Course Number and Name	**CE261-3: Environmental Microbiology**
Credits hours	3 Credit hours
Contact hours	3 Contact hours; 3 for Lecture, 0for Tutorial, 0 for Lab
Instructor/s name/s	Mr. Afzal Husain Khan
Textbook	Madigan, M., J. Martinko, and J. Parker. Brock Biology of Microorganisms. 10th ed. New York: Prentice Hall, 2002. ISBN: 0130662712
Other supplemental materials	1. Brock Biology of Microorganisms, 13th Ed, by Madigan et al., Prentice Hall, 2012. 2. Microbiology: An Evolving Science, 2nd Ed. by Slonczewski and Foster, Norton Publishing, 2011
Specific course information	
a. Catalog description	This class provides a general introduction to the diverse roles of microorganisms in natural and artificial environments. It will cover topics including: cellular architecture, energetics, and growth; evolution and gene flow; population and community dynamics; water and soil microbiology; biogeochemical cycling; and microorganisms in biodeterioration and bioremediation.The course has been presented in five chapters as below: Chapter 1: Introduction to Environmental microbiology Chapter 2: Microbial diversity, Growth & Metabolism Chapter 3: Industrial microbiology Chapter 4: Contaminant biodegradation Chapter 5: Microbiology of Engineered Environmental Systems
b. Prerequisite	ENG 102 - CHEM 101
c. Required / Elective	Required
Specific goals for the course	
Course Learning Outcomes (CLOs)	By the end of this course, the student will be able to: 1. Scope of microbiology. Microbial characterization: prokaryotes and eukaryotes cell structure. 2.Microbial nutrition and cultivation, Microbial growth control: principles, physical and chemical agents 3. Microbial ecology: air, water, and soil microbiology 4.Microbial metabolisms. Microbial genetics: inheritance and variability, genetic engineering, Work mechanism and inhibition of enzymaticmolecules, control of enzyme activities, enzyme kinetics 5.Microbiological application in food processing industries, beveragesindustries etc. 6. Aerobic respirations, diversity of aerobic metabolism, fermentation, anaerobic respirations, anaerobic food chains, autotrophy, regulation of activity. 7. Detoxification of inorganic and organic pollutants by microorganisms 8.Biodeterioration, solid and liquid wastes, bioremediation, biodegradation, biological pest control. 9.Microbes and diseases: resistance, host-parasite interactions, immuneresponse, antibiotics and other chemical agents.

	10.Evaluate the feasibility of bioremediation strategies to mitigateadverse ecological/health impacts of organic pollutants in environmentalmedia and engineer appropriate controls to prevent undesired microbialinfestation.
Student outcomes that addressed by the course	The following student outcomes are addressed by the course: SO1: An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics. SO3: An ability to communicate effectively with a range of audiences. SO4: An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.

Topics to be covered

Topic	Number of weeks
1. Metabolism, anabolism, key enzymes, biosynthesis, nutrient assimilation, fuelling reactions, energetics.	**1,2**
2. Chemical composition of microbial cells, cell structure,	**3,4**
3. Genetic elements, mutation and genetic exchange,	**5**
4. Use of tables and nomograms for Hydraulic computations for the Design of sewers	**6**
5. Microbiological industry development, scope of microbiological industries,	**7**
6. Microbes in mine industries, microbes in waste treatment industries.	**8**
7. Role of microorganisms in petroleum biodegradation	**9**
8. Geochemical cycling of elements, climate control, detoxification of pollutants	**10, 11**
9. Different methods for the characterization of microbial communities (microscopic, molecular, biochemical) and decide which one to apply in order to attempt at solving major openproblems such as reducing drug resistance in biofilms,	**12, 13**
10. Optimizing landfills degradation of waste and use of landfill by products such as methane as alternative energy.	**14**

Schedule of Assessment Tasks for Students During the Semester

Assessment task (i.e., essay, test, quizzes, group project, examination, speech, oral presentation, etc.)	Week due	Proportion of Total Assessment
Homework	2,5,8	10%
Quizzes	3,6,9	10%
Midterm-exam I	7	15%
Midterm-exam II	12	15%
Term Project	14	20%

Final Exam	16	30%

CLO-SO Map

	S01	S02	S03	S04	S05	S06	S07
CLO 1	√						
CLO 2	√						
CLO 3	√			√			
CLO 4			√	√			
CLO 5			√				
CLO 6							
CLO 7							
CLO 8							
CLO 9							