

COURSE CODE: ENE-111
COURSE NAME: Introduction to Microbiology
CREDIT HOURS: Theory = 3 Practical = 0 Total = 3
CONTACT HOURS: Theory = 48 Practical = 0 Total = 48
PREREQUISITE: None
MODE OF TEACHING: Three hours of lecture per week

COURSE DESCRIPTION:

This course is designed to familiarize students of Environmental Engineering with the field of Microbiology, which deals with the taxonomy and growth characteristics of various microorganisms. This includes the study of bacterial structures involved in growth and reproduction. Additionally, the course aims to explore the mechanisms by which microorganisms persist in their environment.

COURSE OBJECTIVES:

The course aims to provide a foundational understanding of the significance of microbiology in environmental engineering, gaining insights into how microorganisms impact natural and engineered processes. The course will explore the characteristics of bacteria, archaea, unicellular eukaryotes, and viruses, emphasizing key features of informational macromolecules and modern analytical techniques. Students will understand microbial diversity, physiological reactions, and biochemical processes, with a focus on applications such as pollutant degradation, bioremediation, bioenergy, and molecular microbiology. Additionally, the course will delve into the study of water-borne pathogens, microorganisms in air and soil, and microbiology related to water pollution.

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the PLOs:

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|------------------------------------|--------------------------|-----------------------------------|--------------------------|
| 1 Engineering Knowledge: | <input type="checkbox"/> | 7 Environment and Sustainability: | <input type="checkbox"/> |
| 2 Problem Analysis: | <input type="checkbox"/> | 8 Ethics: | <input type="checkbox"/> |
| 3 Design/Development of Solutions: | <input type="checkbox"/> | 9 Individual and Teamwork: | <input type="checkbox"/> |
| 4 Investigation: | <input type="checkbox"/> | 10 Communication: | <input type="checkbox"/> |
| 5 Modern Tool Usage: | <input type="checkbox"/> | 11 Project Management: | <input type="checkbox"/> |
| 6 The Engineer and Society: | <input type="checkbox"/> | 12 Lifelong Learning: | <input type="checkbox"/> |

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will demonstrate competency by being able to:

Sr. No.	CLO	Domain	Taxonomy Level	PLO
1	UNDERSTAND basic microbiology concepts.	Cognitive	2	
2	CLASSIFY the physiology of microorganism and their relationship in various environments.	Cognitive	2	

PRACTICAL APPLICATIONS:

The course aims to enhance students' understanding of contemporary microbiological concepts and their applications in improving environmental conditions. Additionally, it will serve as a valuable foundation for students aspiring to delve into further research in environmental microbiology.

TOPICS COVERED:

Week	Topic Covered	Reading Assignment/ Homework	CLO #
1	Overview and History of Microbiology		
2	Microbiology and its scope; Microbes as a Component of Environment; Organisms belonging to the animal and plant Kingdom		
3	Microbial Taxonomy; Scientific naming and classification of microorganisms and major groups (Eucaryotes, Procaryotes)	Assignment 1 Quiz 1	
4	Morphology of Bacteria; Size and Shape	Assignment 2 Quiz 2	
5	Physiology of Bacteria	Quiz 3	
6	Reproduction and Heredity in Bacteria		
7	The basic structure and activities of microorganisms; Gross Morphology of Microorganisms		
8	Biogeochemical Cycles; Influence of Environment on Growth		
9	Mid Semester Exam		
10	Nutritional Requirements [Carbon: Carbohydrates, Lipids, Proteins and Peptones; Nitrogen; Vitamins;	Assignment 3	

	Mineral Salts; Water; Buffers]		
11	Nutritional Group of Microorganisms [Chemoautotrophs; Chemoheterotrophs; Photoautotrophs; Photoheterotrophs]	Quiz 4	
12	Microbial Growth; Bacterial Growth Curve Phases [Lag; Log; Stationary; Death]	Assignment 4 Quiz 5	
13	Transitional Periods Between Growth Phases [Generation Time; Specific Growth Rate; Substrate Utilization Rate]	Quiz 6	
14	Growth of Microorganisms [Batch, Continuous and Mixed Cultures; Synchronous, Turbidostat, Chemostat]		
15	Growth measurement; Microbial Growth Requirements and Adaptation		
16	Environmental Aspects of Microbiology		
17	Groups of pathogenic microorganisms of public health importance in water		
18	End Semester Exam		

LIST OF PRACTICALS:

Not Applicable

Sr. No.	Practical	CLO #
1		
2		
3		

TEXT AND MATERIAL:

Textbook (s)

1. Microbiology: An Introduction, by Tortora, Funke, and Case. Publisher: Benjamin/Cummings Publishing Company, 10th Edition (2009).

References Material:

1. Microbiology, 6th Edition, by Prescott, Harley and Klein, McGraw-Hill (2005).
2. Experimental Microbiology, 3rd Edition, by Woolverton, Morton Publ (2004).

3. Lester, J. N. Microbiology and Chemistry for Environmental Scientists and Engineers. London, UK: Spon Press (1999).
4. Atlas. M. Ronald. Principles of Microbiology. Mosby – Year Book, Inc (1995).
5. Atlas. M. Ronald. Microorganisms in our world. Mosby – Year Book, Inc (1995).
6. Pelczar, J.; Michael, Chan, E. C. S.; Kerg, R. Microbiology concepts and applications. (Ed. International). McGraw – Hill International (1993).
7. Sterrit, R. M.; Lester, J. N. Microbiology for Environmental and Public Health Engineering. E & F N Spon (1988).

ASSESSMENT SYSTEM:

Theoretical/Instruction	100%
Assignments	10%
Quizzes	15%
Mid Semester Exam	25%
End Semester Exam	50%
Practical Work	0%
Lab Attendance	0%
Lab Report	0%
Lab Quiz	0%
Lab Rubrics	0%