

Programme: M.Sc. (Marine Microbiology)

Course Code: MMO 103

Title of the Course: POLAR MICROBIOLOGY

Number of Credits: 4

Effective from Academic Year: 2018-19

Prerequisites	An in-depth understanding of the concepts of marine microbiology is necessary.	
Objective:	This course highlights the unique characteristics of polar environments (the Arctic, Antarctic and the Southern Ocean), with emphasis on their microbial ecology, diversity, community interactions, and response to climate change.	
Content:		
1.	Polar environments (Arctic region, Antarctic region and the Southern Ocean), polar econiches (dry valleys, ornithogenic soils, permafrost, cryoconites, sea ice, glaciers, lakes); microbial ecology, strategies to isolate and characterize polar microorganisms.	(16)
2.	Microbial diversity and factors influencing microorganisms in polar environments: Archaea – <i>Thaumarchaeota</i> ; Bacteria – <i>Glaciecola psychrophila</i> , <i>Pseudoalteromonas haloplanktis</i> , <i>Marinomonas polaris</i> ; cyanobacteria – <i>Oscillatoria</i> ; fungi and yeast - <i>Glaciozyma antarctica</i> , and diatoms - <i>Fragilariopsis cylindrus</i> ; cellular, structural and physiological characteristics, community interactions and food webs, geochemical cycling. Biotechnological importance of polar microorganisms: psychroenzymes, anti-freeze proteins, novel antibiotics and other bioactive compounds.	(16)
3.	The effects of global warming and ocean acidification on polar ecosystems, effects of iron fertilization on productivity and carbon export in the High-Nutrient-Low-Chlorophyll (HNLC) regions of the Southern Ocean and its impact on the Antarctic region.	(16)
Pedagogy:	Lectures/tutorials/assignments/self-study/case-studies	
References/ Readings	Bathmann, U. (2005) Ecological and biogeochemical response of Antarctic ecosystems to iron fertilization and implications on global carbon cycle, Ocean and Polar Research, 27(2): 231-235.	
	Bej, A. K., Aislabie, J. and Atlas, R. M., Polar Microbiology: The ecology, biodiversity and bioremediation potential of microorganisms in extremely cold environments, CRC Press.	

	D'Amico, S., Collins, T., Marx, J. C., Feller, G., Gerday, C. (2006) Psychrophilic microorganisms: challenges for life, EMBO Reports, 7(4): 385-389.
	Duarte, C. M., Impacts of global warming on polar ecosystems, Fundacion BBVA.
	Margesin, R., Miteva, V. (2011) Diversity and ecology of psychrophilic microorganisms, Research in Microbiology, 162: 346-361.
	Miller, R. V. and Whyte, L. G., Polar Microbiology: Life in a Deep Freeze, ASM Press, Washington, DC.
	Smetacek, V., Nicol, S. (2005) Polar ocean ecosystems in a changing world, Nature Insight Reviews, 437: 362-368.
Learning Outcomes	1. Explain the uniqueness of the polar environment. 2. Apply the concepts learned to understand the sensitivity of polar environments to climate change.