

# **Mohanlal Sukhadia University**

## **Udaipur**

**Department of Botany**



**Syllabus and Scheme of Examination**  
**For**  
**M.Sc. CBCS Programme Botany**

**Effective from July, 2019**

**Department of Botany**  
**Mohanlal Sukhadia University**  
**CBCS Scheme of Syllabus for M.Sc. Botany**

Course code	Title of the Course	No. of credits	University exam	Internal assessment	Total
<b>SEMESTER I</b>					
M1BOT01-CT01	BIOLOGY AND DIVERSITY OF ALGAE AND BRYOPHYTES	4	80	20	100
M1BOT02-CT02	MICROBIOLOGY, MYCOLOGY AND PLANT PATHOLOGY	4	80	20	100
M1BOT03-CT03	CYTOGENETICS, GENETICS AND PLANT BREEDING	4	80	20	100
M1BOT04-CT04	PLANT ECOLOGY, CONSERVATION AND EVOLUTION	4	80	20	100
M1BOT05-CP01	PRACTICAL 1	4	80	20	100
M1BOT06-CP02	PRACTICAL 2	4	80	20	100
			480	120	600
<b>SEMESTER II</b>					
M2BOT01-CT05	PTERIDOPHYTES, GYMNOSPERMS AND PALAEOBOTANY	4	80	20	100
M2BOT02-CT06	PLANT DEVELOPMENTAL BIOLOGY AND RESOURCE UTILIZATION	4	80	20	100
M2BOT03-CT07	CELL AND MOLECULAR BIOLOGY	4	80	20	100
M2BOT04-CT08	PLANT GROWTH AND DEVELOPMENT	4	80	20	100
M2BOT05-CP03	PRACTICAL 3	4	80	20	100
M2BOT06-CP04	PRACTICAL 4	4	80	20	100
BOT-SP	SKILL COURSE ELECTIVE 1 (select any one from the list)	2	80	20	100
			560	140	700
<b>SEMESTER III</b>					
M3BOT01-CT09	PLANT BIOCHEMISTRY AND PHYSIOLOGY	4	80	20	100
M3BOT02-CT10	PLANT SYSTEMATICS	4	80	20	100
M3BOT03-ET01 (A/B/C/D)	DSE 1 (select any one group from the list 1)	4	80	20	100
M3BOT04-ET02 (A/B/C/D)	DSE 2 (select any one group from the list 2) or MINOR RESEARCH PROJECT	4	80	20	100

M3BOT05-CP05	PRACTICAL 5	4	80	20	100
M3BOT06-EP01	PRACTICAL 6	4	80	20	100
			480	120	600
<b>SEMESTER IV</b>					
M4BOT01-CT11	PLANT TISSUE CULTURE AND GENETIC ENGINEERING	4	80	20	100
M4BOT02-CT12	TOOLS AND TECHNIQUES IN PLANT SCIENCES	4	80	20	100
M4BOT03-ET03 (A/B/C/D)	DSE 3 (Second paper of group selected in III semester)	4	80	20	100
M4BOT04-ET04 (A/B/C/D)	DSE 4 (Second paper of group selected in III semester) or MINOR RESEARCH PROJECT	4	80	20	100
M4BOT05-CP06	PRACTICAL 7	4	80	20	100
M4BOT06-EP02	PRACTICAL 8	4	80	20	100
BOT-SP	SKILL COURSE ELECTIVE 2 (select any one from the list)	2	80	20	100
			560	140	700

## Core Courses

Course Code	Title of the Course
M1BOT01-CT01	BIOLOGY AND DIVERSITY OF ALGAE AND BRYOPHYTES
M1BOT02-CT02	MICROBIOLOGY, MYCOLOGY AND PLANT PATHOLOGY
M1BOT03-CT03	CYTOGENETICS, GENETICS AND PLANT BREEDING
M1BOT04-CT04	PLANT ECOLOGY, CONSERVATION AND EVOLUTION
M2BOT01-CT05	PTERIDOPHYTES, GYMNOSPERMS AND PALAEOBOTANY
M2BOT02-CT06	PLANT DEVELOPMENTAL BIOLOGY AND RESOURCE UTILIZATION
M2BOT03-CT07	CELL AND MOLECULAR BIOLOGY
M2BOT04-CT08	PLANT GROWTH AND DEVELOPMENT
M3BOT01-CT09	PLANT BIOCHEMISTRY AND PHYSIOLOGY
M3BOT02-CT10	PLANT SYSTEMATICS
M4BOT01-CT11	PLANT TISSUE CULTURE AND GENETIC ENGINEERING
M4BOT02-CT12	TOOLS AND TECHNIQUES IN PLANT SCIENCES
M1BOT05-CP01	PRACTICAL 1
M1BOT06-CP02	PRACTICAL 2
M2BOT05-CP03	PRACTICAL 3
M2BOT06-CP04	PRACTICAL 4
M3BOT05-CP05	PRACTICAL 5
M3BOT06-EP01	PRACTICAL 6
M4BOT05-CP06	PRACTICAL 7
M4BOT06-EP02	PRACTICAL 8

**List 1: Discipline Specific Electives:** Select any one group from following options:

DSE 1 and DSE 3 are linked together in a group		III Semester III Paper		IV Semester III Paper*
Group	Code	DSE1 - Paper	Code	DSE3 - Paper
<b>A</b>	M3BOT03-ET01-A	BIOSYSTEMATICS–I	M4BOT03-ET03-A	BIOSYSTEMATICS–II
<b>B</b>	M3BOT03-ET01-B	PRINCIPLES OF PATHOLOGY AND PLANT DISEASES	M4BOT03-ET03-B	MOLECULAR PLANT PATHOLOGY AND DISEASE MANAGEMENT
<b>C</b>	M3BOT03-ET01-C	BIOLOGY AND EVOLUTION IN BRYOPHYTES-I	M4BOT03-ET03-C	BIOLOGY AND EVOLUTION IN BRYOPHYTES-II
<b>D</b>	M3BOT03-ET01-D	RESTORATION ECOLOGY	M4BOT03-ET03-D	CONSERVATION BIOLOGY

**\*In fourth semester, group will be same as chosen in third semester, and second paper of that group will be allotted to students during fourth semester.**

**List 2: Discipline Specific Electives:** Select any one group from following options or Minor Research Project

DSE 2 and DSE 4 are linked together in a group	Code	III Semester IV Paper	Code	IV Semester IV Paper*
Group		DSE2 - Paper		DSE4 - Paper
<b>A</b>	M3BOT04-ET02-A	PLANT BIOENERGETICS AND APPLIED BIOCHEMISTRY	M4BOT04-ET04-A	SECONDARY METABOLITES AND BIOPROCESS ENGINEERING
<b>B</b>	M3BOT04-ET02-B	PRINCIPLES OF MICROBIAL TECHNOLOGY	M4BOT04-ET04-B	APPLICATIONS OF MICROBIAL TECHNOLOGY
<b>C</b>	M3BOT04-ET02-C	ADVANCED PHYCOLOGY	M4BOT04-ET04-C	APPLIED PHYCOLOGY
<b>D</b>	M3BOT04-ET02-D	APPLIED PLANT SCIENCES	M4BOT04-ET04-D	COMMERCIALIZATION OF MICROPROPAGATION TECHNOLOGIES

**Minor Research Project:**

SEMESTER - III	M3BOT02-ET02 (A/B/C/D)	<b>Minor Research Project:</b> Credit hours for minor research project and marking schemes is equivalent to other DSEs. Students have to submit a hardcopy of dissertation and give a presentation of minor research work for evaluation. Details of dissertation proforma and marking scheme is enclosed as Annexure I.
SEMESTER - IV	M4BOT04-ET04 (A/B/C/D)	<b>Same as above</b>

**Skill Course Elective 1 (select any one option)**

<b>Course Code</b>	<b>Title of the course</b>
M2-BOT-SP-01	ENGLISH COMMUNICATION
M2-BOT-SP-02	COLLECTION, PROCESSING, PRESERVATION & SALE OF PLANT MATERIALS
M2-BOT-SP-03	BIOFERTILIZERS
M2-BOT-SP-04	BIOINFORMATICS
M2-BOT-SP-05	FOREST ECOLOGY

**Skill Course Elective 2 (select any one option)**

<b>Course Code</b>	<b>Title of the course</b>
M4-BOT-SP-06	INTELLECTUAL PROPERTY RIGHT
M4-BOT-SP-07	NURSERY, GARDENING & GREEN HOUSE PRACTICES
M4-BOT-SP-08	ENVIRONMENTAL MONITORING, MANAGEMENT AND RESTORATION
M4-BOT-SP-09	SCIENTIFIC WRITING

# MOHANLAL SUKHADIA UNIVERSITY, UDAIPUR

## M. Sc. BOTANY SEMESTER –I

M1BOT01-CT01	BIOLOGY AND DIVERSITY OF ALGAE AND BRYOPHYTES
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### Unit-I Credit hours: 12

**Algae:** General account, thallus organisation, cell structure, reproduction, life cycle pattern, trends of classification. Systematic position of Blue Green Algae. Economic and evolutionary importance of algae.

### Unit-II Credit hours: 12

**Algae:** Salient features, interrelationships and comparative account of Chlorophyta, Charophyta, Xanthophyta and Bacillariophyta.

### Unit –III Credit hours: 12

**Algae:** Salient features, interrelationships and comparative account of Phaeophyta, Rhodophyta, Prochlorophyceae, Glaucophyceae, Eustigmatophyceae.

### Unit-IV Credit hours: 12

**Bryophytes:** General characters and classification. Origin, evolution of gametophyte and sporophyte. Economic, evolutionary and ecological importance of bryophytes.

### Unit-V Credit hours: 12

**Bryophytes:** Comparative study of structure, reproduction and life cycle and interrelationship with special reference to Sphaerocarpales, Marchantiales, Jungermanniales, Calobryales, Anthocerotales, Sphagnales, Bryales.

### Practicals:

1. Microscopic preparations and study of following algal materials:  
*Chlamydomonas, Volvox, Coleochaete, Hydrodictyon, Ulva, Cladophora, Pithophora, Oedogonium, Vaucheria, Chara, Ectocarpus, Sargassum, Batrachospermum, Polysiphonia*, Diatoms- Available genera.
2. Isolation and establishment of axenic algal culture
3. Study of external and internal morphology and microscopic preparations of following Bryophytes: *Marchantia, Plagiochasma, Astrella, Targionia, Pellia*,

- Porella, Anthoceros, Notothylus, Sphagnum, Funaria, Rhodobryum and Polytrichum.*
4. Local field trip

**Reference Books:**

1. Bold H. C and Wynne M.J (1975). Introduction to the Algae: Structure and Reproduction Prentice Hall Biological Science Series.
2. Chapman V.J and Chapman D.J (1973). The Algae. Macmillan and company, New York.
3. Fritsch F.E (1945). The Structure and Reproduction of the Algae Volume I and II, Cambridge University Press.
4. Kumar H.D. 1988. Introductory Phycology. Affiliated East-West Press Ltd., New Delhi.
5. Morris I. 1986. An Introduction to the Algae. Cambridge University Press, U.K.
6. Round F.E. 1986. The Biology of Algae. Cambridge University Press, Cambridge.
7. Vijayraghavan M.R and Bela Bhatia (1997), Brown Algae: Structure, Ultrastructure and Reproduction, APH publishing Corporations, New Delhi.
8. Vijayraghavan M.R and Bela Bhatia (1997), Red Algae: Structure, Ultrastructure and Reproduction, APH publishing Corporations, New Delhi.
9. Chandrakant, Pathak (2003). Bryophyta, Dominant Publishers and Distributors, New Delhi.
10. Parihar N.S. 1991. Bryophyta. Central Book Depot, Allahabad.
11. Puri P. 1980. Bryophytes. Atma Ram and Sons, Delhi.
12. Rashid A (1998). An introduction to Bryophyta. Vikas Publishing House Pvt. Ltd, New Delhi.



# MOHANLAL SUKHADIA UNIVERSITY, UDAIPUR

## M. Sc. BOTANY SEMESTER –I

M1BOT02-CT02	MICROBIOLOGY, MYCOLOGY AND PLANT PATHOLOGY
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### Unit –I Credit hours: 12

**Archaeobacteria and Eubacteria:** General characters, distribution, ultra-structure, nutrition, multiplication, biology, economic and evolutionary importance. Methods of genetic recombination and their significance. Isolation, culture and identification of bacteria.

### Unit –II Credit hours: 12

**Viruses:** Physical and chemical characteristics, ultra-structure, multiplication, isolation and purification and economic importance. Plant virus transmission.

**Mycoplasma, phytoplasma, L-forms, viroids, rickettsias, spiroplasma and prions:** A general account, economic and evolutionary importance.

### Unit –III Credit hours: 12

**Fungi:** General characters, life cycle patterns, ultra-structure, mycelial growth, cell composition, nutrition (necrotrophs, biotrophs and symbionts), methods of reproduction. Recent trends in classification and phylogenetic relationship among fungal groups.

**Fungal associations:** Mycorrhizae and Lichens; General account of morphology, reproduction, life cycle and significance.

### Unit –IV Credit hours: 12

**Fungi:** General account of morphology, reproduction, life cycle and economic importance of Mastigomycotina, Zygomycotina, Ascomycotina, Basidiomycotina and Fungi *imperfecti*. Economic importance of fungi. Heterothallism, Heterokaryosis and Parasexuality in fungi.

### Unit –V Credit hours: 12

**Plant disease management:** Symptoms of plant diseases. Control methods. Integrated pest management. Study of etiology and management of following important plant diseases; Downy mildew and Green ear of bajra, Blight of maize, Tikka disease of groundnut, Leaf blight of rice, Grassy shoots of sugarcane, Sandal spike, Rice tungro, Bunchy top of banana. Diseases and Pests of Ornamental Plants.

### **Practicals:**

1. Isolation culture and identification of bacteria from various sources.
2. Identification of cultured bacteria using Gram's stain.
3. Isolation culture and identification of blue green algae from various sources and study of heterocyst.
4. Study and identification of following fungal genera: *Synchytrium*, *Phytophthora*, *Peronospora*, *Mucor*, *Penicillium*, *Erysiphe*, *Claviceps*, *Agaricus*, *Puccinia*, *Uromyces*, *Melampsora*, *Sphacelotheca*.
5. Isolation and identification of mycorrhizae associated with various plant species.
6. Study of important plant diseases
7. Study of lichens/mycorrhiza
8. Local field trip

### **Reference books**

1. Alexopoulos, C. J., Mims, C. W. and Blackwel, M., Introductory Mycology, John Wiley & Sons Inc.
2. Mandahar, C. L. Introduction to Plant Viruses. Chand & Co. Ltd., Delhi.
3. Mehrotra, R. S. and Aneja, R. S. An Introduction to Mycology. New Age Intermediate Press.
4. Manual of Microbiology: Tools and Techniques; Kanika Sharma. Ane books. New Delhi. 2007
5. Textbook of Microbiology; Kanika Sharma. Ane books. New Delhi. 2011

# MOHANLAL SUKHADIA UNIVERSITY, UDAIPUR

## M. Sc. BOTANY SEMESTER –I

M1BOT03-CT03	CYTOGENETICS, GENETICS AND PLANT BREEDING
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### Unit-I Credit hours: 12

**Chromosomes:** Structure of chromatin and chromosomes, heterochromatin, euchromatin, Nucleosome structure, Karyotyping, DNA scaffolds and loops. Lampbrush and Polytene chromosomes, Supernumerary chromosomes, Structural and numerical alterations in chromosomes, C-value paradox, Cot curve and its significance, Unique and repetitive DNA, Gene families, transposable elements in eukaryotes and prokaryotes.

### Unit-II Credit hours: 12

**Mendelism and Neo-Mendelism:** Mendalian laws of inheritance, Modern concept of gene and alleles, Gene gene interactions, Multiple alleles and pleiotropy, pseudoalleles, complementation tests, lethal alleles, penetrance and expressivity.

### Unit-III Credit hours: 12

**Chromosomal basis of inheritance:** Sex determination; Sex linked, sex influenced and sex limited traits; Linkage and crossing over, Linkage analysis and linkage map.

**Extra chromosomal inheritance:** Extra-nuclear inheritance in *Neurospora*, *Chlamydomonas*, *Paramecium*, Yeast, *Drosophila* and Man, Mitochondrial genomes, Chloroplast genomes, Cytoplasmic male sterility. Somatic cell genetics.

### Unit-IV Credit hours: 12

**Pedigree:** Pedigree analysis, lod score for linkage testing, genetic disorders. Quantitative genetics: Polygenic inheritance.

**Mutations:** Spontaneous and induced mutations, physical and chemical mutagens. molecular basis of gene mutations,.

**Genetic recombination:** Recombination and genetic mapping, Homologous and non-homologous recombination, site-specific recombination. Physical mapping of genes,

### Unit-V Credit hours: 12

**Plant breeding;** Introduction and objectives. Methods of crop improvement, advantages and limitations; Hybridization, mass selection, pure line selection; inbreeding depression, heterosis. Green revolution.

**Molecular plant breeding:** Development of mapping population in plants, QTL mapping, Importance of molecular marker assisted breeding.

**Practicals:**

1. Meiotic irregularity in *Rhoeo discolor*.
2. Study of Salivary gland chromosome in *Chironomas*.
3. Emasculation, crossing and bagging in crop plants.
4. Problem of genetics.
5. Karyotype determination in onion.
6. Barr body analysis.
7. Pedigree analysis.
8. Genetic exercises and test of goodness of fit using Chi-square

**Reference Books:**

1. G. Karp, 2015. Cell and Molecular Biology, John Wiley & Sans, Inc.
2. EDP De Robertis, 1987. Cell and Molecular Biology, Zea and Febiger.
3. H. Lodish, A. Berk, P. Matsudaira, C.A. Kaiser etc., 2009. Molecular Cell Biology, Scientific American Books.
4. Khush G. S. Cytogenetics of aneuploides. Academic Press New York USA.
5. Burnham C. R. Discussions in Cytogenetics. Burgess Publishing Co. Minnesota.
6. Hartl D. L. and Jones E. W. Genetics: Principles and Analysis Jones and Barew Publishers Massachusetts USA.
7. Karp G. 2015. Cell and Molecular Biology : Concepts and Experiments, John Wiley and Sons Inc USA.
8. Fikui K. and Nakayama S. Plant chromosomes; Laboratory Methods CRC Press Boca Ration Florida.
9. Gupta P. K. Cytogenetics. Rastogi Publication Meerut.
10. Prasad G. Introduction to Cytogenetics. Kalyani Publishers, New Delhi.
11. Sinha U. and Sinha S. Cytogenetics, Plant Breeding and Evolution. Vikas Publishing house Pvt. Ltd. New Delhi
12. Sumner A.T. Chromosome and organization. Blackwell publishing
13. Swanson C. P., Merz T. and Young J. Cytogenetics. Prentice Hill of India Private Ltd. New Delhi.

**MOHANLAL SUKHADIA UNIVERSITY, UDAIPUR**  
**M. Sc. BOTANY SEMESTER –I**

M1BOT04-CT04	PLANT ECOLOGY, CONSERVATION AND EVOLUTION
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**Unit-I                      Credit hours: 12**

**Population:** Concept of Metapopulation, Properties of populations (birth rate, death rate, age pyramids, survivorship curves, logistic model, carrying capacity), r- and k-strategies, life history pattern, Concept of Population Genetics (Hardy–Weinberg principle), Concept of Niche and Habitat; types of niche, niche width and overlap, character displacement, Homeostasis.

**Unit-II                      Credit hours: 12**

**Community Ecology:** Biological and physical structure, Raunkiaer’s Life form, organismal and individualistic model of community, Edges and ecotones, Succession; Concept, models and mechanisms.

**Community interaction:** Intraspecific population regulation, interspecific competition models; Lotka-Volterra model, type of interactions.

**Unit-III                      Credit hours: 12**

**Ecosystem:** Ecosystem structure and function, Ecosystem stability; concept of resistance and resilience, Ecological energetic; energy flow through ecosystem. Global biogeochemical cycles of C, N, P and S.

**Pollution:** Global environmental changes; green house gases, O<sub>3</sub> depletion, eutrophication, International protocols and Acts related with environmental awareness and conservation, carbon foot print, carbon credits, carbon sequestration, Phytoremediation, Plant indicator, Sustainability and environmental monitoring (GIS).

**Unit-IV                      Credit hours: 12**

**Plant Biodiversity:** Concept of Biodiversity, types of biodiversity, measurement of biodiversity (Simpson and Shannon diversity index), IUCN categories of threat. Strategies for conservation – *In situ* (Concept of Hotspots, Sanctuaries, National parks, Biosphere reserves) and *Ex situ* (Seed bank, gene bank, botanical garden, in vitro etc.). Important conservation projects in India. International efforts and peoples participation for conservation. Important terms like Key stone species, Umbrella species, and flagship species, rivet popper hypothesis, species area curve.

**Phytogeography:** Major biomes of the world with special reference to desert and grassland; phytogeographical regions of India, Island biogeography theory.

**Unit-V                      Credit hours: 12**

**Evolution:** Origin of cells and unicellular evolution: Origin of basic biological molecules; abiotic synthesis of organic monomers and polymers; concept of Oparin and Haldane; experiment of Miller; the first cell: origin and evolution in prokaryotes and eukaryotes. Natural selection and Genetic Drift, concepts of neutral evolution. The Mechanisms of evolution, Speciation; allopatricity and sympatricity; convergent and divergent evolution, co-evolution.

**Practicals:**

1. Determination of minimum size of quadrat of the grassland ecosystem.
2. Determination of minimum number of quadrats required for grasslands.
3. Determination of frequency, density, abundance and cover
4. Determination of Important Value Index (IVI)
5. Measurement of biodiversity using diversity indices.
6. Determination of leaf area index
7. Analysis of soil texture, moisture content, pH and water holding capacity
8. Water analysis for Hardness, carbonate, bicarbonate and chloride.
9. Estimation of dissolved oxygen content in eutrophic and oligotrophic water samples by Winkler's method.
10. Local field trip

**Reference books:**

- Aery, N.C. 2010. Manual of Environmental Analysis, Ane Books Pvt. Ltd., New Delhi.
- Kormondy, E.J. 1996. Concepts of Ecology. PrenticeHall India Pvt.Ltd., New Delhi.
- Odum, E.P. 1983. Basic Ecology. Saunders, Philadelphia.
- Smith, R.L. and Smith T.M. 1998. Elements of Ecology. Benjamin/Cummings Publication.
- Townsend, C.R., Begon, M., Harper, J.L. 2007. Essentials of Ecology. Blackwell Publishing.
- Heywood, V. (ed) 1995. Global Biodiversity Assessment. United Nations Environment Programme. Cambridge University Press, Cambridge, U.K.

Katewa, S.S. & Jain Anita. Ethnobotany, Phytogeography, Plant Resources Utilization and conservation. Apex Publishing House, Jaipur. 2007.

Swaminathan, M.N. & Jain, R.S. Biodiversity: Implications for global security, Macmillan, India. 1982.