

**Programme:** M. Sc. (Botany)

**Course Code:** BOO-324

**Title of the Course:** Mycorrhizal Biotechnology.

**Number of Credits:** 2

**Effective from AY:** 2020-21

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| <b>Prerequisites for the course:</b> | Basic knowledge of Mycology.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                             |
| <b>Objective:</b>                    | To familiarize the students with various aspects of Mycorrhizal fungi, study techniques and their applications.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                             |
| <b>Content:</b>                      | <ol style="list-style-type: none"><li><b>1. Biofertilizers:</b> Definition, types, characteristic features, their role and importance in sustainable agriculture.</li><li><b>2. Mycorrhiza:</b> Definition and historical perspective; Types of mycorrhizae; classification; Phylogeny; general importance.</li><li><b>3. Mycorrhizal Techniques:</b> Isolation and pure culture preparation of ecto- and endo-mycorrhizae; Criteria for identification - generic and specific level; staining techniques; Trap and pure cultures; <i>in vitro</i> culture of AM fungi, commercial production of inoculum.</li><li><b>4. Molecular and cell biology of AM symbiosis:</b> Fungal partner; Model plants in AM research; Cytological features of AM plant roots; Root to fungus signaling in AM symbiosis – Asymbiotic phase, presymbiotic phase and symbiotic phase; Fungus to root signaling in AM symbiosis – Presymbiotic phase and symbiotic phase; Transfer of nutrients between plants and fungi; Defense reaction during colonization; Signaling pathways in AM fungi.</li><li><b>5. Phosphate transport and role of AM fungi:</b> Sources of Phosphorus, P uptake from environment; Plant phosphate transporters; Phosphate transport in AM fungi. (2h)</li><li><b>6. Phytohormones and AM symbiosis:</b> Cytokinins, Gibberellins, Ethylene, ABA, Auxins, Salicylic acid, Jasmonic acid; Role of Jasmonates in mycorrhization.</li><li><b>7. Ecology of AM fungi:</b> Mycorrhiza formation in field soil; effects of N and micronutrients. Microbial interactions, phytoremediation; Effects upon AM fungi – disturbance, agrochemicals and grazing.</li><li><b>8. Production of ectomycorrhizal fungal inocula and inoculation procedures:</b> Types of ectomycorrhizal inocula; Methods of preparation, inoculum procedures.</li><li><b>9. Arbuscular Mycorrhizae in phytoremediation:</b></li></ol> | <p><b>2 hours</b></p> <p><b>2 hours</b></p> <p><b>3 hours</b></p> <p><b>4 hours</b></p> <p><b>3 hours</b></p> <p><b>2 hours</b></p> <p><b>3 hours</b></p> <p><b>3 hours</b></p> <p><b>2 hours</b></p> <p><b>4 hours</b></p> |

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|                            | Phytoremediation – definition, advantages and limitations; Contaminated and uncontaminated soils, heavy metals and their effects in plants; Heavy metal detoxification mechanisms in plants and AM fungi; Phytostabilization and phytoextraction; Glomalin and its role; concepts for improving phytoremediation by plant engineering.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |  |
| <b>Pedagogy:</b>           | Lectures/Assignments/Tutorials/Self study.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |  |
| <b>References/Readings</b> | <ol style="list-style-type: none"> <li><b>Allan, M. F.</b> 1991. The Ecology of Mycorrhizae. Cambridge University Press.</li> <li><b>Bacon, C. W. and White, J. H.</b> 2000. Microbial Endophytes Marcel Dekker, New York.</li> <li><b>Dwivedi, B. K. and Pandey, G.</b> 1994. Biotechnology in India. Allahabad: Bioved Research Society.</li> <li><b>Read, D. J., Lewis, D. H. Fitter, A. H. and Alexander, I. J.</b> 1996. Mycorrhizas in Ecosystems. Oxford University Press.</li> <li><b>Rodrigues, B. F. and Muthukumar, T.</b> 2009. Arbuscular Mycorrhizae of Goa – A Manual of Identification Protocols. Goa University, Goa. 135 pp.</li> <li><b>Schenck, N. C.</b> 1982. Methods and principles of mycorrhizal research. St. Paul Minnesota.</li> <li><b>Schenck, N.C. and Perez, Y.</b> 1990. Manual for the identification of VA mycorrhizal fungi. International Culture Collection of VA Mycorrhizal Fungi. Synergistic Publications, Gainesville, Florida, USA.</li> <li><b>Sylvia, D. M., Hung, L. L. and Graham, J. H.</b> 1987. Mycorrhizae in the next Decade, Practical Applications and Research Priorities. University of Florida. Gainesville, Florida.</li> <li><b>Willis, A., B. F. Rodrigues, and Harris, P.J.C.</b> (2013). The ecology of arbuscular mycorrhizal fungi. Critical Reviews in Plant Sciences 32:1-20.</li> </ol> |  |
| <b>Learning Outcomes</b>   | Better prospects in agro-based industries.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |  |

**Programme:** M. Sc. (Botany)

**Course Code:** BOO-325

**Title of the Course:** Lab in Mycorrhizal Biotechnology.

**Number of Credits:** 1 (24 hours)

**Effective from AY:** 2020-21

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| <b>Prerequisites for the course:</b> | Basic knowledge of Mycology. |  |
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