5.	Application of other software (graphpad / systat) for statistical analysis	
Pedagogy:	Experiments in the laboratory, data collection and processing.	
References/ Readings	As given under respective Theory Course MITC-404	
Learning outcomes	Able to collect, handle, process and present the microbiology-related data. Apply the principles of statistics to biological experiments.	

Programme: M.Sc. (Microbiology)
Course Code: MITC-405
Title of the Course: MICROBIAL TAXONOMY AND SYSTEMATICS [T]
Number of Credits: 3, Theory
Contact hours: 45
Effective from Academic Year: 2022-23

Prerequisites	It is assumed that students should have a basic understanding of binomial nomenclature, the basis of classification systems and be familiar with the distinguishing features of different groups of microorganisms.	
Objective:	To introduce the concepts, tools and techniques of taxonomy and systematics of the microbial world. To introduce the salient features of various microbial groups and their underlying diversity.	
Content:		
1.		**(30)**
1.1	**Microbial taxonomy and systematics** Concepts of taxonomy (characterization, classification and nomenclature) and systematics; binomial classification and taxonomic hierarchy of microorganisms, three domain, six-kingdom, 8-kingdom systems, Endosymbiotic theory.	
1.2	**Phenotypic characters** - Morphology, Biochemical tests (e.g. API, BIOLOG), Bacteriophage typing, Serotyping.	
1.3	**Chemotaxonomic markers** - Cell wall components, lipid composition, cellular fatty acid (FAME analysis), isoprenoid quinones, protein profiles (e.g. MALDI-TOF), cytochrome composition, polyamines.	
1.4	**Nucleic acid based techniques** – T-RFLP, G+C content (T_m and HPLC); 16S rRNA / 18S rRNA / ITS gene sequencing; phylogenetic analysis; DNA-DNA hybridization; DNA barcoding.	
1.5	Concepts of species, numerical taxonomy and polyphasic taxonomy.	
2.	Salient features of phylum, class and orders with representative examples of the following – Archaea, Eubacteria (bacteria, cyanobacteria, actinomycetes), Mycota, Protista (algae, protozoa, diatoms); and viruses.	**(15)**

Pedagogy:	Lectures/tutorials/assignments	
References/ Readings	Barlow, A., The prokaryotes: A Handbook on the Biology of Bacteria: Ecophysiology, Isolation, Identification, Applications, Volume 1, Springer-Verlag.	
(Latest editions)	Goodfellow, M. and Minnikin, D. E., Chemical Methods in Bacterial Systematics, The Society for Applied Bacteriology. Technical Series No. 20, Academic Press.	
	Goodfellow, M., Mordarski, M. and Williams, S. T., The biology of the actinomycetes, Academic Press.	
	Kurtzman, C. P., Fell, J. W. and Boekhout, T., The Yeasts - A Taxonomic Study, Elsevier.	
	Norris, J. R. and Ribbons, D. W., Methods in Microbiology, Vol. 18 & 19, Academic Press.	
	Prescott, L. M., Harley, J. P. and Klein, D.A., Microbiology. McGraw Hill, New York.	
	Reddy, C. A., Methods for General and Molecular Microbiology, ASM Press.	
	Sneath, A. H. P., Mair, S. N. and Sharpe, E. M., Bergey's Manual of Systematic Bacteriology Vol. 2. Williams & Wilkins Bacteriology Symposium, Series No 2, Academic Press, London/New York.	
Learning Outcomes	1. Apply knowledge of the standard rules of classification systems to categorize microorganisms. 2. Appreciate and explain the dynamic and ever developing nature of the field of microbial taxonomy and systematics.	

Programme: M.Sc. (Microbiology)
Course Code: MIPC-405
Title of the Course: MICROBIAL TAXONOMY AND SYSTEMATICS [P]
Number of Credits: 1, Practical
Contact hours: 30
Effective from Academic Year: 2022-23

Prerequisites	It is assumed that students should have a basic understanding of binomial nomenclature, the basis of classification systems and be familiar with the distinguishing features of different groups of microorganisms.	
Objective:	To understand the tools and techniques of taxonomy and systematics of the microbial world.	
Content:		**(30)**
1.	Morphological, physiological and biochemical characterization of bacteria.	
2.	Chemotaxonomic analysis of cell wall amino acids.	
3.	Characterization of actinomycetes (*Streptomyces* sp.).	
4.	Characterization of yeast (*Saccharomyces cerevisiae*, *Schizosaccharomyces pombe*).	
5.	Characterization of cyanobacteria.	