

MAULAN AZAD UNIVERSITY, JODHPUR

| CODE | DESCRIPTION | PDS/WEEK | | EXAM (HOURS) | CIA* | ESE | TOTAL |
|--------------|---|----------|-------|--------------|------|-----|-------------|
| | | Th. | Prac. | | | | |
| BSBO 111 | ALGAE, LICHENS AND BRYOPHYTES | 3 | | 3 | 20 | 80 | 100 |
| BSBO 112 | MYCOLOGY, MICROBIOLOGY AND PHYTOPATHOLOGY | 3 | | 3 | 20 | 80 | 100 |
| BSBO 121 | PRACTICAL | | 6 | 3 | 20 | 80 | 100 |
| BSBO 211 | PTERIDOPHYTES | 3 | | 3 | 20 | 80 | 100 |
| BSBO 212 | GYMNOSPERMS AND PALAEOBOTANY | 3 | | 3 | 20 | 80 | 100 |
| BSBO 221 | PRACTICAL | | 6 | 3 | 20 | 80 | 100 |
| BSBO 311 | ANATOMY OF ANGIOSPERMS, ECONOMIC BOTANY AND ETHNOBOTANY | 3 | | 3 | 20 | 80 | 100 |
| BSBO 312 | CELL AND MOLECULAR BIOLOGY | 3 | | 3 | 20 | 80 | 100 |
| BSBO 321 | PRACTICAL | | 6 | 3 | 20 | 80 | 100 |
| BSBO 411 | TAXONOMY AND EMBRYOLOGY OF ANGIOSPERMS | 3 | | 3 | 20 | 80 | 100 |
| BSBO 412 | CYTOGENETICS, GENETICS, PLANT BREEDING, EVOLUTION AND BIOSTATISTICS | 3 | | 3 | 20 | 80 | 100 |
| BSBO 421 | PRACTICAL | | 6 | 3 | 20 | 80 | 100 |
| BSBO 511 | PLANT PHYSIOLOGY AND BIOCHEMISTRY | 3 | | 3 | 20 | 80 | 100 |
| BSBO 512 | PLANT TISSUE CULTURE | 3 | | 3 | 20 | 80 | 100 |
| BSBO 521 | PRACTICAL | | 6 | 3 | 20 | 80 | 100 |
| BSBO 611 | ECOLOGY AND ENVIRONMENTAL BIOLOGY | 3 | | 3 | 20 | 80 | 100 |
| BSBO 612 | RECOMBINANT DNA TECHNOLOGY | 3 | | 3 | 20 | 80 | 100 |
| BSBO 621 | PRACTICAL | | 6 | 3 | 20 | 80 | 100 |
| TOTAL | | | | | | | 1800 |

MAULAN AZAD UNIVERSITY, JODHPUR

PAPER NOMENCLATURE IN BOTANY (UG)

| | |
|------------------|--|
| BSBO 111: | ALGAE, LICHENS AND BRYOPHYTES |
| BSBO 112: | MYCOLOGY, MICROBIOLOGY AND PHYTOPATHOLOGY |
| BSBO 121: | PRACTICAL |
| BSBO 211: | PTERIDOPHYTES |
| BSBO 212: | GYMNOSPERMS AND PALAEOBOTANY |
| BSBO 221: | PRACTICAL |
| BSBO 311: | ANATOMY OF ANGIOSPERMS, ECONOMIC BOTANY AND ETHNOBOTANY |
| BSBO 312: | CELL AND MOLECULAR BIOLOGY |
| BSBO 321: | PRACTICAL |
| BSBO 411: | TAXONOMY AND EMBRYOLOGY OF ANGIOSPERMS |
| BSBO 412: | CYTOGENETICS, GENETICS, PLANT BREEDING, EVOLUTION AND BIOSTATISTICS |
| BSBO 421: | PRACTICAL |
| BSBO 511: | PLANT PHYSIOLOGY AND BIOCHEMISTRY |
| BSBO 512: | PLANT TISSUE CULTURE |
| BSBO 521: | PRACTICAL |
| BSBO 611: | ECOLOGY AND ENVIRONMENTAL BIOLOGY |
| BSBO 612: | RECOMBINANT DNA TECHNOLOGY |
| BSBO 621: | PRACTICAL |

MAULAN AZAD UNIVERSITY, JODHPUR

B.SC. IST SEMESTER BSBO 111- ALGAE, LICHENS AND BRYOPHYTES

UNIT-I

General characters of Algae: Variety of habitats, Range of thallus structure, Structure of typical algal cell, Modes of reproduction, types of life cycle. Classification of algae: outline of Fritsch's classification, recent advances. Economic importance of Algae. Important features of Chlorophyceae. Structure and life cycle of *Volvox*, *Oedogonium* and *Coleochaete*.

UNIT-II

Important features of Charophyceae. Structure and life cycle of *Chara*. Important features of Xanthophyceae. Structure and life cycle of *Vaucheria*. Important features of Phaeophyceae. Structure and life cycle of *Ectocarpus* and *Sargassum*.

UNIT-III

Important Features and life history of Rhodophyceae. Structure and life cycle of *Polysiphonia*. Lichens: Morphology and structure of the two components; biological, ecological and economic importance. Vegetative multiplication methods with special reference to *Parmelia* and *Usnea*.

UNIT-IV

Bryophytes: General characters, alternation of generations and Classification. Characters and Classification of Hepaticopsida. Morphology and life history of *Riccia*, *Marchantia* and *Plagiochasma*.

UNIT-V

Characters and classification of Anthocerotopsida and Bryopsida. Morphology and life history of *Anthoceros* and *Sphagnum*.

SUGGESTED READINGS

1. Puri, P. Bryophytes, Atmaram and Sons, Delhi, Lucknow.
2. Singh, V., Pande, P.C. and Jain, D.K. A Text Book of Botany, Rastogi and Co., Meerut.
3. Vashistha, B.R. Botany for Degree Students (Algae), S. Chand and Co. Ltd., New Delhi.
4. Vashistha, B.R. Botany for Degree Students (Bryophyta), S. Chand and Co. Ltd., New Delhi.
5. Ghemawat, M.S., Kapoor, J.N. and Narayan, H.S. A text book of Algae, Ramesh Book Depot, Jaipur.
6. Kumar, H.D. Introductory Phycology, Affiliated East-West Press, Ltd., New York.
7. Gilbert, M.S. Cryptogamic Botany, Vol. I and II (2nd Ed.), Tata McGraw Hill, Publishing Co. Ltd., New Delhi.
8. Pandey, S.N. and Trivedi, P.S. A Text Book of Botany, Volume I, Vikas Pub. House Pvt. Ltd., New Delhi.

MAULAN AZAD UNIVERSITY, JODHPUR

B.SC. IST SEMESTER

BSBO 112- MYCOLOGY, MICROBIOLOGY AND PHYTOPATHOLOGY

UNIT-I

General characters, classification and economic importance of fungi. Important features and life history of Mastigomycotina- *Albugo*, Zygomycotina- *Rhizopus*, Ascomycotina - *Saccharomyces* and *Aspergillus*

UNIT-II

Important features and life history of Basidiomycotina- *Ustilago*, *Puccinia*, *Agaricus*. Cultivation of mushrooms. Deuteromycotina- *Alternaria*.

UNIT-III

Viruses: Chemical and physical nature, structure, multiplication and transmission of plant viruses. Tobacco mosaic virus and Yellow vein mosaic virus disease. General account of AIDS.

UNIT-IV

Bacteria - Structure, nutrition, cell division, reproduction and economic importance. Cyanobacteria- Life history of *Nostoc* and *Oscillatoria*. Role of Blue green algae in nitrogen fixation. General account and biology of mycoplasma and phytoplasma.

UNIT-V

Principles of plant pathology. Koch's postulates. Basics of plant –microbes interaction. Causes and symptoms, diseases cycle and control measures of Green ear disease of bajra, Loose smut of wheat, Black rust of wheat, Citrus canker, Little leaf of brinjal. A brief account of principles of plant protection.

SUGGESTED READINGS

1. Sharma, P.D. Microbiology and Plant Pathology, Rastogi Publ. Meerut.
2. Singh, V., Padey, P.C. and Jain, D.K. A text book of Botany. Rastogi Publication. Meerut
3. Mehrotra, R.S. and Aneja, K.R.: An introduction to mycology, New Age International Publishers.
4. Dubey, H.C. Fungi Rastogi Publication, Meerut.
5. Vashihsta, B.R. and Sinha A.K. Botany for Degree student Fungi, S. Chand and Co., New Delhi.
6. Pelczer, Chan and Krieg. Microbiology, McGraw Hill Book Co., London.
7. Bilgrami, K.S. and Dubey, H.C. A Text Book of Modern Plant Pathology, Vikas Publ House, New Delhi.
8. Kaushik, P. Microbiology, Emkay Publication.
9. Madahar, C.L. Introduction to plant viruses. S. Chand and Co. Ltd. New Delhi.
10. Alexopoulos, C.J. and Mims. Introductory Mycology. John Wiley and Sons, New York.
11. Pathak, V.N. Fundamentals of Plant Pathology. Agro Botanica.

MAULAN AZAD UNIVERSITY, JODHPUR

BSBO 121-PRACTICAL

(A) Microscopic preparation and study of following:

- i. Algae:** *Volvox*, *Oedogonium*, *Coleochaete*, *Chara*, *Vaucheria*, *Ectocarpus*, *Sargassum* and *Polysiphonia*. (Material-A)
- ii. Bryophyte:** *Riccia*, *Marchantia*, *Plagiochasma*, *Anthoceros* and *Sphagnum*. (Material-B)
- iii. Lichens:** External morphology of different types.
- iv. Fungi:** *Albugo*, *Rhizopus*, *Saccharomyces*, *Aspergillus*, *Ustilago* (*Teleutospores*), *Puccinia*, *Agaricus* and *Alternaria*. (Material-C)

(B) Microbiology:

- i.** Disease symptoms caused by Tobacco mosaic virus and Yellow vein mosaic virus.
- ii.** Bacteria: Gram's staining of bacteria. *Nostoc*, *Oscillatoria* and Root Nodule. (Material-D)
- iii.** Preparation of nutrient medium for Bacteria and their culture- demonstration.

(C) Plant pathology: Study of symptoms of following diseases (specimen or photographs):

- i.** Green ear disease of Bajra
- ii.** Loose smut of wheat
- iii.** Citrus canker
- iv.** Black rust of wheat
- v.** Little leaf of brinjal.

MAULAN AZAD UNIVERSITY, JODHPUR

UG PRACTICAL EXAMINATION BOTANY (BSBO 121) SEMESTER- I

Time: 3 hours

Max. Marks: 80

Make suitable preparation of material "A", "B", "C" and "D". Identify and comment upon your preparation. Leave your preparation for inspection.

- | | |
|---|-----------|
| 1. Material A | 12 |
| 2. Material B marks | 12 |
| 3. Material C marks | 12 |
| 4. Material D | 10 |
| 5. Identify and comment upon the spots 1 to 6 | 6x 4 = 24 |
| i. _____ | |
| ii. _____ | |
| iii. _____ | |
| iv. _____ | |
| v. _____ | |
| vi. _____ | |
| 6. Viva-voce | 10 |

MAULAN AZAD UNIVERSITY, JODHPUR

B.Sc. IIND SEMESTER BSBO 211- PTERIDOPHYTES

UNIT- I

General characters, life cycle pattern, affinities of Pteridophytes and classification of Pteridophytes. Important Characteristics of Psilopsida, Lycopsida, Sphenopsida and Pteropsida. Climate change and economic importance of Pteridophytes. Stellar Systems in Pteridophyta.

UNIT- II

Occurrence, structure of vegetative and reproductive parts and life history of *Psilotum* and *Lycopodium*.

UNIT- III

Occurrence, structure of vegetative and reproductive parts and life history of *Selaginella*. Heterospory and origin of seed habit.

UNIT- IV

Occurrence, structure of vegetative and reproductive parts and life history of *Equisetum* and *Adiantum*.

UNIT- V

Occurrence, structure of vegetative and reproductive parts and life history of *Marsilea* and *Azolla*.

SUGGESTED READINGS

1. Singh, V., Pande, P.C. and Jain, D. K.: A Text Book of Botany, Rastogi and Co., Meerut.
2. Pandey, S.N., Mishra, S.P., Trivedi, P.S. A Text Book of Botany Vol. II, Vikas Pub. House Pvt. Ltd., New Delhi.
3. Sharma, O.P. : Pteridophytes, Today and tomorrow Publication.
4. Sarabhai, R.C. and Saxena, R.C.: A text book of Botany, Rastogi and Co., Meerut.
5. Vashista, P.C.: Pteridophytes, S.Chand and Co., New Delhi.
6. Rashid, A.: An introduction to Pteridophytes. Vikas Publishing House Pvt Ltd, India.
7. Parihar N.S.: Biology and Morphology of Pteridophytes. Central Book Depot, Allahabad.
8. Gifford, E.M. and Foster, A.S.: Morphology and Evolution of Vascular Plants, W.H. Freeman and Company, New York.

MAULAN AZAD UNIVERSITY, JODHPUR

BSBO 212- GYMNOSPERMS AND PALAEOBOTANY

UNIT-I

Characteristics of seed plants. General features of Gymnosperms and their classification. Affinities of Gymnosperms with Pteridophytes and Angiosperms. Economic importance of Gymnosperms.

UNIT-II

Cycas: Morphology of vegetative and reproductive parts. Anatomy of root, stem, leaf and reproductive parts. Reproduction and life cycle.

UNIT-III

Pinus: Morphology of vegetative and reproductive parts. Anatomy of root, stem, leaf and reproductive parts. Reproduction and life cycle.

UNIT-IV

Ephedra: Morphology of vegetative and reproductive parts. Anatomy of root, stem, leaf and reproductive parts. Reproduction and life cycle.

UNIT-V

Geological time scale, fossilization and types of fossils. Techniques for fossil study.

Primitive land plants: *Rhynia*. Fossil Pteridophytes – *Lepidodendron*. Fossil Gymnosperms - *Williamsonia*.

SUGGESTED READINGS

1. Singh, V., Pande, P.C. and Jain, D. K.: A Text Book of Botany, Rastogi and Co., Meerut.
2. Pandey, S.N., Mishra, S.P., Trivedi, P.S. A Text Book of Botany Vol. II, Vikas Pub. House Pvt. Ltd., New Delhi.
3. Sporne, K.R. : The Morphology of Gymnosperms, B.I. Publ. Pvt., Bombay, Calcutta, Delhi.
4. Wilson, N.S. And Rothewall, G.W. : Palaeobotany and evolution of Plants, (2nd ed.), Cambridge University Press, U.K.
5. Bhatnagar, S.P. and Moitra, A. Gymnosperms. New Age international limited, New Delhi.
6. Gifford, E.M. and Foster, A.S.: Morphology and Evolution of Vascular Plants, W.H. Freeman and Company, New York.
7. Stewart, W.M. Paleobotany and the evolution of plants. Cambridge University Press, Cambridge.
8. Andrews, H.N.: Studies in Palaeobotany. John Wiley & Sons Inc.
9. Arnold, C. A.: An Introduction to Palaeobotany. McGraw Hill Book Company, New York.
10. Taylor, T. N. Palaeobotany : An Introduction to Fossil plant Biology . Mc Graw-Hill Book Co. Inc. , New York .

MAULAN AZAD UNIVERSITY, JODHPUR

BSBO 221- SUGGESTED LABORATORY EXERCISES

PTERIDOPHYTES: (Material A- Vegetative Part, Material B- Reproductive Part)

1. *Psilotum* - External morphology (show photographs / specimen).
2. *Lycopodium* - External morphology, T.S. of stem and L.S. of cone.
3. *Selaginella* - External morphology, T.S. of stem and L.S. of cone.
4. *Equisetum* - External morphology, stem (internode) and L.S. of cone.
5. *Marsilea* - External morphology, rhizome, petiole and sporocarp (H.L.S. /V.T.S. /V.L.S.).
6. *Adiantum* - External morphology and sporophyll (T.S.).
7. *Azolla* - External morphology

GYMNOSPERMS: (Material C- Vegetative Part, Material D- Reproductive Part)

1. *Cycas*: External morphology, T.S. of normal root (slide only), coralloid root, rachis and leaflet, specimens of micro and megasporophylls.
2. *Pinus*: External morphology, T.S. of needle, stem (slide only), W.M. of pollen grains, specimens and slides of male and female cones.
3. *Ephedra*: External morphology, T.S. of stem, mounting of male and female reproductive parts.

PALAEOBOTANY:

1. *Rhynia*, *Lepidodendron* and *Williamsonia* (Slides/Photograph/Material).

MAULAN AZAD UNIVERSITY, JODHPUR

UG PRACTICAL EXAMINATION BOTANY (BSBO 221) SEMESTER- II

Time: 3 hours

Max. Marks: 80

1. Cut a T. S. of material "A" and make double stained temporary mount of the same. Draw labeled diagram. Identify the material, giving reasons. Leave your preparation for inspection.
Material "A" 16

2. Make a suitable preparation of the reproductive parts of the material "B" Draw labeled diagram. Identify and comment upon the features of interest. Leave your preparation for inspection. Material "B" 07

3. Cut a T. S. of material "C" and make double stained temporary mount of the same. Draw labeled diagram. Identify the material, giving reasons. Leave your preparation for inspection. Material "C" 16

4. Make a suitable preparation of the reproductive parts of the material "B" Draw labeled diagram. Identify and comment upon the features of interest. Leave your preparation for inspection. Material "D" 07

5. Identify and comment upon the spots 1 to 6 6x 4= 24
 - i. _____
 - ii. _____
 - iii. _____
 - iv. _____
 - v. _____
 - vi. _____

6. Viva-voce 10

MAULAN AZAD UNIVERSITY, JODHPUR

B.Sc. IIIRD SEMESTER

BSBO 311: ANATOMY OF ANGIOSPERMS, ECONOMIC BOTANY AND ETHNOBOTANY

UNIT-I

Anatomy of Angiosperms: Root system; Root apical meristem; differentiation of primary and secondary tissues and their roles; structural modification for storage, respiration, reproduction and for interaction with microbes.

UNIT-II

Shoot system : The shoot apical meristem and its histological organization; vascularization of primary shoot in monocotyledons and dicotyledons; cambium and its functions; differentiation of secondary xylem, characteristics of growth rings, sapwood and heart wood ; differentiation of secondary phloem-structure, function relationship; Periderm.

UNIT-III

Abnormal structure in stem: primary anomalous in Dicot and Monocot stem; Secondary growth in *Dracaena* Stem; Abnormal origin and activity of cambium in Dicot stem.

Leaf: Internal structure in relation to photosynthesis and water loss; adaptations to water stress; senescence and abscission.

UNIT-IV

Economic Botany: Food plants: Rice, wheat, sugarcane. Fibers: Cotton. Vegetable oils: Groundnut, mustard and coconut. General account of sources of firewood, timber and bamboos. Beverages: Tea and coffee; Rubber.

UNIT-V

Spices and Condiments: General account. Medicinal plants with special reference to Rajasthan: *Aloe*, *Asparagus*, *Commiphora*, *Boswellia*, *Pedaliium*, *Zizyphus*, *Haloxylon*, *Tribulus*, *Vitex* and *Withania*.

Ethnobotany: Introduction, Methods of Ethnobotanical studies, and knowledge of aboriginals in Rajasthan.

SUGGESTED READINGS

1. Singh, V., Pande, P.C. and Jain, D. K.: A Text Book of Botany Angiosperms, Rastogi Publications, Meerut.
2. Pandey, B. P.: A Text Book of Botany Angiosperms, S. chand & company Ltd. Ram nagar, new Delhi.
3. Cutter, E.G.: Plant Anatomy: Experiment and Interpretation, Part II. Organs, Edward Arnold, London.
4. Esau, K.: Anatomy of Seed Plants, John Wiley & Sons, New York.
5. Fahn, A.: Plant Anatomy, , Pergamon Press, Oxford.
6. Mauseth, J.D.: Plant Anatomy, the Benjamin/Cummings Publ. Company Inc., Menlo Park, California, USA.
7. Kocchar, S.L.: Economic Botany in Tropics, Mac-Millan India Ltd., New Delhi.
8. Sambamurthy, A.V.S.S. and Subramanyam, N.S.: A Text book of Economic Botany, Wiley Eastern Ltd., New York.
9. Sharma, O.P.: Hill's Economic Botany (Late Dr. A.F. Hill, Adapted by O.P. Sharma), Tata McGraw Hill Co., Ltd., New Delhi.
10. Simposon, B.B. and Conner-Ororzaly, M.: Economic Botany Plants in Our World, McGraw Hill, New York.
11. Jain, S.K and V. Mudgal: A Handbook of Ethnobotany BSMPS publication
12. Jain, S.K: Manual of Ethnobotany, 2nd Edition, Scientific Publisher

MAULAN AZAD UNIVERSITY, JODHPUR

B.Sc. IIIRD SEMESTER BSBO 312: CELL AND MOLECULAR BIOLOGY

UNIT-I

Cell theory. Prokaryotic and eukaryotic cell. Cell organization: structure of a plant cell, cell wall, plasmodesmata, plasma membrane. Mitosis, Meiosis and cell cycle regulation.

UNIT-II

Structure and function of cell organelles: Plastid, Mitochondria, Endoplasmic reticulum, Golgi body, Ribosomes, Peroxisomes, Vacuoles. Nucleus: Structure, nuclear pore complex, nucleolus and chromatin network.

UNIT-III

DNA the genetic material: Structure and different forms of DNA, Replication of DNA: Mode of replication, Enzymes and proteins involved, Replication fork, Leading and lagging strand, Okazaki fragments. Differences between prokaryotic and eukaryotic DNA replication. DNA damage and repair mechanisms.

UNIT-IV

Gene: definition and structure (Promoter, coding sequences, terminator). Prokaryotic and eukaryotic transcription: Transcriptional factors and machinery, RNA polymerases, regulatory elements and mechanism of transcription -formation of initiation complex, elongation, and termination, RNA processing (brief account).

UNIT-V

Translation: Prokaryotic translation- translational machinery, aminoacylation of tRNA, aminoacyl tRNA synthetase, formation of initiation complex, elongation and termination of translation. Regulation of gene expression in prokaryotes (operon concept) and basics of gene expression in eukaryotes.

SUGGESTED READINGS:

1. Krishnamurthy, K.V.: Methods in Cell Wall Cytochemistry. CRC Press, Boca Raton, Florida.
2. De, D.N.: Plant Cell Vacuoles: An Introduction. CSIRO Publication, Collingwood, Australia.
3. Kleinsmith, L.J. and Kish, V.M.: Principles of Cell and Molecular Biology. Harper Collins College Publishers, New York, USA.
4. Hall, J.L. and Moore, A.L.: Isolation of Membranes and Organelles from Plant Cells. Academic Press, London, UK.
5. Harris, N. and Oparka, K.J.: Plant Cell Biology: A Practical Approach. IRL Press, at Oxford University Press, Oxford, U.K.
6. Gunning, B.E.S. and Steer, M.W.: Plant Cell Biology: Structure and Function. Jones and Bartlett Publishers. Boston, Massachusetts.
7. Karp, G.: Cells and Molecular Biology: Concepts and Experiments. John Wiley & Sons, Inc., U.S.A.
8. Lewin, B.: Gene X. Oxford University Press, New York, USA.
9. Alberts, B., Bray, D., Lewis, J., Raff, M., Roberts, K. and Watson, J.D.: Molecular Biology of the Cell. Garland Publishing, Inc., New York.
10. Buchanan, B.B., Gruissem, W., and Jones, R.L.: Biochemistry and Molecular Biology of Plants, American Society of Plant Physiologists, Maryland, USA.
11. Gupta P.K.: A Textbook of cell and Molecular Biology, Rastogi Publications, Meerut
12. Paoella: Introduction to molecular biology. Tata McGraw Hill.

MAULAN AZAD UNIVERSITY, JODHPUR

BSBO 321- SUGGESTED LABORATORY EXERCISES

Anatomy: (Material-A)

1. Dicot Stem: Sunflower, *Nyctanthes*, *Bignonia*, *Salvadora* and *Boerhaavia*.
2. Monocot Stem: *Dracaena*.
3. Dicot Root: *Tinospora*
4. Monocot Root: Maize
5. Dicot Leaf: *Nerium*
6. Monocot Leaf: Maize.

Economic Botany: (Material-B)

Purity and identification test (with principle, diagram, etc.):

1. Purity test of Haldi, Mustard oil, Hing, Katha and Coriander powder.
2. Test for starch in Wheat & Rice (from pre-soaked grains) and potato.
3. Test for Cellulose in cotton and filter paper.
4. Test for lignin in coir and matchstick.
5. Test for fats & oils in seeds of Groundnut, Mustard and Sunflower.

Cell Biology: (Material-C & D)

1. Study of various stages of mitosis in onion root tip.
2. Study of cell wall using suitable chemicals.

Spots:

1. Slide of any anatomy plant material.
2. Different types of stomata and thickening in xylem vessels (slides/photographs).
3. Medicinal plants / Ethnobotany specimens:
 - i. Medicinal plants: *Aloe*, *Asparagus*, *Commiphora*, *Tribulus* and *Withania* .
 - ii. Ethnobotany: *Abrus*, *Leptadenia*, *Calotropis* and *Crotalaria*.
4. Economic botany: Wheat, Sugarcane, Cotton, Jute, Groundnut, Mustard, Cloves, Cardamom, Black pepper, Tea leaves & Rubber.
5. Slides/Models/Photographs/Drawings: Cell structure and Cell organelles: Plasmodesmata, Plasma lemma, Chloroplast, Mitochondria, Nucleus, Nuclear Pore Complex, Peroxisome, Chromosome, DNA-Physical and Chemical properties.

MAULAN AZAD UNIVERSITY, JODHPUR

UG PRACTICAL EXAMINATION BOTANY (BSBO 321) SEMESTER- III

Time: 3 hours

Max. Marks: 80

1. Prepare a hand section of the anatomy material provided and illustrate with (i) labelled outline and cellular diagrams, (ii) identification and (iii) characters. Submit the double stained section for evaluation. **Material "A"**

16 marks

2. Perform the phytochemical / purity test of the given material and report the result. **Material "B"**

07 marks

3. Prepare a suitable smear of the onion root tip and observe metaphase and anaphase stage of mitosis. Draw a labelled diagram of the same. Submit the smear for evaluation. **Material "C"**

16 marks

4. Study the cell wall of given material using suitable chemicals. **Material "D"**

07 marks

5. Identify and comment upon the spots 1 to 6

6 x 4= 24 marks

- i. _____
- ii. _____
- iii. _____
- iv. _____
- v. _____
- vi. _____

6. Viva-voce

10 marks

MAULAN AZAD UNIVERSITY, JODHPUR

B.Sc. IVTH SEMESTER BSBO411: TAXONOMY AND EMBRYOLOGY OF ANGIOSPERMS

UNIT-I

Angiosperms: Origin and Evolution, Angiosperm Taxonomy- Alpha, Omega and Holotaxonomy, Taxonomic Literature, Botanical Nomenclature, Principles and Rules, Taxonomic Ranks, Type Concept, Principle of Priority.

Classification of Angiosperms –Natural, Artificial and Phylogenetic, Salient Features of Systems proposed by Bentham and Hooker , Engler and Prantl and Hutchinson.

UNIT-II

Flower- Modified Shoot, Structure and Development of Flower, Inflorescence-Types of inflorescence.

Major Contributions of cytology, molecular biology, phytochemistry and taxometrics to taxonomy.

Diversity of Flowering Plants as illustrated by members of families – Ranunculaceae, Papaveraceae, Caryophyllaceae, Apiaceae.

UNIT-III

Diversity of Flowering Plants as illustrated by members of families: Asteraceae, Acanthaceae, Apocynaceae, Asclepiadaceae, Scrophulariaceae, Lamiaceae, Euphorbiaceae and Poaceae.

UNIT-IV

Structure of Anther, Microsporogenesis, Tapetum-Types and Function, Development of Male Gametophyte, Structure of Pollen Grains, Types of Ovules, Megasporogenesis, Structure and Development of Female Gametophyte (Embryo sac), Types of Embryo Sacs- Monosporic, Bisporic and Tetrasporic, Pollen Pistil Interaction, Self Incompatibility, Fertilization, Double Fertilization, Significance of Double Fertilization. A brief account of Genomic Imprinting.

UNIT-V

Development of Monocot and Dicot Embryo, Endosperm: Types of Endosperm, Endosperm Haustoria, Polyembryony, Induced Polyembryony, Apomixis, A brief account of Genomic Imprinting.

Brief Account of Experimental Embryology – Haploid Culture, Ovary Culture, Endosperm Culture, Parthenogenesis and Parthenocarpy.

Suggested Readings:

1. Singh, V., Pandey, P.C. And Jain, D.K. Angiosperms. Rastogi Pub., Meerut.
2. Bhandari, M.M. Flora of Indian Desert, Scientific Publisher, Jodhpur
3. Bhojwani, S.S. and Bhatnagar, S.P.: The Embryology of Angiosperms, 4th Revised and enlarged edition, Vikas Publ., New Delhi.
4. Davis, P.H. and Heywood, V.H.: Principles of Angiosperm Taxonomy, Oliver and Boyd, London.
5. Jeffery, C.: An Introduction to Plant Taxonomy, Cambridge University Press, Cambridge, London.
6. Jones, S.D. Jr. and Suhsinger, A.E.: Plant Systematics. McGraw- Hill Book Co., New York.
7. Maheshwari, P.: An Introduction to the Embryology of Angiosperms. New Delhi.
8. Sharma, O.P. Taxonomy: Tata McGraw Hill Pub. Company Ltd., New Delhi
9. Singh, Gurcharan. Plant Systematics: Theory and Practices, Oxford and IBH Pvt. Ltd., New Delhi,
10. Trivedi, P.C., Sharma, N. and Sharma, J.L., Structure, Development and Reproduction in Flowering Plants, Ramesh Book Depot, Jaipur.
11. V.N. Nair: Taxonomy of Angiosperms. TMH Publishing Company Limited, New Delhi.
12. V.V. Sivrajan : Introduction to the Principles of Plant Taxonomy, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

MAULAN AZAD UNIVERSITY, JODHPUR

B.Sc. IVTH SEMESTER

BSBO412: CYTOGENETICS, GENETICS, PLANT BREEDING, EVOLUTION AND BIOSTATISTICS

UNIT-I

Cytogenetics: Chromatin organization: Organization and structure of chromosomes, concept of nucleosomes, types of chromosomes: Special types of chromosome (Polytene and lampbrush) and sex chromosomes. Chromosome aberrations: Structural aberrations: deletion, duplication, translocation, inversion: Numerical aberrations: aneuploidy and polyploidy.

UNIT-II

Genetics: Nature of inheritance: Laws of Mendelian inheritance, Mono and Dihybrid cross, test cross, back cross, exceptions of Mendel's law: incomplete dominance, codominance, multiple alleles, Complementary interaction, supplementary interaction, Epistasis, duplicate gene, polygenic inheritance, Pleiotropy, maternal inheritance. Chromosome theory of inheritance, crossing-over, linkage.

UNIT-III

Plant breeding: Origin of Agriculture, Centres of origin of crop plants and centres of Diversity, Domestication, Introduction, Selection, Clonal propagation, Hybridization, Mutation breeding, breeding work done on wheat.

UNIT-IV

Evolution: origin of life (Haldane/A.I. Oparin Hypothesis), Lamarck theory, Darwin theory, Evidences of organic evolution, Natural selection, origin of species, Population genetics: Allele and genotype frequency, Hardy-Weinberg principle.

UNIT-V

Biostatistics: Definition and Applications, Collection and representation of data (Tabular, graphical and diagrammatic representation), Mean (Arithmetic, geometric, harmonic mean), Median (for grouped and ungrouped data), Mode, Standard deviation: computation for grouped and ungrouped data, merits and demerits; Standard error.

SUGGESTED READINGS:

1. Atherly, AG., Girton, JR and McDonald, J.F.: The Science of Genetics. Saunders, College Publishing, Fort Worth, USA.
2. Burnham, C.R.: Discussions in Cytogenetics. Burgess Publishing Co. Minnesota.
3. Hartl, D.L. and Jones, E.W.: Genetics: Principles and Analysis. Jones & Bartlett Publishers, Massachusetts, USA.
4. Khush, G.S.: Cytogenetics of Aneuploids. Academic Press, New York, London.
5. Russel, P.J.: Genetics (5th edition). The Benjamin/Cummings Publishing Company Inc., USA.
6. Snustad, D.P. and Simmons: Principles of Genetics. John Wiley & Sons Inc., USA.
7. Chaudhary, H.K.: Elementary principles of plant Breeding, Oxford IBH Publishing New Delhi
8. Gupta, P.K.: Cytology, Genetics, Evolution and plant Breeding, Rastogi Publications, Meerut.
9. Singh B.D.: Textbook of plant Breeding, Kalyani Publishers, Ludhiana.
10. Shukla, R.S. and Chandel, P.S.: Cytogenetics, Evolution and Plant Breeding. S. Chand Co. Ltd., New Delhi.
11. Singh B.D.: Textbook of Genetics, Kalyani Publishers, Ludhiana.
12. Sinha, U. And Sinha, S.: Cytogenetics, Plant Breeding and Evolution, Vikas Publishing House, New Delhi.
13. Prasad S.: Elements of Biostatistics, Rastogi Publications, Meerut.

MAULAN AZAD UNIVERSITY, JODHPUR

BSBO 421: PRACTICAL

TAXONOMY

Description of following flowers in taxonomic sense:

1. **Ranunculaceae:** *Delphinium*
2. **Papaveraceae:** *Papaver*
3. **Caryophyllaceae:** *Dianthus, Saponaria*
4. **Apiaceae:** *Coriandrum*
5. **Asteraceae:** *Helianthus, Sonchus*
6. **Acanthaceae:** *Adhatoda, Barleria*
7. **Apocynaceae:** *Catharanthus, Thevetia, Nerium*
8. **Asclepiadaceae:** *Calotropis*
9. **Scrophulariaceae:** *Antirrhinum, Linaria*
10. **Lamiaceae:** *Ocimum*
11. **Euphorbiaceae:** *Euphorbia pulcherrima*
12. **Poaceae:** *Triticum*

EMBRYOLOGY:

1. Germination of pollen in control and 5 % sucrose solution (10 plants of the campus)
2. Translator mounting: *Calotropis*
3. Study of Placentation : Axile, Free Central, Parietal, Marginal and Basal
4. Pollen stainability(1:1 Glycerin: Acetocarmine) in *Cassia fistula* and *Datura*
5. Structure of Ovule: Orthotropus, Anatropus, Campylotropus and Amphitropus (Slides/Photographs)

GENETICS/PLANT BREEDING/STATISTICS

1. Problems related to Mendel's law of dominance, segregation and independent assortment (Seed sample).
2. Problems related to Incomplete dominance, modified ratios and multiple alleles (Seed sample).
3. Problems related to linkage (Photographs).
4. Problems related to quantitative inheritance (Seed sample/Photographs).
5. Problems related to central tendency (Mean, Mode and Median- data sheet/plant material).
6. Demonstration of Emasculation techniques including bagging, tagging and labelling.
7. Demonstration of Pure line and Mass line selection (Photograph)

SPOTS

- 1 **Leaf** : Simple and compound
- 2 **Inflorescence** : Cyathium, Verticillaster and Umbel
- 3 **Fruits** : Pepo, Caryopsis, Cremocarp and Hesperidium
- 4 **Endosperm** : Coconut and Ruminant in Walnut and Sitafal
- 5 Chart showing Pure line and mass selection
- 6 Scientific contribution of Darwin, Lamarck, Hugo de vries, Vavilov and Mendel (Photographs with names)
- 7 Slides/Models/Photographs/Drawings: Chromosome structure (nucleosome, solenoid model), lampbrush and polytene chromosome, Chromosomal aberrations- structural and numerical.

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UG PRACTICAL EXAMINATION BOTANY (BSBO 421) SEMESTER- IV

Time: 3 hours

Max. Marks: 80

- 1 Describe the given flower in taxonomic sense with floral diagram and floral formula, mentioning special features of identifications 16 marks
- 2 Prepare and identify the given material from embryological point of view. 07 marks
- 3 Perform biostatistical exercise. 09 marks
- 4 Genetics exercise. 07 marks
- 5 Emasculate the given material and submit for evaluation. 07 marks
- 6 Identify and comment upon the spots 1 to 6 6 x 4= 24 marks
 - i. _____
 - ii. _____
 - iii. _____
 - iv. _____
 - v. _____
 - vi. _____
7. Viva-voce 10 marks

MAULAN AZAD UNIVERSITY, JODHPUR

B.Sc. VTH SEMESTER BSBO511: PLANT PHYSIOLOGY AND BIOCHEMISTRY

UNIT-I

Plant-water relations: Importance of water to plant life; structure & physical properties of water; diffusion and osmosis; absorption by roots, ascent of sap and transpiration

Mineral nutrition: Role of Essential macro- and micro-elements and their deficiency symptoms

Transport of organic substances: Source-sink relationship; Mechanism of phloem transport, factors affecting translocation

UNIT-II

Photosynthesis: Photosynthetic pigments; absorption & action spectra, enhancement and red drop effect; concept of two photosystems; Z-scheme; photophosphorylation; Calvin cycle; C4 pathway; CAM pathway; photorespiration

UNIT-III

Respiration: Aerobic and anaerobic respiration; Glycolysis & Krebs cycle; electron transport mechanism (chemi – osmotic theory);oxidative phosphorylation; pentose phosphate pathway

Basics of enzymology: Discovery, nomenclature, classification and characteristics of enzymes; concept of holoenzyme, apoenzyme, coenzyme and cofactors; mechanism of action; regulation of enzyme activity

UNIT-IV

Nitrogen metabolism: Biological nitrogen fixation; nitrate reduction; importance of nitrate reductase and its regulation; ammonium assimilation

Lipid metabolism: Saturated and unsaturated fatty acids, classification, structure and function of lipids; fatty acid biosynthesis; -oxidation ; storage and mobilization of fatty acids

UNIT-V

Growth and development: Definitions; phases of growth and development; plant hormones-auxins, gibberellins, cytokinins, abscisic acid and ethylene - discovery, physiological roles & mechanism of action; seed germination & dormancy; photoperiodism & vernalization; photomorphogenesis and skotomorphogenesis; phytochromes-their discovery, physiological role and mechanism of action

SUGGESTED READINGS

1. Dennis, D.T., Turpin, D.H., Lefebvre, D.D. and Layzell . Plant Metabolism, Longman, Essex, England
2. Galston, A.W. Life processes in Plants, Scientific American Library, Springer-Verlag, New York, USA
3. Hopkins, W.G. Introduction to plant physiology, John Wiley & Sons, Inc., New York, USA
4. Lea, P.J. and Leegood, R.C. Plant Biochemistry and Molecular Biology, John Wiley & Sons, Chichester, England
5. Mohr, H. and Schopfer, P. Plant Physiology, Springer-Verlag, Berlin, Germany
6. Salisbury, F.B. and Ross, C.W. Plant Physiology, Wadsworth Publishing Co., California, USA,
7. Srivastava, H.S. Plant Physiology, Rastogi Publication, Meerut
8. Taiz, L. and Zeiger, E. Plant Physiology, Sinauer Associates, Inc. Publishers, Massachusetts, USA
9. Amar Singh. Practical Plant Physiology, Kalyani Publishers, New Delhi
10. Moore, T.C. Research Experiences in Plant Physiology: A Laboratory Manual, Springer-Verlag, Berlin
11. Nifa, A.J. and Ballou, D.P. Fundamental Laboratory Approaches for Biochemistry and Biotechnology, Fitzrerald Science Press, Inc., Maryland, USA

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12. Wilson, K. and Goulding, K.H. A Biologists Guide to principles and techniques of Practical Biochemistry, Edward Arnold, London
13. Verma, V. Text book of plant physiology. Ane books, India.
14. Sinha, R. K. Modern plant physiology. Narosa publishing house.
15. Trivedi, P. C., Atreya, A and Pathak, K. Plant physiology, Biochemistry and Biotechnology. Ramesh Book Depot.

MAULAN AZAD UNIVERSITY, JODHPUR

B.Sc. VTH SEMESTER BSBO512: PLANT TISSUE CULTURE

UNIT-I

History of plant tissue culture: Cell theory, Totipotency, Pleuripotency, Contribution of different scientist (Haberlandt, White, Skoog, Reinert, Vasil I. K., Guha and S.C. Maheshwari, Cocking, Murashige).

Basic technique and tools of plant tissue culture: Sterilization, concept of clean area/aseptic condition, laminar air flow bench, growth room, green house.

Culture media: Basic constituents of culture media (MS: Inorganic and organic nutrients, energy source, gelling agents, PGR's, pH).

UNIT-II

Micropropagation: Definition, various stages of Micropropagation: Explant types and origin (in relation to establishment of different types of cultures), pretreatment of explants, surface sterilization of explants (types of chemicals, concentration used and duration of surface sterilization, establishment of cultures, Repeated transfer of explants, subculture of *In vitro* established cultures, rooting (*In vitro* and *ex vitro*) and hardening of plantlets. Methods of Micropropagation, Axillary bud culture, Adventitious shoot culture, shoot tip culture, Callus cultures: Initiation and maintenance, organogenesis, somatic embryogenesis.

UNIT-III

Protoplast culture technique: source of protoplasts, isolation techniques, enzymes, osmoticum, purification of protoplasts, viability of protoplast and various culture techniques, culture medium, protoplast development: Cell wall formation, Growth, division and plant regeneration.

Somatic hybridization: protoplast fusion. Identification and selection of hybrid cells, verification and characterization of somatic hybrids, Cybrids, Potential, problems and limitations of somatic hybridization.

UNIT-IV

Cell culture: Types of suspension culture, growth measurement, synchronization of cells, techniques for single cell culture, selection of cells for higher yield, optimization of growth conditions, bioreactors for large scale culture, types of bioreactors, immobilization of cell culture, Hairy root cultures, Elicitations and biotransformation.

UNIT-V

Application and scope of plant tissue culture: In forestry, floriculture, agriculture and biodiversity conservation. Production of virus - free plants, haploids, soma clonal variants and synthetic seeds. Cryopreservation: Raising aseptic cultures, addition of cryoprotectants, freezing, storage, thawing, and determination of viability, Retrieval of plants and its applications.

Suggested readings

1. Beyl C. A. & Trigiano R. N.: Plant Propagation Concept & Laboratory Exercises, CRC press, Taylor & Francis Group.
2. Lindsey K.: Plant Tissue Culture Manual Supplement 7, Springer India Private Limited, New Delhi, India.
3. Ravishankar G. A. and Venkataraman L. A.: Recent Advances in Biotechnological Applications of Plant Tissue and Cell Culture. Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.
4. Ahuja M. R.; Micropropagation of Woody Plants. Kluwer Academic publishers, AHD ordrecht, The Netherlands.
5. Razdan M. K.: Introduction to Plant Tissue Culture, Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.
6. Bhojwani S.S. and Razdan M. K.: Plant Tissue Culture: Theory and Practice, Elsevier Science
7. Mather J. P. and Roberts P. E.: "Introduction to Cell and Tissue Culture: Theory and Technique" Springer.

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8. George E.F.: Plant Propagation by Tissue Culture: Volume1.The background, Springer.
9. Singh B.D.: Biotechnology Expanding Horizon, Kalyani Publishers, Ludhiana.
10. Chawla H. S.: Introduction to Plant Biotechnology, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
11. Purohit, S.D.: Introduction to plant cell, tissue and organ culture. Prentice Hall.

MAULAN AZAD UNIVERSITY, JODHPUR

BSB0 521 PRACTICAL

PLANT PHYSIOLOGY AND BIOCHEMISTRY

MAJOR EXERCISES

1. Determine osmotic potential by diffusion pressure deficit.
2. Determine Rf value of an unknown amino acid using paper chromatography.
3. Separate chlorophyll pigments by paper chromatography.

MINOR EXERCISES

1. Demonstrate effect on membrane permeability by different temperature (room, hot water treatments)
2. Demonstrate effect on membrane permeability by different organic solvents (Ethanol, Methanol, Butanol).
3. Demonstrate opening and closing of Stomata (using distilled water, sucrose and KCl, independently).
4. Demonstrate plasmolysis

SPOTS

1. Contribution of Scientist to Physiology and biochemistry: E. Munch, M. Calvin, H.P. Hatch and C.R. Slack, E. Fischer, P. Mitchell, S.B. Hendricks and H.A. Borhwick.
2. Ripening of fruits.
3. IBA effect on rooting
4. Ethylene effect
5. Photomorphogenesis
6. Senescence
7. Chlorophyll separation
8. RQ
9. Protein structure: secondary (helix, sheets), tertiary and quaternary.
10. Root nodules.

PLANT TISSUE CULTURE EXPERIMENTS

1. Prepare culture medium (mentioning PGR and each constituent in mg/L) for induction of callus; surface sterilize and inoculate the given explant for culture initiation.
2. Prepare culture medium (mentioning PGR and each constituent in mg/L) for axillary shoots; surface sterilize and inoculate the given explant for culture initiation.
3. Prepare culture medium (mentioning PGR and each constituent in mg/L) for *In vitro* roots; surface sterilize and inoculate the given explant for culture initiation.
4. Prepare culture medium (mentioning PGR and each constituent in mg/L) for haploid culture; surface sterilize and inoculate the given explant for culture initiation.

SPOTS

1. Contribution of Scientist to Biotechnology: Gottlieb Haberlandt, Miller and Skoog.
2. Anther culture.
3. Synthetic seeds.
4. Protoplast
5. Somatic hybridization.
6. Tools and techniques: Laminar air flow bench, Autoclave, Bioreactor.
7. *In Vitro* Production: Shikonin; Diosgenin; Ephedrin; Vinca Alkaloids

MAULAN AZAD UNIVERSITY, JODHPUR

UG PRACTICAL EXAMINATION BOTANY (BSBO 521) SEMESTER- V

Time: 3 hours

Max. Marks: 80

- 1 Perform the physiological experiment allotted by lots and report the result in suitable form.
 - a. Major experiment 16 marks
 - b. Minor experiment 07 marks

- 2 Perform the tissue culture experiment allotted by lots.
 - a. Preparation of nutrient medium & reporting the constituents in mg/l 07 marks
 - b. Pre-treatment, surface sterilization and inoculation of the explants according to the given experiment. 16 marks

- 3 Identify and comment upon the spots 1 to 6 6 x 4 = 24 marks
 - i. _____
 - ii. _____
 - iii. _____
 - iv. _____
 - v. _____
 - vi. _____

8. Viva-voce 10 marks

MAULAN AZAD UNIVERSITY, JODHPUR

B.Sc. VITH SEMESTER BSBO611: ECOLOGY AND ENVIRONMENTAL BIOLOGY

UNIT-I

Plants and Environment: Atmosphere (gaseous composition) water (properties of water cycle), Light (Global radiation, Photosynthetically active radiation), temperature, soil (development, soil profile, Physicochemical properties) and adaptation of plants to water, temperature, light and salinity.

UNIT-II

Population ecology: Concept & Character, growth curve, biotic potential, ecotypes and ecads. Community ecology and succession: community characteristics Frequency, density, cover, life forms & biological spectrum. Succession: Concept, classification, model and mechanisms; examples (hydrosere and Xerosere).

UNIT-III

Ecosystem: structure, abiotic and biotic components, food chain, Food web, ecological pyramids, energy flow, biogeochemical cycles of carbon, nitrogen and phosphorus.

UNIT-IV

Productivity: Primary productivity, its measurements and Factors affecting primary productivity. Environmental biology of Indian Desert: Climate, vegetation Types, adaptive strategies of desert plants. Desertification: meaning, causes, critical issues. Biodiversity: Types of biodiversity and their conservation (*in situ*, *ex-situ*)

UNIT-V

Pollution ecology; Definition, classification, Sources, effect and control measures of air, water and land Pollution. Green house effect, Acid rain, Eutrophication. Biogeographical regions of India.

SUGGESTED READINGS:

1. Odum, E.P. : Basic ecology, Saunders Philadelphia
2. Sharma, P.D. : Ecology and environment, Rastogi publications, Meerut
3. Dash, M.C. : Fundamentals of ecology, Tata McGraw Hill publishing Co.LTD, New Delhi
4. Singh, J.S. , Singh S.P. and Gupta, S.R. : Ecology environment and Resource conservation, Anamaya publishers, New Delhi
5. Shukla, R.S. and Chandel, P.S : A textbook of plant ecology, S. Chand & Company LTD. Ram Nagar, New Delhi
6. Sen, D.N. Environment and plant life in Indian desert, Geobios International, Jodhpur.
7. Kumar, H.D. General Ecology. Vikas publishing house, Pvt. New Delhi.

MAULAN AZAD UNIVERSITY, JODHPUR

B.Sc. VITH SEMESTER BSBO612: RECOMBINANT DNA TECHNOLOGY

UNIT-I

Basics of recombinant DNA Technology: History and definition, source of desired gene, isolation of desired gene, restriction enzymes (types and their properties), Genomic and cDNA library, Gene cloning vectors: properties of an ideal vector, carrying capacity of vectors, types of vectors (pBR³²², pUC). Integration of gene into vector and Transformation. artificial chromosome (BAC, YAC). **Selection** of desired recombinant cells.

UNIT-II

Gene transfer methods in plants: *Agrobacterium* mediated gene transfer in plants: Properties of *Agrobacterium*, types of *Agrobacterium*, molecular organization of Ti-plasmid (nopaline and octopine types), molecular organization of T-DNA, molecular biology of T-DNA transfer, integration of T- DNA into host cell. Direct method of gene transfer: Electroporation, chemical methods, biolistics, microinjection, macro injection. Marker genes: Reporter genes (e.g. Lux gene, GUS gene), Selectable markers (e.g. Antibiotic resistance markers, Herbicide resistance markers)

UNIT-III

Transgenic Crops –Resistant to abiotic stress, Resistance to biotic stress (Insect resistance, virus resistance, disease resistance), herbicide resistance and transgenics for improved storage, flower colour, shape, male sterility, terminator seed, protein quality, vitamin and production of edible vaccines

UNIT-IV

GMOs, Biosafety, Risk assessment, and Containment. Labelling of GMOs. IPR and Bioresources. Patent: requirement and process of patent. Copyright, geographical indicators, trade mark, farmer's and plant breeder's rights; bioethics

UNIT-V

Techniques: Electrophoresis: Principle, types (Horizontal and Vertical Electrophoresis) and applications. DNA fingerprinting: Principle and applications. PCR: Principle, types and applications. Southern and Northern Blotting: principle, method and application. DNA sequencing (Chain termination method) principle, method and applications.

SUGGESTED READINGS

1. Singh B.D. Biotechnology Expanding Horizon, Kalyani Publishers, Ludhiana.
2. Chawla H. S. Introduction to Plant Biotechnology, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
3. Greene J. J. And Rao V. S.: Recombinant DNA–Principles and Methodologies. Marcel Dekker, New York.
4. Primrose S. B. and Twyman R. M.: Principles of gene manipulation and genomics, Blackwell Science, Oxford.
5. Hansen and Harper: Differentially expressed gene in plants, Taylor and Francis Ltd. London.
6. Collins G. B. And Shepherd R. J.: Engineering plants for commercial products and applications, NYA cad. of Science Publishers.

MAULAN AZAD UNIVERSITY, JODHPUR

PRACTICAL 621

ECOLOGY AND ENVIRONMENTAL BIOLOGY MAJOR EXERCISES

1. Determine frequency, density and abundance from quadrat sample sheet.
2. Determine Important Value Index from quadrat sample data.
3. Determine diversity indices from quadrat sample data.
4. Determine carbonate and bicarbonate from water samples
5. Determine chlorosity/salinity from water samples
6. Determine hardness from water samples
7. Determine dissolved oxygen content in water samples

MINOR EXERCISES

1. Determine relative frequency quadrat sample data.
2. Determine relative density quadrat sample data.
3. Determine relative abundance quadrat sample data.
4. Determine soil texture
5. Qualitatively assess nitrate, nitrogen content in soil sample
6. Qualitatively assess available phosphorus content in soil sample
7. Determine water holding capacity of soil sample

SPOTS

1. *Opuntia, Euphorbia* – Xerophytes-Succulents
2. *Capparis, Calligonum, Leptadenia, Parkinsonia*- Xerophytes - True
3. *Atriplex, Chloris*- Halophytes – salt secreting
4. *Suaeda, Salsola* – Halophytes – salt accumulating
5. *Eichhornia, Nymphaea, Hydrilla*- Hydrophytes

RECOMBINANT DNA TECHNOLOGY:

1. Isolation of plasmid DNA from given bacterial culture.
2. Detection of DNA by agarose gel electrophoresis,
3. Demonstrate the PCR.
4. Demonstrate restriction digestion.
5. Demonstrate transformation experiment.

SPOTS:

- Techniques: DNA finger printing, PCR, Electrophoreses, DNA Sequencing (Dideoxy method), microinjection, gene gun, electroporation, genomic and cDNA library,
- Gene cloning vectors: BAC, YAC.
- Ti plasmid (Crown gall)
- GM Crops (golden rice, Bt cotton).

MAULAN AZAD UNIVERSITY, JODHPUR

UG PRACTICAL EXAMINATION Botany (BSBO 621) SEMESTER- VI

Time: 3 hours

Max. Marks: 80

- 1 Perform the Ecology experiment allotted by lots and report the result in suitable form.
 - a. Major experiment 16 marks
 - b. Minor experiment 07 marks

- 2 Perform the Biotechnology experiment allotted by lots.
 - a. Major experiment 16 marks
 - b. Minor experiment 07 marks

- 3 Identify and comment upon the spots 1 to 6 6 x 4 = 24 marks
 - i. _____
 - ii. _____
 - iii. _____
 - iv. _____
 - v. _____
 - vi. _____

9. Viva-voce 10 marks