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

Course Code: MIC-504

Number of Credits: 3, Theory

Contact hours: 45

Effective from Academic Year: 2022-23

Prerequisites	The student should be familiar with the concepts in chemistry and Microbiology.	
Objective:	This course develops the concepts of methodology and instruments involved in studying the different components of microbial cells and their products.	
Content:		
1.		**(15)**
1.1	**Chromatographic techniques:**	**5**
	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).	
1.2	**Centrifugation:**	**5**
	Principles, methodology, application, types: low speed, high speed and Ultracentrifugation (preparative and analytical) Density gradient centrifugation; Differential centrifugation	
1.3	**Spectroscopy:**	**5**
	Atomic Absorption Spectrophotometry (AAS), UV-Visible, fluorimetry, Fourier transformation infra-red spectroscopy (FTIR), NMR, MS:MALDI-TOF.	
2.		**(15)**
2.1	**Microscopy:**	**5**
	Phase Contrast, Epifluorescence filter technique (DEFT), SEM, TEM, Confocal and AFM.	
2.2	**Radio-isotope and tracer techniques:**	**5**
	Isotope and types of isotopes, Radio-activity counters, Autoradiography, Radiorespirometry.	
2.3	**Cell and tissue culture techniques:**	**5**
	Biohazards and Biosafety cabinet; Primary and secondary/established cell lines, Monolayer and suspension cultures, Fluorescence activated cell sorting (FACS).	
3.		**(15)**
3.1	**Electrophoretic technique:**	**6**
	PAGE, IEF, Agarose gel electrophoresis, PFGE, DGGE, TGGE, Capillary electrophoresis, Single stranded conformation	

	polymorphism (SSCP), Electroporator, Micro-array technique.	
3.2	**Isolation of cell organelles:**	**6**
	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	
3.3	**Other Bio-Instrumentation Techniques:**	**3**
	X-ray diffraction, Oxygen analyser, Biosensors.	
Pedagogy:	Lectures/tutorials/assignments/self-study	
References/ Readings	Arora MP.Biophysics, Himalaya Publishing House, New Delhi (2020)	
	Bajpai P.K. Biological Instrumentation & methodology, 2nd revised edition, S.Chand and Co. (2010)	
	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. (2013)	
	Goswami, C., Paintal, A. and Narain, R., Handbook of Bioinstrumentation, Wisdom Press, New Delhi. (2011)	
	Jayaraman, J., Laboratory Manual in Biochemistry, John Wiley & Sons Limited, Australia. (2011)	
	Mahesh S. Biotechnology-3. Including Molecular Biology and Biophysics, New Age International Pvt. Ltd Publishers, New Delhi. (2018)	
	Norris, J. R. and Ribbons, D. W., Methods in Microbiology, Volume 5, Part B, Academic Press. (1971)	
	Parakhia, M. V., Tomar, R. S., Patel, S. and Golakiya, B. A., Molecular Biology and Biotechnology: Microbial Methods, New India, Pitampura. (2010)	
	Sambrook, J., Fritsch, E. F. and Maniatis, T., Molecular Cloning: A Laboratory Manual, Cold Spring Harbor Laboratory Press, USA. (2012)	
	Wilson, K. and Walker, J., Principles and Techniques of Biochemistry and Molecular Biology, Cambridge University Press, N.Y., USA. (2018)	
Course Outcomes	◆ Describe the various techniques and instruments used in study of microoganisms, metabloites, etc. ◆ Interpret the observations collected using various techniques and instruments. ◆ Outline the procedures and techniques used in investigation of microorganisms, metabolite, etc ◆ Plan the strategies for analysis of microbial products.	