Name of the Program: M.Sc. Marine Microbiology
Course Code: MMI-530
Title of the Course: Coral Microbiology
Number of Credits: 03
Effective from AY : 2022 - 23

Prerequisites for the course:	It is assumed that students have a basic knowledge of corals- their structure, classification and ecology.	
Objective:	This course focuses on the various characteristics of coral ecosystems including the physico-chemical variables, evolution, survival strategies and associated microbial diversity.	
Content:	**Module I** Introduction to Corals: Coral reef biology - Types of corals, composition, ecology, structure- anatomy and physiology. Types of coral reefs and their global distribution. Factors affecting coral reefs - Abiotic factors: pH, temperature, salinity, sedimentation, wave action, weather conditions, nutrient availability, pollution, aerial exposure, light. Biological factors: competitors, disease, predators, symbiotic relationships, nutrient flux. Natural and human disturbances to reefs and their impacts. Importance of coral reefs - Fisheries and marine products associated with coral reefs. Ecological importance of coral reefs. Cultivation and conservation of corals. Law and policy for conservation and management of corals in India **Module II** Microbial interaction with coral communities: Coral evolution and development - Subsidence theory, Glacial Control Theory, Stand Still Theory, Cycle of Erosion theory. Coral communities and trophic structure. Primary producers (zooxanthellae, turf algae, coralline algae, endolithic algae, phytoplankton, benthic diatoms), consumers, food webs, productivity in coral reefs. Coral and microbiome dynamics - Coral holobiont. Rosenberg's hologenome hypothesis, Adaptive bleaching hypothesis (ABH), Adaptive Dysbiosis hypothesis (ADH), Coral probiotic hypothesis, DDAMed Model, Influence of sponge loop on corals. Symbiotic associations: Algal-coral associations, bacterial symbiosis, Multi-partner symbiosis. Nutrient cycling. **Module III** Diagnosis and recovery of diseased/damaged corals:	15 hrs 15 hrs

	Microbial causative agents associated with coral diseases - Bacterial infections (Black band disease, Yellow band disease, White band disease, White plague, White patch disease, Lethal Orange Disease**,** bacterial bleaching); Fungal infections (Aspergillosis); Viral infections; Protozoic infections (Brown band disease, Skeletal eroding band). Coral disease spread assessment, treatment and recovery - Coral disease survey and monitoring protocols. Disease response plan. Outbreak management. Use of antibiotics and anti-oxidants for treating diseased corals. Phage therapy. Coral Restoration and Health Consortium (CRHC).	15 hrs
Pedagogy:	Lectures/ assignments/ self-study	
References/ Readings:	1. Sheppard C., Davy S., Pilling G. & Graham N. (2018). The Biology of Coral Reefs (2nd edn). Oxford University Press. USA. 2. Munn C.B. (2019). Marine Microbiology: Ecology and Applications, CRC Press. Florida. 3. Jones O.A. & Endean R. (1973). Biology and Geology of coral reefs (1st edn). Academic Press. Cambridge. 4. Van Oppen M. J. H. & Blackal L. L. (2019). Coral microbiome dynamics, functions and design in a changing world. Nature Reviews Microbiology. 17: 557–567. 5. Van Oppen M. J. H. et al. (2015). Building coral reef resilience through assisted evolution. PNAS. 112 (8): 2307-2313. 6. Chakravarti L. J., Van Oppen M. J. H. (2018). Experimental Evolution in Coral Photosymbionts as a Tool to Increase Thermal Tolerance. Frontiers in Marine Science. 5 :227. 7. Contardi M. et al. (2020) Treatment of coral Wounds by combining an Antiseptic Bilayer film and an injectable Antioxidant Biopolymer. Scientific Reports.10: 988.	
Course Outcomes:	1. Understand the biodiversity of corals and their interactions. 2. Describe coral ecosystem function and examine its economic implications. 3. Indicate the physico-chemical and biological factors influencing coral ecology. 4. Create awareness of the impact of anthropogenic activities on coral health.	

	5. Identify microbial infections in corals and understand their epidemiology. 6. Survey the conservation and management strategies of damaged corals and their recovery.	