Semester I

Core Courses

Title of the Course: MICROBIAL BIOCHEMISTRY [T]

Course Code: MIC-500
Number of Credits: 3, Theory
Contact hours: 45
Effective from Academic Year: 2022-23

Prerequisites	The student should be familiar with the different biomolecules and their metabolism.	
Objective:	This course deals with the characteristics, properties and biological significance of the biomolecules of life. In depth knowledge of the energetics and regulation of different metabolic processes in microorganisms.	
Content:		
1.	**Biological Molecules**	**(15)**
1.1	**Protein**	**8**
A.	Amino acids: features and properties.	
B.	Protein: structure, principles of separation and purification, molecular weight determination; sequencing and chemical synthesis.	
C.	Enzymes: activity, inhibition, mechanism of action; regulatory – allosteric and covalently modulated enzymes and their significance in metabolism.	
1.2	**Carbohydrate**	**4**
A.	Monosaccharides: types, characteristics and properties.	
B.	Disaccharides, oligosaccharides, polysaccharides – biological significance.	
1.3	**Lipid**	**3**
A.	Fatty acids: saturated and unsaturated, structure and properties.	
B.	Lipids: classification, structure (phospholipids, sphingolipids), properties; biological significance; lipid composition of microorganisms.	
2.	**Bioenergetics and Carbohydrate Metabolism**	**(15)**
2.2	**Bioenergetics**	**3**
	Thermodynamics, exergonic and endergonic reactions, redox potential, high energy compounds, ATP structure and significance.	
2.3	**Oxidative Phosphorylation**	**3**
	Redox enzymes, aerobic electron transport and oxidative phosphorylation, Proton Motive Force	
2.1	**Carbohydrate metabolism**	**9**
A.	Carbohydrates: Central pathways of metabolism – regulatory mechanisms, bioenergetics and significance – EMP, TCA cycle (glucose aerobic and anaerobic metabolism, malate metabolism), Homolactic	

	and Heterolactic acids pathway, Glyoxylate cycle. Utilization of sugars such as lactose, galactose, maltose and of polysaccharides such as starch, glycogen, cellulose, pectin.	
B.	Gluconeogenesis from TCA intermediates / amino acids / acetyl-CoA; biosynthesis of polysaccharides (Peptidoglycan, starch and glycogen) and sugar inter-conversions.	
3.	**Lipids, Amino Acids, Nucleotides and other Metabolic Paths**	**(15)**
3.1	**Lipid Metabolism**	**4**
A.	Catabolism: Oxidation of fatty acids and the bioenergetics involved.	
B.	Anabolism: Biosynthesis of fatty acids: saturated and unsaturated, triglycerides, phospholipids, sterol.	
3.2	**Amino Acid and Nucleotide Biosynthesis**	**4**
A.	Amino acid biosynthetic pathways and their regulation.	
B.	Purine and pyrimidine nucleotides, Deoxyribo nucleotides: biosynthesis and regulation.	
C.	Biosynthesis of nucleotide coenzymes.	
3.3	**Photosynthetic Metabolism**	**3**
A.	Microorganisms and photosynthetic pigments, fundamental processes in Photosynthesis.	
B.	Photosynthetic electron transport; Oxygenic and anoxygenic Photosynthesis; photophosphorylation.	
3.4	**Bioenergetics of Chemolithotrophic microorganisms**	2
3.5	**Antimetabolites of Microbial Origin**	2
	Structure, biosynthesis, types and mechanism of action	
Pedagogy:	Lectures/tutorials/assignments	
References/ Readings	Berg, J.M., Tymoczko, J.L., Gatto, G.J. and Stryer, L. Biochemistry. W. H. Freeman & Company. (2018)	
	Bull, A. T. and Meadow, P., Companion to Microbiology, Longman Group Limited, New York. (1978)	
	Jayaraman, J., Laboratory Manual in Biochemistry, John Wiley & Sons, Limited, Australia. (1981)	
	Lehninger, A., Cox, M. and Nelson, D. L., Principles of Biochemistry, W. H. Freeman & Company. (2021)	
	Moat, A. G., Foster, J. W. and Spector, M. P., Microbial Physiology, A. John Wiley & Sons Inc. Publication. (2003)	
	Murray, R. K., Bender, D. A., Botham, K. M., Kennelly, P. J., Rodwell, V. W. and Weil, P. A., Harper's Illustrated Biochemistry, The McGraw-Hill Companies, Inc. (2018)	
	Plummer, D. T., An Introduction to Practical Biochemistry, Tata McGraw Hill Publishing Company. (2001)	
	Sadasivam, S., Manickam, A., Biochemical Methods, New Age International (P) Limited. (2007)	

	Voet, D., Voet, J. G. and Pratt, C. W., Principles of Biochemistry, John Wiley and Sons Inc. (2018)	
Course Outcomes	● Apply the principles of biochemical processes to microbial physiology. ● Demonstrate the regulation of the biochemical pathway. ● Discriminate metabolic processes applicable to various biomolecules of the microbial origin. ● Explore microorganisms for their microbial products.	