishnamurthy, K.V. 2000. Methods in Cell Wall Cytochemistry. CRC Press, Boca Raton, Florida.
6. Buchanan, B.B., Gruissem, W., and Jones, R.L. 2000. Biochemistry and Molecular Biology of Plants, American Society of Plant Physiologists. Maryland, USA.
7. De, D.N. : 2000. Plant Cell Vacuoles : An Introduction. CSIRO Publication Collingwood, Australia.
8. Kleinsmith, L.J. and Kish, V.M. 1995. Principles of Cell and Molecular Biology (2nd Edition). Harper Collins College Publishers, New York USA.
9. Lodish, H., Berk, A. Zipursky, S.L. Matsudaira, P., Baltimore D. and Darnell, J. 2000. Molecular Cell Biology (4th Edition) W.H. Freeman and Co., New York, USA.

See the following Review Journals

Annual Review of Plant Physiology and Molecular Biology.

Current Advances in Plant Sciences.

Trends in Plant Sciences.

Nature Reviews : Molecular and Cell Biology.

Suggested laboratory Exercises

1. Isolation of mitochondria and the activity of its marker enzyme succinate dehydrogenase (SDH).
2. Isolation of chloroplasts and SDS-PAGE profile, of proteins demarcate the two subunits of Rubisco.

3. Isolation of nuclei and identification of histones by SDS-PAGE.
4. Isolation of plant DNA and its quantitation by spectrophotometric method.
5. Isolation of DNA. And preparation of 'cot' curve.
6. Restriction digestion of plant DNA, its separation by agarose gel electrophoresis and visualization by ethidium bromide staining.
7. Isolation of RNA and quantitation by a spectrophotometric method.
8. Separation of plant RNA by agarose gel electrophoresis and visualization by EtBr staining.
9. Southern blot analysis using a gene specific probe.
10. Northern blot analysis using a gene specific probe.
11. Immunological techniques : Ouchterlony method, ELISA and western blotting.
12. Fluorescence staining with FDA for cell viability and cell wall staining with calcofluor.
13. Demonstration of SEM and TEM.

Note : Chemicals and kits for conducting some of the above molecular biology experiments are available in India, for example from M/s Bangalore Genei and Centre for Biotechnology (CSTR) Mall 'Road, Delhi.'

Suggested Reading (For laboratory exercises)

1. Glick, B.R. and Thompson, J.E. 1993, Methods in Plant Molecular, Biology and Biotechnology, CRC Press, Boca Raton, Florida.
2. Glover, D.M. and Hames, B.D. (Eds.), 1995. DNA Cloning 1: A Practical Approach, Core techniques. 2nd edition. PAS, IRL Press at Oxford University Press, Oxford.
3. Gunning, B.E.S. and Steer, M.W. 1996. Plant Cell Biology : Structure and Function Jones and Bartlett Publishers, Boston, Massachusetts.

4. Hackett, P.B., Fuchs, J.A. and Messing, J.W. 1988. An Introduction to Recombinant DNA Techniques : Basic Experiments in Gene Manipulation. The Benjamin Cummings Publishing Co.Inc. Menlo Park, California.
5. Hall, J.E. and Moore, A.L. 1983. Isolation of Membranes and Organelles from Plant Cells. Academic Press, London, U.K.
6. Harris, N and Oparka, K.J. 1994, Plant Cell Biology : A Practical Approach, IRL Press, at Oxford University Press, Oxford, U.K.
7. Shaw C.H. (Ed.), 1988. Plant Molecular Biology : A Practical Approach IRL press, Oxford.

Paper IX-Biochemistry

Maximum Marks

: 100 Marks

Duration of Examination: 3 Hours

Semester Assessment	: 70 Marks
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Unit-I

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

Enzyme: Discovery and nomenclature, characteristics of enzyme, concept of holozymes, apozymes, coenzyme, ribozyme, abzyme and artificial enzyme, regulation of enzyme activity, mechanism of enzyme action and Michaelis-Menten equation.

Unit-II

Carbohydrates Metabolism: Classification, structure and function of monosaccharides, polysaccharides and glycoproteins including starch, cellulose and pectins.

Unit-III

Amino acids, Proteins and Nitrogen Metabolism: Nod factor, root nodulation, structure of amino acids, stereo-monomers, Amphoteric properties, synthesis of amino acids by reductive amination, GS-GOGAT system and transamination.

Unit-IV

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

Sulphur metabolism : sulphur uptake, transport and assimilation.

Unit-V

Biomoleculej: General structure, classification properties, distribution biosynthesis and function of primary metabolites (carbohydrates, proteins, amino acids, lipids) and secondary metabolites (flavonoids, alkaloids, steroids etc).

Suggested Reading :

- 1 Dennis, D.T. Turpin, D.H. Lefebvre, D.D. and Layzell, D. (Eds) 1997. Plant Metabolism (second edition). Longman sex, England.
- 2 Hooykaas, P.J.J., Hall M.A. and Libbenga, K.R. (eds) 1999. Biochemistry and Molecular Biology of Plant Hormones, Elsevier, Amsterdam, The Netherlands.
- 3 Westhoff, P. 1998 Molecular Plant Development from Gent to Plant, Oxford University Press, Oxford, U.K.

- 4 Taiz. L and Zeiger, E. 2006. Plant Physiology, 4th Edition, Sinauer Associates, Inc., Publishers, Massachusetts, USA.
- 5 Salisbury, F.B. and Ross, C.W. 1992. Plant Physiology. Asia Ltd. Singapore.
- 6 Devlin, R.M. and Witham, F.H. 1986. Plant Physiology, 4th Ed. CBS Pub. Delhi
- 7 Voet, D and Voet J.G. 1995. Plant Biochemistry, John Wiley, New York.
- 8 Lehninger, A.L. 1982. Principles of biochemistry, CBS Publication.

Suggested Laboratory Exercises :

1. Effect of time and enzyme concentration on the rate of reaction of enzyme (e.g. acid phosphatase nitrate reductase)
2. Determination of succinate dehydrogenase activity, its kinetics and sensitivity to inhibitors.
3. Principles of colorimetry, spectrophotometry and fluorimetry.
4. Estimation of Lipids
5. Separation of chlorophyll by paper chromatography.
6. Separation of amino acids by paper chromatography.
7. Separation of chlorophyll by liquid chromatography.
8. Test of phenols, alkaloids and terpenoids.
9. Isolation of VAM fungi.
10. Determination of amylase activity
11. Separation of aliphatic wax components by thin layer chromatography (TLC)
12. Isolation of root nodule bacteria from roots of legume plant.
13. Quantification of protein in given plant sample.
14. Quantification of carbohydrates in given sample.
15. The effect of temperature on enzyme activity.
16. The effect of pH on enzyme action.
17. To determine total soluble carbohydrates in given plant material.
18. To determine proline in given plant material.

M.Sc. (Botany)
2017-18
Semester-II
Skeleton Paper

Time: 6hrs

M. Marks 100

1. (a) Calculate the quantitative characters of the plant community by quadrat method in college campus. 10
- (b) To investigate the water content/air content/soil particles in given various samples. 5

OR

Investigate the pH/ chloride content/oxygen content in given water sample.

2. (a) Identify any materials from the given samples. Give economic importance with special reference to origin, cultivation, part used and processing, if any. 10
- (b) Mark the highest yield producing areas in the map (Rajasthan / India) provided to you. 5

OR

Mark the area of centre of origin of cultivated plants according to Vavilov.

3. (a) Perform the given cell biology exercise. 10
- (b) Perform the given molecular biology exercise. 5
4. Perform exercise of biochemistry in the given sample.
- (a) Estimation 10
- (b) Biochemical test 5
5. Spots (2X6)=12
6. Record 12
7. Sessional/Project/Seminar 8
8. Viva-Voce 8

