

Course Code	Course Name	Credits
26BY103	MICROBIAL TECHNOLOGY	04

### Course Objectives

- To introduce the fundamental concepts, scope, and historical development of industrial microbiology and the role of microorganisms in industrial production.
- To develop understanding of fermentation technology, including types of fermentation processes, media composition and environmental factors influencing microbial growth and product formation.
- To familiarize students with fermenter design, operation, sterilization and downstream processing techniques used in industrial microbiology.
- To provide knowledge of industrial production of microbial products and their applications in biotechnology, agriculture, environment and healthcare sectors.

### Learning Outcomes

Upon successful completion of this course, it is intended that a student will be able to:

- Explain and analyze the importance of microorganisms and their products (biomass, enzymes, metabolites, recombinant products) in industrial applications.
- Demonstrate understanding of fermentation processes, including media preparation, optimization and control of environmental factors.
- Describe and evaluate the structure and functioning of fermenters, as well as basic downstream processing methods.
- Apply knowledge of industrial microbiology in real-world contexts such as biofertilizers, waste treatment, biofuels and production of pharmaceuticals and enzymes.

### Unit 1 - Introduction to Industrial Microbiology (12 Hrs.)

Introduction and scope of industrial microbiology. Historical development of the fermentation industry. Importance of microorganisms in industrial production. Microbial products of industrial importance including microbial biomass, enzymes, primary and secondary metabolites and recombinant products. Isolation and screening of industrially important microorganisms. Basic methods for improvement of industrial strains.

### Unit 2 – Fermentation Technology (12 Hrs.)

Definition and basic principles of fermentation. Types of fermentation processes: submerged fermentation and solid-state fermentation. Components and type of fermentation media. Environmental factors affecting fermentation. Basic methods of media optimization.

### Unit 3 – Fermenters and Fermentation Process (12 Hrs.)

Definition and functions of a fermenter. Basic design and parts of a fermenter. Types of fermenters used in industry. Sterilization of fermenters and fermentation media. Aeration and agitation in fermentation. Introduction to probes used for monitoring fermentation. Basic techniques for recovery of fermentation products.

### Unit 4 – Industrial Production of Microbial Products (12 Hrs.)

Primary metabolites and their industrial importance with ethanol production as a case study. Secondary metabolites and their importance with antibiotic production as an example. Introduction to recombinant DNA technology in microbial production. Overview of industrial strain development and scale-up production.

### Unit 5 – Applications of Industrial Microbiology (12 Hrs.)

Industrial applications of microbial enzymes. Microbial biotransformation processes. Production of vitamins and other useful metabolites. Application of microorganisms in pollution control and waste treatment. Biomass production including single cell protein (SCP). Use of microorganisms in agriculture such as biofertilizers, biopesticides and bioherbicides; Biofuels and bioremediation.

### Reference Books:

1. Prescott, S. C., & Dunn, C. G. (n.d.). Industrial microbiology. CBS Publishers & Distributors.
2. Casida, L. E. (n.d.). Industrial microbiology. New Age International Publishers.
3. Patel, A. H. (n.d.). Industrial microbiology. Macmillan India Ltd.
4. Stanbury, P. F., Whitaker, A., & Hall, S. J. (n.d.). Principles of fermentation technology. Elsevier.
5. Waites, M. J., Morgan, N. L., Rockey, J. S., & Higton, G. (n.d.). Industrial microbiology: An introduction. Blackwell Publishing.