MMC 202 – Archaea- Ecology, Physiology, Biochemistry and Genetics
Course credit: 4 – Three credits theory and one credit practical

Theory **(Contact Hours)**

1

1.1 Emergence of Archaeobacteria and the domain Archaea: Three major lineages of life – Archaea, Eubacteria, Eukarya Similarities and dissimilarities - Archaea, eubacteria and eukaryotes Uniqueness of archaebacteria v/s other Extremophilic microorganisms **(01)**

1.2 Significance of Archaea: **(02)**
Biotechnology, Biogeochemical cycling, Evolutionary developments

1.3 Ecology, physiology and diversity of Archaea **(03)**
Global econiches; Culture – Retrieval- methods, novel samplers, Non-culture-methods. Preservation
Nutrition, Growth and growth kinetics and physiological versatility, Stress Response, Methanogens (*Methanobacterium thermoautotrophicum*); Halophiles (*Halobacterim halobium*); Thermophiles (*Thermoplasma*) and Thermoacidophiles (*Sulfolobus*).

1.4 Cell structure and architecture of Archaea: **(09)**
Cellular organization - cell morphotypes, cell envelopes, Purple membrane, cell organelles - ribosomes, appendages; molecular organization
Novel bio-molecules: GDEMs and macrocyclic lipid, enzymes, Co- enzymes Methanopterin, formaldehyde activation factor, Component B, Coenzyme M, F420, F430, corrinoids. DNA Binding and Repair proteins

2 Metabolism and energetics of Archaea **(15)**

2.1 Modified anabolic pathways. (carbohydrates, lipids), Methanogenesis and acetoclastic reactions

2.2 Modified Central metabolic pathways including C1, C3 compounds. Incomplete TCA; Carbon dioxide reduction pathways

2.3 Bioenergetics: (i) respiration driven (ii) light driven (iii) chloride driven (iv) cation driven ATP synthesis. Anaerobiosis.

2.4 Bacterioruberin pathway

2.5 Lipid synthesis

3 Genome of Archaea **(15)**

3.1 Size of genome, G + C content, associated proteins

3.2 FI-DNA, FII-DNA,Plasmids, IS elements, AT-rich-islands.
Modifications in tRNA and rRNA structure. Novel 7S rRNA. Signature sequences. DNA Replication, Recombination and DNA Repair in archaea

3.3 Gene organization in Archaea: (i) fdh operon (ii) his operon (iii) bob operon (iv) mcr operon.

3.4 Archaeal virus like particles and phages.

Practicals **(45)**

1 Isolation and Culturing of Archaea

2 Identification of isolate:

a Analysis of morphological features by SEM.

b Cellular lipids - Extraction and chromatographic resolution of lipids

3Bioprospecting for hydrolytic enzymes / for Archaeocin

Reference Books

1 The Bacteria: A Treatise on Structure and Function. Archaebacteria, vol. 8, pp. 525–544, Woese C. R. and Wolfe R. S. (eds), Academic Press.

2 Archaea: New Models for Prokaryotic Biology edited by Paul Blum, Beadle Caister (Academic Press).

3 Archaea: Evolution, Physiology, and Molecular Biology edited by Garrett and Klenk (Amazon.com)

4 Archaea: Molecular and Cellular Biology, model archaea, archaeal genomes, other haloarchaea, archaeal flagella (Amazon.com)