

UNIVERSITY OF KOTA

SEMESTER SCHEME

(w.e.f. 2017)



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 Plants

II. Pteridophyta, Gymnosperms and Paleobotany

III. Plant Physiology

IV. Microbiology and Plant Pathology

V. Practicals

Semester-II

Paper VI . Plant Ecology

VII. Plant Resource Utilization & Conservation

VIII. Cell and Molecular Biology

IX. Biochemistry

X. Practical

Semester-III

Paper XI. Plant Development and Reproduction

XII. Cytogenetics

XIII. Taxonomy of Angiosperms

XIV. Elective Paper-(a) Adv. Plant Pathology -I (b) Adv.Plant Ecology-I.
(Environment Biology)

XV. Practicals

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-II (b) Adv. Plant Ecology-II
(Arid Zone Ecology)

XX. Practicals

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

Paper I-Biology and Diversity of Lower Plants

	Maximum Marks	: 100 Marks
Duration of Examination: 3 Hours	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

Phycology: Algae in diversified habitats (terrestrial, fresh water, marine), thallus organization, cell ultrastructure, reproduction (vegetative, asexual, sexual), criteria for classification of algae: pigments, reserve food, flagella, modern classification.

Unit-II

Salient features of protochlorophyta, chlorophyta, charophyta, xanthophyta, Bacillariophyta, phaeophyta and Rhodophyta with special reference to *Microcystis*, *Hydrodictyon*, *Chara*, *Drapernaldiopsis*, *Sargassum*, *Dictyota*, *Batrachospermum*. Algal blooms, algal biofertilizers; algae as food, feed and use in industry.

Unit-III

Mycology: General characters of fungi, substrate relationship in fungi, cell ultrastructure, unicellular and multicellular organization, cell wall composition, nutrition (saprobic, biotrophic, symbiotic), heterothallism, heterokaryosis, parasexuality, recent trends in classification, phylogeny of fungi.

Unit-IV

General account of Mastigomycotina, Zygomycotina, Ascomycotina, Basidiomycotina, Deuteromycotina with special reference to *Pilobolus*, *Chaetomium*, *Morchella*, *Melampsora*, *Polyporus*, *Drechslera* and *Phoma*. Fungi in industry, medicine and as food, mycorrhizae, fungi as biocontrol agents.

Unit-V

Bryophyta: morphology, structure, reproduction and life history, distribution, classification, general account of Sphaerocarpales-*Sphaerocarpos*, Jungermanniales-*Porella*, Calobryales-*Calobryum*, Anthocerotales-*Notothylus*, Sphagnales-*Sphagnum*, Polytrichales-*Pogonatum*. Economic and ecological importance.

Suggested Reading

1. Alexopoulos, C.J., Mims. C.W. and Blackwel, M. 1996. Introductory Mycology, John Wiley & Sons Ind.
2. Mehrotra, R.S. and Aneja, R.S. 1998. An Introduction to Mycology, New Age Intermediate Press.
3. Morris, I.1986. An Introduction to the Algae. Cambridge University Press, U.K.
4. Parihar, N.S. 1991. Bryophyta. Central Book Depot, Allahabad.
5. Puri, P. 1980, Bryophytes. Atma Ram & Sons, Delhi.

6. Round, F.E. 1986. The Biology of Algae. Cambridge University Press, Cambridge.

Suggested Laboratory Exercises

Morphological study of representative members of algae, fungi and bryophytes:- *Microcystis*, *Aulosira*, *Oocystis*, *Pediastrum*, *Hydrodictyon*, *Ulva*, *Pithophora*, *Stigeoclonium*, *Draparnaldiopsis*, *Closterium*, *Cosmarium*, *Batrachospermum*, *Chara*, *Stemonitis*, *Peronospora*, *Albugo*, *Mucor*, *Pilobolus*, *Yeast*, *Emericella*, *Chaetomium*, *Pleospora*, *Morchella*, *Melampsora*, *Phallus*, *Polyporus*, *Drechslera*, *Phoma*, *Penicillium*, *Aspergillus*, *Colletotrichum*, *Plagiochasma*, *Asterella*, *Notothylium*, *Polytrichum*, *Shaerocarpos*, *Porella*, *Calobryum*, *Sphagnum*, *Pogonatum*.

Symptomology of some diseased specimens: White rust, downy mildew, powdery mildew, rusts, smuts, ergot, groundnut leaf spot, red rot of sugarcane, wilts, paddy blast, citrus canker, bacterial blight of paddy, angular leaf spot of cotton, tobacco mosaic, little leaf brinjal, sesame phyllody, mango malformation.

Study of morphology, anatomy and reproductive structures of bryophytes.

Identification of fungal cultures : *Rhizopus*, *Mucor*, *Aspergillus*, *Penicillium*, *Emericella*, *Chaetomium*, *Drechslera*, *Curvularia*, *Fusarium*, *Phoma*, *Colletotrichum*, *Graphium*

Paper II-Pteridophyta, Gymnosperm and Paleobotany

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

General characters and classification of pteridophyta, Stelar system, Telome theory, Heterospory and origin of seed habit. Introduction to Psilopsida, Lycopsida, Sphenopsida and Pteropsida.

Unit-II

Life history of *Psilotum*, *Lycopodium*, *Gleichenia*, *Isoetes*, *Botrychium* and *Pteris*.

Unit-III

General characters, classification and economic importance of Gymnosperm, Evolution of Gymnosperm, Distribution in India, Life History of *Ginkgo*, *Taxus* and *Gnetum*.

Unit-IV

General Characters and life history of *Lyginopteris*, *Medullosa*, *Caytonia*, *Glossopteris*, *Cycadeoidea*, *Pentoxylon*, and *Cordaite*.

Unit-V

General introduction of Paleobotany, fossilization, types of fossils, Techniques of fossil study, Geological time scale, General characters of fossil members of pteridophyta with special reference to *Horneophyton*, *Asteroxylon* and *Cladoxylon*. Paleobotany and evolution of vascular plants.

Suggested Reading;

1. Bhatnagar, S.P. and Moitra, A. 1996. Gymnosperm New Age International Pvt. Ltd., New Delhi.
2. Parihar, N.S. 1996. Biology and Morphology of Pteridophytes, Central Book Depot, Allahabad.
3. Singh, M. 1978, Embryology of Gymnosperms, Encyclopaedia of Plant Anatomy. X. Gebruder Borntraeger, Berlin.
4. Sporne, K.K. 1991. The morphology of pteridophytes. B.I. publishing Pvt. Ltd. Mumbai.
5. Stewart, W.N and Rathwell, G.W.1993. Paleobotany and the evolution of plants, Cambridge University press.
6. Sunderrajan, S.2007. Introduction to pteridophyta, New Age International Publishers, New Delhi.

Suggested Laboratory Exercises

Morphology and anatomy of vegetative and reproductive part of *Psilotum*, *Lycopodium*, *Selaginella*, *Equisetum*, *Gleichenia*, *Isoetes*, *Ophioglossum*, *Botrychium*, *Pteris*, *Cycas*, *Ginkgo*, *Cedrus*, *Abies*, *Picea*, *Cupressus*, *Araucaria*, *Cryptomeria*, *Taxodium*, *Pedocarpus*, *Agathis*, *Taxus*, *Ephedra* and *Gnetum* and the members in their natural habitat found in your locality.

Study of important fossil of Pteridophytes and Gymnosperms from specimens.

Paper III-Plant Physiology

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

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- **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

Water relation of plants:- Unique physicochemical properties of water, chemical potential, water potential, apparent free space, bulk movement of water. Soil plant atmosphere continuum (SPAC), stomatal regulation of transpiration, signal transduction in guard cell.

Membrane Transport:- Passive-non-mediated transport and Ernst equation, passive-mediated transport, ATP driven active transport, Uniport, Symport, Antiport, Ion channels.

Unit-II

Structure of proteins:- primary, secondary, tertiary, quaternary domain structure, reverse turn and Ramchandran plot. Protein ability: electrostatic forces, hydrogen bonding, disulfide bonding hydrophobic interaction.

Unit-III

Photosynthesis:- Photosynthetic pigments, absorption and transformation of radiant energy, photooxidation, four complexes of thylakoid membranes: photo system I, cytochrome-b-f complex, photosystem II and coupling factors, photolysis of water and C_4 evolution, noncyclic and cyclic transportation of electrons, water cycle, proton gradient and photophosphorylation, calvin cycle regulation of RUBISCO activity. Control of calvin cycle. C_4 pathway and its adaptive significance, CAM pathway, differences between C_3 and C_4 plants. Glycolate pathway and photorespiration chlororespiration and CO_2 concentrating mechanism in micro-organism.

Unit-IV

Respiration:- Anaerobic and aerobic respiration amphibolic nature of TCA cycles, pentose phosphate pathway, glyoxylate pathway, oxidative phosphorylation, gluconeogenesis, high energy compounds: their synthesis and utilization.

Unit-V

Plant growth regulators:- Auxins-chemical nature, bioassay, physiological effects and mode of action.

Gibberellins:- Chemical nature, bioassay, physiological effect and mode of action.

Cytokinins:- Chemical nature, bioassay, physiological effect and mode of action.

Absciscic acid: Chemical nature, bioassay, physiological effect and mode of action.

N_2 fixation, Abiological, Biological, mechanism of N_2 fixation.

Suggested Reading :

1. Bachanan, B.B. Gruissim, W. and Iones, R.L. 2000, Biochemistry and Molecular Biology of Plants. American Society Plant physiologists, Maryland, USA.
2. Dennis, D.T. Turpin, D.H. Lefebvre, D.D. and Layzell, D. (Eds) 1997. Plant Metabolism (second edition). Longman sex, England.
3. Galston, A.W. 1989. Life Processes in Plants. Scientific American, Springer-Verlag. New York, USA.
4. Hooykaas, P.J.J., Hall M.A. and Libbenga, K.R. (eds) 1999. Biochemistry and Molecular Biology of Plant Hormones, Elsevier, Amsterdam, The Netherlands.

5. Hopkins, W.G. 1995. Introduction to Plant Physiology. John Wiley & Sons, Inc., New York, USA.
6. Lodish, H., Berk, A., Zipursky, S.L., Matsudaira P., Baltimore, D. and Darnell, J. 2000. Molecular Cell Biology (fourth edition). W.M. Freeman and Company, New York USA.
7. Moore, T.C. 1989. Biochemistry and Physiology of Plant Hormones. (second edition). Springer-Verlag, New York, USA
8. Nobel, P.S. 1999. Physiochemical and Environmental Plant Physiology (second edition), Academic Press, San Diego, USA.
9. Salisbury, F.B. and Ross, C.W. 1992. Plant Physiology (4th edition). Wadsworth Publishing Co., California, USA.
10. Singhal, G.S. Renger, G., Sopory. S.K., Irrgang, K.D. and Govindjle 1999., Concepts in Photobiology : Photosynthesis and Photomorphogenesis. Narosa Publishing House, New Delhi.
11. Taiz. I., and Zeiger, E., 1998. Plant Physiology (2nd edition) Sinauer Associates, Inc., Publishers, Massachusetts, USA.
12. Thomas, B. and Vince-Preu, D. 1997 Photoperiodism in Plants (second edition). Academic Press, San Diego, USA.
13. Westhoff, P. 1998. Molecular Plant Development from Gene to Plant, Oxford University Press, Oxford, U.K.

Suggested Laboratory Exercises :

1. Effect of time and enzyme concentration on the rate of reaction of enzyme (e.g. acid phosphatase nitrate reductase).
2. Effect of substrate concentration on activity on any enzyme and determination of its K_m value.
3. Demonstration of the substrate inducibility of the enzyme nitrate reductase.
4. Extraction of chloroplast pigments from leaves and preparation of the absorption spectrum of chlorophylls and carotenoids.
5. To determine the chlorophyll a. chlorophyll b. ratio in C_3 and C_4 Plants.
6. Isolation of intact chloroplasts and estimation of chloroplast proteins by spot protein assay.
7. To demonstrate photophosphorylation in intact chloroplasts, resolve the phosphoproteins by SDS-PAGE and perform autoradiography.

8. Extraction of seed proteins depending upon the solubility.
9. Determination of succinate dehydrogenase activity, its kinetics and sensitivity to inhibitors.
10. Desalting of proteins by gel filtration chromatography employing Sephadex.
11. Preparation of the standard curve of protein (BSA) and estimation of the protein content in extracts of plant material by Lowry or Bradford's method.
12. Fractionation of proteins using gel filtration chromatography by Sephadex G100 or Sephadex. G200.
13. SDS-PAGE for soluble proteins extracted from the given plant materials and comparison of their profile by staining with Coomassie Brilliant Blue or silver nitrate.
14. Separation of isozymes of esterases, peroxidases by native polyacrylamide gel electrophoresis.
15. Radioisotope methodology, autoradiography, instrumentation (GM count and Scintillation counter) and principles involved.
16. Principles of colorimetry, spectrophotometry and fluorimetry.

Paper IV-Microbiology and Plant Pathology

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

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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

Important landmarks in the history of microbiology arch-aebacteria and eubacteria: General account, ultrastructure, nutrition and reproduction, biology and economic importance, cyanobacteria-salient features and biological importance.

Viruses: Classification, characteristics and ultrastructure of isolation and purification of viruses, chemical nature, replication, transmission of viruses, cyanophages, economic importance.

Phytoplasma : General characteristics and role in causing plant diseases.

Unit-II

General account of immunity, allergy, properties of antigens antibodies. Antibody structure and function, affinity and antibody specificity. Monoclonal antibodies

and their uses, antibody engineering, serology, types of vaccines. Preliminary account of Biofilms, biochips, biosensors and biosurfactants.

Unit-III

History and scope of plant pathology : General account of diseases caused by plant pathogens. Pathogen attack and defense mechanisms Physical, physiological, biochemical and molecular aspects.

Plant disease management : Chemical, biological, IPM systems, development of transgenics, biopesticides, plant disease clinics.

Unit-IV

Symptomology, identification and management of following plant diseases.

Fungal diseases : Wheat (Rust, Smut, Bunt), Bajra (Greenear, ergot and smut), crucifer (Rust).

Paddy (Paddy blast), Cotton (Wilt), Grapes (Downy mildew and powdery mildew).

Unit-V

Preliminary account of application of Biotechnology in plant pathology.

Bacterial disease : Wheat (Tundu), Soft rot of vegetables.

Viral disease : Tobacco mosaic, Bhindi yellow mosaic.

Phytoplasma disease : Little leaf of brinjal.

Nematode disease : Root-knot of vegetables.

Suggested Reading

1. Alexopoulos, C.J., Minis, C.W. and Blackwel, M. 1996 Introductory Mycology. John Wiley & Sons Inc.
2. Agrios, G.N. 1997. Plant Pathology. Academic Press, London.
3. Albajes, R., Cullino, M.L., Van Lenteren, J.C. and Elad, 2000 Integrated Pest and Disease Management in Greenhot Crops. Kluwer Academic Publishers.
4. Bridge, P. Moore, D.R. & Scott, P.R. 1998. Information Technology. Plant Pathology and Biodiversity. CAB International, U.K.
5. Clifton, A. 1958. Introduction to the Bacteria. McGraw Book Co., New York.
6. Mandahar, C.I. 1978. Introduction to plant viruses. Chan Co. Ltd. Delhi.

7. Mehrotra R.S. Plant Pathology. Tata McGraw Hill.
8. Rangaswamy, G. & Mahadevan, A. 1999. Diseases of crop plants in India (4th edition) Prentice Hall of India, Pvt. New Delhi. Horsfall, J.G. & A.L. Dimond. Plant Pathology Vols. 1, 2 & 3. Academic Press, New York, USA.
9. Trivedi, P.C. 1998. Nematode Diseases in Plants, CBS Publisher & Distributor, New Dehli.

Suggested Laboratory Exercises (Microbiology)

1. Calibration of microscope : determination of dimensions of micro-organisms (suggested model organisms : yeast, lactobacilli, cyanobacteria)
2. Cultivation media of autotrophic and heterotrophic micro-organisms (cleaning of glasswares, mineral media, complex media, solid media, sterilization)
3. Isolation of microorganisms, streaking on agar plates/pour plate method, isolation of clones, preservation
4. Determination of growth of a microorganism (model organism : *Escherichia coli*, effects of nutrients, e.g. glucose, fructose, sucrose, principle of colorimetry/spectrocolorimeter)
5. Determination of microbial population size (suggested model organism yeast, use of haemocytometer, serial dilution techniques, relationship between dilution and cell count, determination of standard error, reliability in cell counts)
6. Preparation of Winogradsky column using pond bottom mud. Observations on temporal sequence of appearance of microbes (visual appearance, microscopic, observations)
7. Observation on virus infected plants (symptoms)
8. Fermentation by yeast (inverted tube method, use of different substrates, e.g. glucose, fructose, cane sugar, starch)

M.Sc.-(Botany) 2017-18
Semester-I
Paper V- Practical
Skeleton Paper

Time : 6 hrs

Max. Marks: 100

Q1. Identify the material present in the mixture A, draw a labeled diagram and comment upon their Significant characteristics and systematic. **8**

Q2. Make a suitable preparation of material B so as to show vegetative or reproductive part of the given plant. **8**

Q3. Make a suitable preparation of vegetative and or reproductive part of material C, draw labeled sketches, write features of special interest and identify with reasons. **8**

Q4. Make a suitable preparation of vegetative and or reproductive part of material D, draw labeled sketches, write features of special interest and identify with reasons. **8**

Q.5. make a suitable preparation of vegetative/reproductive part of material 'E', draw labelled sketches, write feature of special interest. **8**

Q.6. Perform the Physiological, experiment, describe the methodology, record your observation and conclusions (i) Exercise A (major) (ii) Exercise B (minor).
8+4= 12

Q.7. Perform the microbiological exercise 'F'. **4**

Q8. Prepare a suitable preparation of material 'G'. **4**

Q9. Spots. **(2x6) = 12**

Q10. Record **12**

Q11. Sessional **8**

Q12. Viva-Voce **8**