

Programme: M. Sc. (Botany)

Course Code: BOO-324

Title of the Course: Mycorrhizal Biotechnology.

Number of Credits: 2

Effective from AY: 2020-21

Prerequisites for the course:	Basic knowledge of Mycology.	
Objective:	To familiarize the students with various aspects of Mycorrhizal fungi, study techniques and their applications.	
Content:	<ol style="list-style-type: none">1. Biofertilizers: Definition, types, characteristic features, their role and importance in sustainable agriculture.2. Mycorrhiza: Definition and historical perspective; Types of mycorrhizae; classification; Phylogeny; general importance.3. Mycorrhizal Techniques: 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.4. Molecular and cell biology of AM symbiosis: 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.5. Phosphate transport and role of AM fungi: Sources of Phosphorus, P uptake from environment; Plant phosphate transporters; Phosphate transport in AM fungi. (2h)6. Phytohormones and AM symbiosis: Cytokinins, Gibberellins, Ethylene, ABA, Auxins, Salicylic acid, Jasmonic acid; Role of Jasmonates in mycorrhization.7. Ecology of AM fungi: Mycorrhiza formation in field soil; effects of N and micronutrients. Microbial interactions, phytoremediation; Effects upon AM fungi – disturbance, agrochemicals and grazing.8. Production of ectomycorrhizal fungal inocula and inoculation procedures: Types of ectomycorrhizal inocula; Methods of preparation, inoculum procedures.9. Arbuscular Mycorrhizae in phytoremediation:	<p>2 hours</p> <p>2 hours</p> <p>3 hours</p> <p>4 hours</p> <p>3 hours</p> <p>2 hours</p> <p>3 hours</p> <p>3 hours</p> <p>2 hours</p> <p>4 hours</p>

	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.	
Pedagogy:	Lectures/Assignments/Tutorials/Self study.	
References/Readings	<ol style="list-style-type: none"> 1. Allan, M. F. 1991. The Ecology of Mycorrhizae. Cambridge University Press. 2. Bacon, C. W. and White, J. H. 2000. Microbial Endophytes Marcel Dekker, New York. 3. Dwivedi, B. K. and Pandey, G. 1994. Biotechnology in India. Allahabad: Bioved Research Society. 4. Read, D. J., Lewis, D. H. Fitter, A. H. and Alexander, I. J. 1996. Mycorrhizas in Ecosystems. Oxford University Press. 5. Rodrigues, B. F. and Muthukumar, T. 2009. Arbuscular Mycorrhizae of Goa – A Manual of Identification Protocols. Goa University, Goa. 135 <i>pp</i>. 6. Schenck, N. C. 1982. Methods and principles of mycorrhizal research. St. Paul Minnesota. 7. Schenck, N.C. and Perez, Y. 1990. Manual for the identification of VA mycorrhizal fungi. International Culture Collection of VA Mycorrhizal Fungi. Synergistic Publications, Gainesville, Florida, USA. 8. Sylvia, D. M., Hung, L. L. and Graham, J. H. 1987. Mycorrhizae in the next Decade, Practical Applications and Research Priorities. University of Florida. Gainesville, Florida. 9. Willis, A., B. F. Rodrigues, and Harris, P.J.C. (2013). The ecology of arbuscular mycorrhizal fungi. Critical Reviews in Plant Sciences 32:1-20. 	
Learning Outcomes	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

Prerequisites for the course:	Basic knowledge of Mycology.	
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