

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

**Course Code:** BOO- 505

**Title of the Course:** Fungal Biodiversity, Bioprospecting and Biotechnology

**Number of Credits:** 3

**Effective from AY:** 2020-21

<b>Prerequisites for the course:</b>	Knowledge of fungi and fungal biotechnology at UG Level.	
<b>Objective:</b>	To introduce students to interesting and exciting world of biodiversity of fungi in different ecosystems and habitats, their role in ecosystem functioning, their chemical creativity useful in biotechnology and economy based on industrially important strains.	
<b>Content:</b>	<p><b>1. Evolutionary biology and population genetics of fungi;</b> fungal phylogeny; current status of fungal dimension of global biodiversity; inventory and monitoring methods; Fungi in global ATBI; fungi as friends and foes.</p> <p>Characteristics of diverse fungal habitats; Fungi in terrestrial, marine and freshwater habitats; fungi in tropical ecosystems and extreme environments; Fungi in phyllosphere and phylloplane, Endophytic, rhizosphere and soil fungi; fungal endosymbionts; insect –fungus mutualism.</p> <p><b>Diseases of nurseries and forest trees; diseases of agro- and farm forestry; fungi as biodeteriorating agents in tropics; economic losses due to fungal decomposition; Soil-born pathogens; nematode-trappers; Fungal biodiversity of India. Case studies: fungal biodiversity of Western Ghats, Arabian Sea, Indian Ocean; fungi from alpine and polar regions.</b></p> <p><b>Present knowledge of research in fungal ecology; nutritional modes of fungi-saprotrophs, biotrophs and necrotrophs; role of fungi in ecosystem services.</b></p> <p><b>Fungi and global warming, conservation biology of fungal habitats and fungal resources.</b></p> <p><b>2. Fungal bioprospecting:</b>Chemically creative fungi; screening for industrially useful fungal metabolites; drugs and pharmaceuticals from fungi; Ecotaxonomic approach in chemical screening; primary and secondary products of metabolism; classification of secondary metabolites; primary and secondary screening of antibiotic producers; auxanography; enrichment culture, techniques for strain improvement and Strain development; Industrial fungal strains preliminary and high throughput screening (HST); leads and lead</p>	<b>12 hours</b>

	<p>optimization.</p> <p><b>3. Fungal biotechnology:</b> Fungal biotechnological processes, Principles of fermenter design and operation, types of fermenters, formulation of fermentation medium, analysis of fermentation products.</p> <p>Biotechnological applications of yeast/fungi and their derivatives during history: bread making, alcohol production, applications in medical science, bioconversion and bio-ethanol.</p> <p>Production of antibiotics—beta lactam antibiotics-penicillins and cephalosporins, Organic acids-production of citric acid, fungal enzymes and their industrial applications- alpha amylases, cellulases, xylanases, invertase, proteases, Vitamins, pigments, PUFAs; therapeutic peptides.</p> <p>Production and utilization of fungal biomass; fungi as food and feed; Bakers and industrial yeast; production of alcoholic beverages-beer, wines; production of bread and cheese; Edible fungi; Mycoproteins. Advancement in mushroom cultivation technology; Commercial mushroom species; strain improvement and cultivation; tropical mushrooms and their cultivation; mushroom spawns; nutritional aspects of mushrooms.</p> <p>Fungal biofertilizers and biopesticides, myconematicides.</p> <p><b>Recombinant technology in yeast and fungi:</b> composition of the different types of fungal vectors, selection markers, transformation strategies, yeast surface display, yeast two-hybrid.</p> <p><b>Heterologous gene expression/protein production:</b> Description of the yeast secretion pathway, post-translational modifications (e.g. glycosylation), how to increase gene expression, examples, applications and future perspectives.</p>	<p><b>8 hours</b></p>
<b>Pedagogy:</b>	Lectures/ Tutorials/Seminars/Videos/Moodle Based Assignments/Assignments/Self-Study	<b>16 hours</b>
<b>References/Readings</b>	<p>1.Nair, L. N. (2007). Topics in Mycology and Pathology, New Central Book agency, Kolkata.</p> <p>2.Oliver R. P. and Michael Schweizer (1999). Molecular Fungal Biology, CUP.</p> <p>3.Berry D. R. (1988). Physiology of industrial Fungi, Blackwell Scientific Publishers.</p> <p>4.Zhingiang Ann (2005). Handbook of Industrial</p>	

	<p>Mycology, CRC Press.</p> <p>5. <b>Anonymous</b> (2006). Handbook of the Convention on Biological Diversity, CBD secretariat, earthscan.</p> <p>6. <b>Satyanarayana T. and Johri B.N.</b> (2005). Microbial Diversity, Current Perspectives and Potential Applications, IK international.</p> <p>7. <b>Gregory Michael Mueller, Gerald F. Bills and Mercedes S. Foster</b> (2004). Biodiversity of fungi: inventory and monitoring methods, Academic Press.</p> <p>8. <b>Arora Dilip K.</b> (2004). Fungal biotechnology in agricultural, food, and environmental applications, CRC Press.</p> <p>9. <b>Jan S. Tkacz and Lene Lange</b> (2004). Advances in fungal biotechnology for Industry, Agriculture, and Medicine, Springer.</p> <p>10. <b>Alan T. Bull</b> (2004). Microbial Diversity and Bioprospecting, ASM Press.</p> <p>11. <b>Robson, G. D., Pieter van West and Geoffrey Gadd</b> (Eds.) (2007). Exploitation of Fungi (British Mycological Society Symposia), CUP, 350 pp.</p>	
<b>Learning Outcomes</b>	<ol style="list-style-type: none"> <li>1. Being able to grasp advanced concepts in fungal biotechnology, genomics and proteomics,</li> <li>2. Being able to identify emerging areas of research and development in fungal bioprospecting and biotechnology,</li> <li>3. Better capacity to assist in local fungal biodiversity registers and fungal aspects of ATBI,</li> <li>4. Establish and manage accredited Fungus culture collections and contribute to local efforts of fungi habitat conservation.</li> </ol>	