

17. Transitory provision

PG syllabus revision once in 2 years and afterwards 2 years under transitory provision.

Paper I Plant Diversity I (Algae, Fungi and Lichens)

Contact hours: 6 hrs. /week

Learning Outcomes:

On successful completion of the course, the students will be able to:

- Identify Algae, Fungi and Lichens
- Understand the structural organization of Algae, Fungi and Lichens
- Relate the structure and lifecycle patterns of Algae, Fungi and Lichens
- Appreciate the economic importance of Algae, Fungi and Lichens

Unit I: Classification of Algae (F.E. Fritsch, 1945). Criteria used for algal classification. Range of thallus structure, Life cycle patterns of algae, Phylogeny and Evolutionary trends in algae. General account on the structure and reproduction of algae belonging to Cyanophyceae, Chlorophyceae, Bracillariophyceae, Phaeophyceae and Rhodophyceae.

Unit II: Ecology of Algae: freshwater algae, marine algae, soil algae, symbiotic algae and parasitic algae. Algae as pollution indicators, algal blooms, algicides. Culture and cultivation of fresh water and marine algae. Economic importance of algae: Food and Feed, Agar-agar, Carrageenan, Diatomaceous earth, Iodine, Vitamin, Medicine, Single cell protein and Industrial products.

Unit III: Fungi: General features, occurrence and distribution, mode of nutrition in fungi, culture of fungi, classification of fungi (Alexopoulos and Mims, 1979), recent trends in the classification of fungi. General characters of major classes: Myxomycetes, Oomycetes, Zygomycetes, Ascomycetes, Basidiomycetes and Deuteromycetes (Thallus organization, cell structure and fruiting bodies)

Unit IV: Homothallism and heterothallism in fungi. Homokaryon and heterokaryon. Sex hormones in fungi. Reproduction – Life cycle types, parasexual cycle, reduction in sexuality in fungi. Spore dispersal mechanism. Ecological and Economic importance of fungi.

Unit V: Lichens: A general account of lichens with special reference to their mode of life. Gross and fine structure, nutrition, reproduction, classification; micro-chemical tests for their classification; their economic importance and ecological significance; role of lichens in biological estimation of pollution. Lichens *-in vitro* culture– a detailed study of one or two available species of lichens belonging to *Ascolichen* and *Basidiolichen*.

Practical

1. Critical examination of algal and fungal samples of different classes
2. Micro preparation of lichens

- Illustrate the design of various fermenters and bioreactors
- Explain the process of production of various fermented products

Unit I: Industrially important microorganisms – Screening industrially important microorganisms, thermophilic microorganisms- strain improvement by classical and recombinant methods. Principles fermentation – liquid and solid state fermentations, medium development and industrial scale fermentation.

Unit II: Design of fermenters and bioreactors – Basic fermenter and control of basic fermenter, various designs of fermenters – lift – fixed – bed reactor, fluidized bed reactor, batch, fed batch and fermentation cell and enzyme immobilization.

Unit III: Large scale fermentation and downstream processing – scale up of microbial fermentation. Growth kinetics, effect of pH, temperature, nutrient concentrations. Downstream processing, precipitation, centrifugation, filtration, solvent extraction, chromatographic purification, affinity purification, fermentation economics – cost analysis.

Unit IV: Major products of industrial microbiology – single cell protein and industrial enzymes – analyses & proteases, alcoholic fermentation – beer and wine , antibiotics – penicillin – organic acid – citric acid , amino acid – glutamate, vitamins B12 , biogas production

Unit V: Fermentation of foods, Fermented milk and milk products – food spoilage and methods of preservation.

References

1. Demain, A.L. (et.al) 1999. **Manual of Industrial Microbiology and Biotechnology**. 2nd Edition ASM press.
2. Gerald Reed E/e. 1981. **Prescott and Dunn's Industrial Microbiology**. Chapman & Hall.
3. Michael , J. Waites, 2001. **Industrial Microbiology: An introduction (Illustration)**. Blackwell Science Inc.
4. Stanbury, P.F., Whitaker, A. & Hall, S.J. 2016. **Principles of Fermentation Technology**, Butterworth-Heinemann publications.

SEMESTER – II MAJOR ELECTIVE II BIOFERTILIZERS

Contact hours: 5 hrs. /week

Learning Outcomes:

On successful completion of the course, the students will be able to:

- Familiarize with the basic principle and techniques of Biofarming
- Appreciate the agronomic importance of beneficial micro-organisms
- Formulate, produce and apply Biofertilizers in a pilot scale

Unit I: Biofertilizers - Introduction, scope. A general account of plant growth promoters and regulators – Cyanobacterial Biofertilizer: Algalization – mass cultivation of cyanobacterial biofertilizers.

Unit II: Nitrogen fixing Bacteria: Isolation, characterization, identification, mass cultivation and inoculation method of Rhizobium and Azospirillum. Mechanism of nitrogen fixation (free-living and symbiotic) - Biochemistry and molecular basis of nitrogen fixation.

Unit III: Azolla – Structure and Morphology – Mass cultivation method and Application. Economic and Ecological importance of Azolla.

Unit IV: Phosphate solubilizing Bacteria: Isolation, characterization, identification, mass cultivation and inoculation method of Phosphobacteria. Biochemistry of Phosphate solubilization and mobilization.

Unit V: Mycorrhizal fungi as biofertilizers - Introduction, scope. A general account of Ecto, Endo and Arbuscular mycorrhizae (AM). Isolation and method of inoculation of Arbuscular mycorrhizae (AM), Legume - AM interactions .

Carrier based inoculum production methods and Field application

References

1. **A text book of microbiology**, second reprint. S. Chand and Company• Ltd., New Delhi. Reference Books Ann Larkin Hansen , 2010,
2. Dubey, R. C. 2008. **A Textbook of Biotechnology**. S. Chand & Co., New Delhi.
3. Kannaiyan, S. 2002 **Biotechnology of Biofertilizers**. Narosa publishing house, New• Delhi. Dubey, R.C. 2001.
4. Subba Rao, N. S. 2002. **Soil Microbiology**. 4th ed. Soil Microorganisms and Plant Growth. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
5. **The Organic Farming Manual: A Comprehensive Guide to• Starting and Running a Certified Organic Farm**. Storey Publishing LLC.
6. Niir Board, 2004. **The Complete Technology Book On Bio-Fertilizer And Organic Farming**, National Institute Of Industrial Research, Delhi.

SEMESTER III

Paper VII

TAXONOMY OF ANGIOSPERMS

Contact hours: 6 hrs. /week

Learning Outcomes:

On successful completion of the course, the students will be able to:

- Acquire knowledge on principles of Botanical nomenclature
- Comparative study about different systems of classification
- Describe the salient features of various families belonging to Dicotyledons and Monocotyledons
- Appreciate the modern trends in Taxonomy

*Placed at the meeting of
Academic Council
held on 26.03.2018*

APPENDIX - BL
MADURAI KAMARAJ UNIVERSITY
(University with Potential for Excellence)

**Revised Syllabus for
Environmental Studies (2 Credits)**

**For All U.G. Courses in Fifth Semester w.e.f. 2018 onwards
Semester – V**

Contact classes per week - 2 hours & Contact classes per Semester - 30 hours.

A. Objectives

- To create awareness on Environment, ecosystem, energy flow, food chain, food web and Biogeochemical cycles
- To understand the sustainable agriculture and exploitative human activity in polluting the environment locally and globally
- To provide awareness about issues relating to drinking and driving, Road safety rules and Traffic signals
- To create awareness on disasters through intensive public education
- To create awareness on village adoption towards clean, green infrastructure, education, health, drinking water supply, etc

Plan of Teaching and Evaluation

Allotted hours : Total 30 Hours, 25 hours may be allotted for theory and 5 hours for field study / report writing / internal assessment.

Evaluation Total 100

External 75

Internal 25

Scheme for Internal Exam (for 25 marks)

Field Trip and Report / Case Study and Report (Assignment) 10 Marks

Continuous Assessment Test 5 Marks

Seminar / Quiz / CD 5 Marks

Peer-Team Teaching 5 Marks

Unit I. Earth and its Environment

- a) Earth formation and Evolution of Earth over time – Structure of earth and its components : Atmosphere, Lithosphere, Hydrosphere and Biosphere
- b) Resources – Renewable and Non- renewable resources.

Unit II. Ecology and Ecosystem concepts

- a) Ecology definition – ecosystem – definition – structure and function –energy flow- food chain and food web – one example for an ecosystem
- b) Biogeochemical cycles – Nitrogen, Carbon, Phosphorous, Water

Unit III. Biodiversity and India

- a) Introduction- definition- values of biodiversity- threats to biodiversity- conservation of biodiversity
- b) Biodiversity of India – as a mega diversity nation-bio-geographical distribution – hot spots of biodiversity- national biodiversity conservation board and its function.

Unit IV. Pollution and Global Issues

- a) Definition, causes, effects and control measures of air, water, soil, marine, noise, thermal and nuclear pollution.
- b) Global issues : Global warming and Ozone layer depletion.

Unit V. Development and disaster management

- a) Sustainable Development - sustainable agriculture – organic farming, irrigation – water harvesting and waste recycling – cyber waste and management.
- b) Disaster management – Flood and Drought – Earthquake and Tsunami – Landslides and Avalanches – Cyclones and Hurricanes – Precautions, Warnings rescue and Rehabilitation.
- c) Road safety rules – Traffic signals – Conduct of road safety awareness programme.
- d) Role of the Colleges, Teachers and Students in village adoption towards clean, green and make in villages in various aspects.

Text Books

1. Arumugam, N, 2016, Concepts of Ecology. Saras publication, Nagercoil

Reference Books

1. Odum E.P., 1971, Fundamentals of ecology, W.B. Saunders Company, London.
2. Verma and Agarwal, 2003, Principles of Ecology, S.Chand& Company. New Delhi,
3. Ecology for Environmental science. Biosphere- Anderson J.M. 1981
4. Water pollution and Management- C.K.Varshney, 1984
5. Environmental Biology- P.D.Sharma, 2005
6. Natural disaster-A guide for relief workers- JAC Adliyatmasadhana Kendra.
7. Disaster planning- the preservation of life and property, Foster,H.D
8. India Disaster report: towards a policy initiative, Parasuraman.s, 2000
9. Disaster Management, Mukesh Kapoor, 2009
10. Textbook of Highway and Traffic Engineering, Saxena S.C, 2005
11. Road safety management issues and perspectives, Prabha shastri ranade, 2010
12. Safety and Disaster Management, O.P. Dutta, 2014. Methods, Techniques, Recent Approach, Major Events & Exist Framework Hazardous Material
13. The Indian Ocean Tsunami: The Global Response to a Natural Disaster By Pradyumna P. Karan, Shanmugam P. Subbiah, 2011
14. Village Adoption & Development Programme guidelines, 2016, National Institute of Rural Development & Panchayati Raj (NIRD&PR) Ministry of Rural Development, GoI Rajendranagar Hyderabad – 500030

References

1. Easu, 1987. **The Anatomy of seed plants**. Wiley Eastern Ltd. New Delhi.
2. Fahh, A. 1989. **Plant Anatomy**. Pergamon Press, Oxford, New York.
3. Cutler, D. F. 1978. **Applied Plant Anatomy**. Orient Longman Publishers, New Delhi.
4. Bhojwani, S.S and Bhatnagar, S.P. 2000. **The Embryology of Angiosperms**, Vikas Publishing House Pvt. Ltd. New Delhi.
5. Johri, B.M. 1984. **Embryology of Angiosperms**. Springer Verlag, Berlin.
6. Pandey, A.K. 1997. **Introduction to Embryology of Angiosperms**. CBS Publishers and Distributors, New Delhi.
7. Pandey, S.N. and Chadha, A. 2000. **Embryology**. Vikas Publishing House Pvt. Ltd. New Delhi.
8. Shivanna, K.R. 2003. **Pollen biology and biotechnology**. Oxford and IBH publishing house, New Delhi.
9. Fosket, D. E. 1994. **Plant growth and development - A molecular approach**. Academic Press.
10. Varghese T.M. 1984. **An introduction to Experimental and Applied Embryology of Angiosperms**. Oxford

I - Semester

Paper III

Instrumentation and Biotechniques

Unit I

Basic principles and uses of various microscopes (Light, Compound, Phase Contrast, Scanning, Transmission Electron microscopes and Atomic Force Microscope). Photomicrography and videophoto micrography and image processing. Principles, methods and application; uses of camera lucida, stage and ocular micrometer and Haemocytometer.

Unit II

pH : basic principles, different types of electrodes, measurement of pH, preparation of buffers.
Chromatography: basic principles, types- sephadex, ion exchange- column, thin layer and gas liquid (GC and HPLC)

Unit III

Electrophoresis (SDS, PAGE and Immunoelectrophoresis). Two dimensional Electrophoresis - Instrument used, electrophoresis of proteins: Southern, Northern, Western blotting.

Unit IV

Spectrophotometer: Visible, UV and Fluorescence - Principles, uses of flame photometer, Bomb calorimeter and atomic absorption spectrophotometer, IR, NMR and FTIR.

Unit V

Sterilization techniques; Culture techniques- media preparation, PDA, Nutrient agar, MS medium. Microtomy; biological sample preparation techniques for microscopy.

Practicals

1. Measurement of plant cells using micrometry
2. Preparation of buffer
3. Chromatography - separation of pigments and amino acids - TLC, paper and column.
4. Separation of protein - SDS-PAGE
5. Antigen - antibody reaction in immunoelectrophoresis.
6. Estimation of biomolecules using spectrophotometer.
7. Preparation of culture media
8. Preparation of specimen and sectioning using microtome.

References

1. Plummer, D.T. 1996. **An introduction to practical biochemistry**. Tata Mc Graw Hill
2. Johanson, D. A. 1940. **Plant microtechniques**. Mac Graw Hill
3. Stock, R and Rice, C.B.F. 1980. **Chromatographic methods** Chapman and hall
4. Ruzin, Z.E. 1999. **Plant Microtechnique and Microscopy**. Oxford University Press, New York
5. Gahan, P.B. 1984. **Plant Histochemistry and Cytochemistry**, Academic Press, London.
6. Gary, P. 1964. **Hand Book of basic microtechnique**, John Wiley & Sons, New York.
7. Johanson, W.A. 1984. **Plant Microtechnique**. Mc Graw Hill.

IV SEMESTER

Major Elective III

Optional II Plant Tissue Culture

Unit I

(Science and technology of tissue culture – Definition, scope and its impact - an overview; Laboratory requirements and general techniques; Tissue culture media; Somatic embryogenesis; micropropagation; organ culture.)

★Unit II

Development of transgenic plants – Transformation in plants – *Agrobacterium* mediated direct methods, Vectors in transformation. Biosafety and ethical issues.

Unit III

Role of tissue culture in practical plant breeding; micropropagation: (anther culture, ovule culture, embryo culture and protoplast fusion.)

Unit IV

Commercial plant tissue culture – setting up of a commercial tissue culture unit, Commercial tissue culture units in India, cost management and marketing, commercially available plants, visit to commercial unit. Protocols for commercial production of Banana, Sugarcane and Potato.

Unit V

Practical applications of Plant tissue culture – hybridization; production of haploid plants; production of secondary metabolites; pathogen-free plants; synthetic seeds.

References

1. Razdan, M.K., 1993. *An introduction to plant tissue culture*. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi
2. Bhojwani, S.S. and Razda, M.K. 2004 *Plant Tissue Culture*. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi
3. Ramawat, K.G. 2000. *Plant Biotechnology*. 1st edition, S. Chand and Co. New Delhi.

I Semester

Paper I

Plant Diversity - I (Gymnosperms and Taxonomy of Angiosperms)

Unit I

General characters, distribution, phylogeny, classification (Coulter & Chamberlin) and economic importance of Gymnosperms of the following orders. Pteridospermales, Pentoxylales, Cordaitales, Cycadales, Coniferales and Gnetales.

Unit II

Definition, aims, importance and scope of Taxonomy; Development and phases of classification; Systems of classification - Artificial - Linnaean system. Natural - Bentham and Hooker system. Phylogenetic - Engler and Prantl and Hutchinson, Takhtajan and Cronquist system (Comparative study).

Unit III

Plant nomenclature, Principles and role of ICBN. Effective and Valid publication; type concept and author citation, Retention of names, Publication of names; rules of priority

Unit IV

Modern concepts and trends in Plant taxonomy; Elementary treatment of Cytotaxonomy, Chemotaxonomy, Numerical Taxonomy, Molecular Taxonomy, Cladistics.

Unit V

Study of important taxonomic character and popular examples of the following natural order of Bentham and Hooker Classification - Ranunculaceae, Capparidaceae, Caryophyllaceae, Rhamnaceae, Rosaceae, Lythraceae, Aizoaceae, Apiaceae, Sapotaceae, Gentianaceae, Scrophulariaceae, Bignoniaceae, Verbenaceae, Piperaceae, Loranthaceae, Hydrocharitaceae, Amaryllidaceae, Commelinaceae, Arecaceae and Orchidaceae.

Practicals

Gymnosperms

1. Study of the external features of *Cycas*, *Pinus*, *Araucaria*, *Podocarpus*, *Agathis* and *Gnetum*
2. C.S., R.L.S & T.L.S. of stems
3. Micropreparation of leaves and cone
4. Observation of fossil slides

Angiosperms

1. Preparation of dichotomous keys
2. Solving nomenclatural problems
3. Training the student to use computers for cladogram and dendrograms
4. Identification of families mentioned in the syllabus with the help of floral characters.
5. Submission of minimum 25 herbarium sheets representing different locations
6. Submission of 5 permanent slides from gymnosperms
7. Students must be taken minimum 3 days field trips for herbarium collection.

References

1. Biswas, C. and Johri, B.M. 1999. *The Gymnosperms*. Narosa Publishing House, New Delhi.
2. Chamberlain, C.J. 2000. *Gymnosperms*. C B S Publishers and Distributors, New Delhi.
3. Sporne, K.R. 1986. *Morphology of Gymnosperms*. Hutchinson University Press.
4. Vashishta, P.C. 1999. *Gymnosperms*. S. Chand & Company Ltd. New Delhi.
5. Bhatnagar, S.P. and Moitra, A. 1996. *Gymnosperms*. New Age Int, Pvt. Ltd., New Delhi.
6. Sivarajan V. V. 1991. *Principles of Plant Taxonomy*. Oxford & IBH Publishing Co. Pvt Ltd. New Delhi.
7. Bhattacharya, B. and Johri, B.M. 1996. *Flowering plant- taxonomy and phylogeny*. Narosa Publishing House, New Delhi. 1996.
8. Heywood, V.H. and Moore, D.N. 1994. *Current concepts in plant taxonomy*. Academic Press London.
9. Naik, V.N. 1993. *Taxonomy of Angiosperms*. Tata Mc-Graw-Hill Publishing Company Ltd., New Delhi. 1993
10. Lawrence, G.H.M. 1959. *Taxonomy of vascular plants*. Mac Millan, New York.