	National Institute of Technology Meghalaya An Institute of National Importance	**CURRICULUM**

Programme	**Doctor of Philosophy (Ph.D.)**	Year of Implementation	**2025-26**
Department	**Chemical and Biological Sciences**	Semester	**I/II**

Course Code	Course Name	Prerequisite	Credit Structure				Marks Distribution			
			L	T	P	C	INT	MID	END	Total
			3	**0**	**0**	3	**50**	**50**	**100**	**200**
CB706	**Microbial Technology**	**Nil**								

			COs	**Statement**	**Bloom's Taxonomy**
Course Objectives	To introduce the student the fundamentals of microbial technology	Course Outcomes	**CO1**	Students will understand the basic concepts of microbial technology.	Understanding
	To introduce the students with the diverse technologies and the varied applications achieved through microbial systems important to industry.		**CO2**	Students will learn about the various microbial products and related techniques used for production.	Applying
	To understand microbial products and their applications in environmental science and agriculture.		**CO3**	Students will learn about the various applications of microbes used to combat pollution and climate change, as well as the use of microbes in agriculture in a sustainable way.	Analysing
	To understand microbial products and their applications in medical and synthetic microbiology		**CO4**	Students will acquire knowledge of the human microbiome and their role in human health, along with detailed antimicrobial molecules and biosensors.	Analysing
	To make them aware of the frontier sciences and technologies in microbiology		**CO5**	Students will learn about the prospects of microbial technologies, such as the use of Artificial Intelligence/ Machine Learning (AI/ML) and their use in microbiome sciences.	Analysing

SYLLABUS

No.	Content	Hours	COs
I	**Fundamentals of Microbial Technology** History and development of microbial biotechnology, microbial physiology and metabolism, microbial diversity, industrially relevant strains, cultivation and characterization of microbes.	4	CO1
II	**Industrial Microbiology** Microbes in industry, Metabolic engineering and Bioprocess engineering, Fermentation technology and biomanufacturing, Microbial enzymes, Microbes in food and beverages (food technology and fermented foods), Bio-based chemicals (ethanol, succinic acid, polylactic acid), Biofuels (Bioethanol and Biodiesel), Bioplastics, Clustered Regularly Interspaced Short Palindromic Repeats (CRISPR) and Synthetic biology.	10	CO2
III	**Environmental and Agricultural Microbiology** Microbes in bioremediation (hydrocarbons, heavy metals and pesticides), microbial wastewater treatment, microbial fertilizer, biopesticides and microbial solutions for climate change (microbial carbon capture).	10	CO3
IV	**Medical and Synthetic Microbiology** Human microbiome (Sources, health effects, Feacal microbiota transplant, FMT), Production of antibiotics and antimicrobial molecules, Biosensors for microbial detection and phage therapy.	10	CO4
V	**Emerging Microbial Technologies and Future Directions** Artificial Intelligence/ Machine Learning (AI/ML) in microbial technologies, AI in microbial genome annotation and metabolic pathway prediction, microbiome engineering, Machine learning for microbiome data analysis and drug discovery	8	CO5
	Total Hours	Total Hours	**42**

Readings

1. Stanbury, P. F., Whitaker, A., & Hall, S. J. (2013). Principles of fermentation technology. Elsevier.
2. Pareek, R. P., & Pareek, N. (2019). *Agricultural microbiology*. Scientific Publishers.
3. Mitchell, R., & Gu, J. D. (Eds.). (2010). *Environmental microbiology*. John Wiley & Sons.
4. Lee, S. Y., Nielsen, J., & Stephanopoulos, G. (2022). Principles in Microbiome Engineering. John Wiley & Sons.