Name of the Program: M.Sc. Marine Microbiology
Course Code: MMI-604
Title of the Course: Microbial Growth and Enzyme Kinetics
Number of Credits: 03
Effective from AY: 2022 - 23

Prerequisites for the course:	Students should have undergone M.Sc. Marine Microbiology/Marine Biotechnology Part I Courses.	
Objective:	Development of concepts in microbial enzymology and the microbial processes used in industries to produce microbial products.	
Content:	**Module I** Microbial growth kinetics. Batch kinetics: Monod's model (single substrate), deviations from Monod's model, dual substrates, multiple substrates, substrate inhibition, product synthesis (primary and secondary metabolite), toxic inhibition, death constant. Fed-batch kinetics: fixed volume, variable volume and cyclic fed-batch, applications and examples. Continuous cultivation system: relationship between specific growth rate (μ) and dilution rate, comparison between various cultivation systems. **Module II** Enzyme kinetics: Michaelis - Menten Equation, Line-Weaver Burk plot for one substrate reactions, significance of V_{max} and K_m. Enzyme turnover: K_s and K_d, its measurement and significance, mechanism of enzyme degradation and reversible and irreversible inhibition: competitive, uncompetitive and non-competitive. **Module III** Enzyme catalysis mechanisms, identification of functional groups, factors affecting catalytic efficiency, proximity and orientation effects. Enzyme regulation: control of activity, availability of substrate and inhibitor or enhancer molecules, change in the covalent structure of enzyme. Regulatory enzymes: Allosteric (aspartate transcarbamylase) and covalently modulated enzymes (glycogen phosphorylase, glutamine synthetase); Mechanism of action and their significance in metabolism. Zymogens and isozymes. Multienzyme systems: disassociated system (catabolic enzymes), multienzyme complex (pyruvate dehydrogenase); membrane-bound system (electron carrying enzymes).	15 hrs. 15 hrs. 15 hrs.
Pedagogy:	Lectures/ assignments/ self-study.	

References/ Readings:	1. Stanbury, P. F., Whitaker, A., & Hall, S. J. (2005). *Principles of fermentation technology*. (Third Edition), Butterworth-Heinemann Publishers. 2. Flickinger, M. C., & Drew S. W. (2002). The *encyclopedia of bioprocess technology: Fermentation, biocatalysis and bioseparation*, Vols. 1 - 5, New Jersey: John Wiley Publishers. 3. Atkinson, B., & Mavituna, F. (1992). *Biochemical engineering and biotechnology handbook*. (Second Edition), Stockton Press. 4. Lehninger, A. L., Nelson, D. L., & Cox, M. M. (2008). *Principles of biochemistry*. (Fifth Edition), New York: Worth Publishers. 5. Dixon, M., & Webb, E. C. (2014). *Enzymes*. (Second Edition) Elsevier. 6. Price N. C., & Stevens, L. (2009). *Fundamentals of enzymology*. (Third Edition), Oxford University Press.	
Course Outcomes:	1. Differentiate microbial growth kinetics based on nutrient availability. 2. Discuss factors responsible for extracellular enzyme activity. 3. Analyse regulation of enzymes under different cellular environments.	