MMC 204 – Marine Microbiology I
Course credit: 4 – Three credits theory and one credit practical

Theory **(Contact Hours)**

1 **(15)**

1.1 Introduction to oceanography: the world's oceans and seas, properties of seawater, physico-chemical factors in the marine environment such as temperature, density, nutrients, salinity, dissolved gases, waves, tides, oceanic currents, Ekman transport and upwelling; oceanic phenomena such as Coriolis effect, eddies, gyres, El Nino Southern Ocean (ENSO), El Nino, La Nina.

1.2 Marine microbial habitats: estuaries, mangroves, salt marshes, beach and coastal ecosystems, reef and coral reefs, water column, sediments.

2 **Marine microbes: their growth, physiology and contribution to ocean processes** **(15)**

2.1 Modes of microbial growth: viable but non-culturable (VBNC) microorganisms, biofilms, microbial mats, epibiosis

2.2 Physiology of marine microbes: metabolic diversity and energy-yielding processes: microbial loop; marine snow; phototrophy and primary productivity, fermentation, aerobic respiration, anaerobic respiration (denitrification, sulphate reduction, methanogenesis); nitrification, annamox, sulphur oxidation, methanotrophy; carbon dioxide fixation in autotrophs; the role of microorganisms in biogeochemical cyling: carbon, nitrogen, phosphorous, sulphur, iron, manganese.

3 **Methods in marine microbiology** **(15)**

3.1 Sampling equipment: water samplers such as Niskin sampler, Hydro-Bios sampler, Rosette samplers; sediment samplers such as van Veen grabs and corers

3.2 Analysis of primary productivity: the radiocarbon method

3.3 Analysis of bacterial productivity: the thymidine uptake method

3.4 Measurement of respiration rates: light-dark bottle method

3.5 Tools to study marine microbial diversity: flow cytometry (bacteria, picoplankton, picoeukaryotes, viruses); molecular approaches such as metagenomics, community fingerprinting and Fluorescence in situ hybridization (FISH).

Practicals **(45)**

1 Isolation and identification of microbes from mangroves, coastal waters and sediments with special emphasis on sample collection methodology, collection trips in boats/ trawlers
2 Assessment of salt requirement of marine isolates from different ecosystem
3 Analysis of physico-chemical parameters
4 Study of biofilm microorganisms
5 Hydrolytic enzyme profiling of the marine bacterial isolates
6 Nitrification and denitrification by the marine bacterial isolates

Reference Books

1 Hunter-Cevera, J., Karl, D. and Buckley, M., Marine Microbial Diversity: the key to Earth's habitability, American Academy of Microbiology.

2 Mitchell, R. and Kirchman, D. L. Microbial Ecology of the Oceans, Wiley-Blackwell Publishers.

3 Belkin, S. and Colwell, R. R., Ocean & health: Pathogens in the Marine Environment, Springer.

4 Meller, C. B. and Wheeler, P. A., Biological Oceanography, Wiley-Blackwell Publishers

5 Munn, C. Marine Microbiology: ecology and applications, Garland Science, Taylor and Francis group, N.Y.

6 Oliver, J. D. (1982) Taxonomic scheme for the identification of marine bacteria by Deep Sea Research Part A. Oceanographic Research Papers, 29 (6): 795 -798.