Name of the Program: M.Sc. Marine Microbiology
Course Code: MMI-502
Title of the Course: Microbial Biochemistry
Number of Credits: 03
Effective from AY : 2022 - 23

Prerequisites for the course:	The student should be familiar with the different biomolecules and their metabolism.	
Objective:	To provide in depth knowledge about characteristics, properties and biological significance of the biomolecules of life and energetics and regulation of different metabolic processes in microorganisms.	
Content:	**Module I** Biological Molecules: Proteins - Amino acids: features and properties. Protein structure, principles of separation and purification, molecular weight determination; sequencing and synthesis. Enzymes: activity, inhibition, mechanism of action. Carbohydrates – Monosaccharides, Disaccharides, oligosaccharides, polysaccharides: types, characteristics, properties and biological significance. Lipids - Fatty acids: saturated and unsaturated, structure and properties. Lipid composition of microorganisms and biological significance. **Module II** Metabolic pathways: Carbohydrate metabolism - Central pathways of metabolism – regulatory mechanisms, bioenergetics and significance – EMP, TCA cycle (glucose aerobic and anaerobic metabolism, malate metabolism), Glyoxylate cycle. Gluconeogenesis from TCA intermediates / amino acids / acetyl-CoA; biosynthesis of polysaccharides and sugar interconversions. Lipid Metabolism - Anabolism: Biosynthesis of fatty acids: saturated and unsaturated, triglycerides, phospholipids. Amino Acid and Nucleotide Biosynthesis - Amino acid biosynthetic pathways and their regulation. Purine and pyrimidine nucleotides, Deoxyribonucleotides: biosynthesis and regulation. Biosynthesis of nucleotide coenzymes. **Module III** Mechanisms involved in Photosynthesis and Chemosynthesis: Photosynthetic Metabolism - Organisms and photosynthetic pigments, fundamental processes in Photosynthesis. Photosynthetic electron	15 hrs 15 hrs

	transport and photophosphorylation. Alternative pathways for carbon fixation in autotrophs: Calvin Benson cycle, Reverse TCA, Hydroxypropionate pathway. Chemosynthesis - Organisms, substrates, bioenergetics of metabolism. Osmoregulation: Salt-in-cytoplasm mechanism, Organic-Osmolyte mechanism, Proton-motive force, Osmolyte transporters, Osmosensing.	15 hrs
Pedagogy:	Lectures/ assignments/ self-study	
References/ Readings:	1. Cox M.C., Freeman W.H., & Nelson D.L. (2004). Lehninger Principles of Biochemistry (4th edn), W. H. Freeman & Co. New York. 2. Foster J.W., & Spector M.P. (2002). Microbial Physiology (4th edn), A. John Wiley & Sons Inc. Publication. New York. 3. Voet D., Voet J.G. & Pratt C.W. (2012). Principles of Biochemistry (4th edn), John Wiley and Sons Inc. New York. 4. Murray R.K., Bender D.A., Botham K.M., Kennelly P.J., Rodwell V.W. & Weil P.A. (2018). Harper's Illustrated Biochemistry (31st edn), The McGraw-Hill Companies, Inc. NewYork. 5. Kunte H.J. (2006). Osmoregulation in Bacteria: Compatible Solute Accumulation and Osmosensing. Environ. Chem. 3 : 94–99. doi:10.1071/EN06016	
Course Outcomes:	1. Identify various biomolecules and their importance in microbial physiology. 2. Differentiate various metabolic pathways and study their bioenergetics. 3. Analyze the regulation of the biochemical pathways. 4. Discuss various carbon fixation pathways in marine microbes.	