

**Programme: M.Sc. (Microbiology)**

**Course Code: MITC-403**

**Title of the Course: TECHNIQUES AND INSTRUMENTATION IN MICROBIOLOGY [T]**

**Number of Credits: 3, Theory**

**Contact hours: 45**

**Effective from Academic Year: 2022-23**

<b>Prerequisites</b>	The student should be familiar with the concepts in chemistry and Microbiology.	
<b>Objective:</b>	This course develops the concepts of methodology and instruments involved in studying the different components of microbial cells and their products.	
<b>Content:</b>		
<b>1.</b>		<b>(15)</b>
<b>1.1</b>	<b>Chromatographic techniques:</b>	
	Gas Chromatography (GC), High Performance Liquid Chromatography (HPLC), detectors, column/s matrix- Ion-exchange, affinity and molecular exclusion. (using examples for separation of microbial lipids, fatty acids, pigments, nucleic acids and proteins/enzymes).	
<b>1.2</b>	<b>Centrifugation:</b>	
	Principles, methodology, application, types: low speed, high speed and Ultracentrifugation (preparative and analytical) Density gradient centrifugation; Differential centrifugation	
<b>1.3</b>	<b>Spectroscopy:</b>	
	Atomic Absorption Spectrophotometry (AAS), UV-Visible, fluorimetry, Fourier transformation infra-red spectroscopy (FTIR), NMR, MS:MALDI-TOF.	
<b>2.</b>		<b>(15)</b>
<b>2.1</b>	<b>Microscopy:</b>	
	Phase Contrast, Epifluorescence filter technique (DEFT), SEM, TEM, Confocal and AFM.	
<b>2.2</b>	<b>Radio-isotope and tracer techniques:</b>	
	Isotope and types of isotopes, Radio-activity counters, Autoradiography, Radiorespirometry.	
<b>2.3</b>	<b>Cell and tissue culture techniques:</b>	
	Biohazards and Biosafety cabinet; Primary and secondary/established cell lines, Monolayer and suspension cultures, Fluorescence activated	

	cell sorting (FACS).	
<b>3.</b>		<b>(15)</b>
<b>3.1</b>	<b>Electrophoretic technique:</b>	
	PAGE, IEF, Agarose gel electrophoresis, PFGE, DGGE, TGGE, Capillary electrophoresis, Single stranded conformation polymorphism (SSCP), Electroporator, Micro-array technique.	
<b>3.2</b>	<b>Isolation of cell organelles:</b>	
	Different methods of cell lysis/ breakage and isolation and purification of various cell organelles - Cell surface structures, cell envelopes, plasma membranes, peptidoglycan, Outer membrane, ribosomes, protoplasts, vesicles, spheroplast, DNA, RNA. Separation of ribosomal subunits of bacteria	
<b>3.3</b>	<b>Other Bio-Instrumentation Techniques:</b>	
	X-ray diffraction, Oxygen analyser, Biosensors.	
<b>Pedagogy:</b>	Lectures/tutorials/assignments/self-study	
<b>References/ Readings</b>	Ahora MP. Biophysics, Himalaya Publishing House, New Delhi	
<b>(Latest Edition)</b>	Bajpai P.K. Biological Instrumentation & methodology, 2 <sup>nd</sup> revised edition, S.Chand and Co.	
	Cooper, T. G., The Tools of Biochemistry, Wiley India Pvt. Ltd.	
	Colowick, S. P. and Kaplan, N. O., Methods in Enzymology, Vol. VI, Academic Press, N.Y.	
	Goswami, C., Paintal, A. and Narain, R., Handbook of Bioinstrumentation, Wisdom Press, New Delhi.	
	Jayaraman, J., Laboratory Manual in Biochemistry, John Wiley & Sons Limited, Australia.	
	Mahesh S. Biotechnology-3. Including Molecular Biology and Biophysics, New Age International Pvt. Ltd Publishers, New Delhi	
	Norris, J. R. and Ribbons, D. W., Methods in Microbiology, Volume 5, Part B, Academic Press.	
	Parakhia, M. V., Tomar, R. S., Patel, S. and Golakiya, B. A., Molecular Biology and Biotechnology: Microbial Methods, New India, Pitampura.	
	Sambrook, J., Fritsch, E. F. and Maniatis, T., Molecular Cloning: A Laboratory Manual, Cold Spring Harbor Laboratory Press, USA.	
	Wilson, K. and Walker, J., Principles and Techniques of Biochemistry and Molecular Biology, Cambridge University Press, N.Y., USA.	
<b>Learning Outcomes</b>	Understand the use of various techniques and instruments involved in the study of microorganisms and their products.	