Environmental Engineering Microbiology			
Course code	**NVE3305**	Credit no.	**3 CH**
Department	**Environmental Engineering**	Faculty	**Engineering**
Pre-requisites Course code	**Biology + lab** **BIO2310C**	Co-requisites Course code	
Course coordinator	**Dr Zmnako A Awrahman**		
Email	zmnako@kissr.edu.krd zmnako.awrahman@komar.edu.iq	IP no.	**W: 104** **R: 111**
Course website	**Google classroom**		
Learning hours	**Wednesday and Thursday (10:00 - 11:30)**		
Contact hours	**Wednesday (12:00-14:00)** **You can anytime with appointment as well.**		
Course type	**Departmental requirements**		
Offer in academic year	**Spring 2016**		

Course Description

Introduction to the fundamental aspects of microbiology and biochemistry that are pertinent to environmental engineering and science. Provides an overview of the characteristics of bacteria, Archaea, unicellular Eukaryotes (protozoa, algae, fungi), and viruses. Includes discussions of cell structure, bioenergetics and metabolism, and microbial genetics. Focus is then applied to topics pertinent to environmental engineering: pathogens; disease and immunity; environmental influences on microorganisms; roles of microbes in the carbon, nitrogen, and sulfur cycles; enzymes; molecular microbiology; and microbial ecology.

Course objectives

The sustainability of life without microorganisms, such as bacteria, virus and fungi, will be an impossible process. Microorganisms are mainly beneficial and essential in the health of ecosystems. However, some are pathogens, and are hazard to human, plant and other animals. There are many techniques to collect and diagnose microorganisms. Some are genetically modified to produce essential substances, which are important to human health such as insulin production. This course will consist of three hours of lecture per week (two 1.5 hour lectures). The main objectives of this course are:

a. To learn the basic principles of environmental microbiology
b. To learn the basic groups and structure of microorganisms
c. know what types of microorganisms are found in the air, terrestrial and aquatic environments
d. Understand the role of microorganisms in environment and how they shape our ecosystems
e. To become familiar with diagnostic techniques in environmental microbiology
f. To learn roles of microorganisms in industry and genetic modification.

Expected learning outcome

1. Understand the diversity of microorganism and its environments. **(ABET outcome A)**
2. Apply techniques and methods to identify microorganisms. **(ABET outcome A&B)**
3. Illustrate role of microorganisms in industry and economy. **(ABET outcome A)**
4. Calculate lethal dose in the dose-response curve. **(ABET outcome A&B)**
5. Differentiate between detrimental and beneficial microorganisms. **(ABET outcome A)**

Grading scale

Points	Score %
A	95-100
A-	90-94
B+	87-89
B	83-86
B-	80-82
C+	75-79
C	70-74
C-	65-69
D+	60-64

D	55-59
D-	50-54
F	0-49
W	Withdrawal
I	Incomplete

Note: The minimum passing grade is **C-** to pass this course that is equivalent to **65%**

Course outline

Chapter 1: Review of Basic Microbiological Concepts

Chapter 2: Microbial Environments

Chapter 3: Detection, Enumeration and Identification

Chapter 4: Biogeochemical Cycles

Chapter 5: Remediation of Organic and Metal Pollutants

Chapter 6: Water- and Foodborne Pathogens

Chapter 7: Microorganisms and Industry

Chapter 8: Drinking water Treatment

Chapter 9: Urban Microbiology

Course teaching and learning activities

- Interactive class discussion
- Homework and assignments
- Tests and quizzes
- Report writing

Markings and evaluations

Assessment Tool	Description	Weight
Quizzes (5)	Quizzes are scheduled as shown in the semester schedule.	**15 %**
Assignments	Short assignments on environmental microbiology issues in Kurdistan and Middle East.	**10 %**
Mid-term	The mid-term will be conducted after week 7 of the semester.	**25 %**
Contribution	Students will be evaluated by the instructor based on their participation in the class, commitment, pop quizzes and other activities.	**5 %**
Final Exam	The final exam will be conducted in week 16 of the semester	**45 %**

Essential and Recommended books and readings

1. Pepper, I. L.; Gerba, C. P. and Gentry, T. J. (2015). *Environmental Microbiology*, 3rd edition, Elsevier, Amsterdam, The Netherlands.

2. Hurst J. C. and et al. (2007). *Manual of Environmental Microbiology*. 3rd edition, ASM Press, Washington D.C., USA.
3. Ivanov, V. (2011). *Environmental Microbiology for Engineers*. CRC Press, Boca Raton, USA.
4. Bertrand, J.C.; Caumette, P.; Lebaron, P.; Matheron, R.; Normand, P. and Sime-Ngando, T. (2015). *Environmental Microbiology: Fundamentals and Applications - Microbial Ecology*. Springer Science, Dordrecht, The Netherlands.

Note: Based on the subjects of each classes, further readings will be advised

Course Policy

Attendance policy:

Students are expected to attend each class for the entire semester. Students are responsible for material present in lectures. Only students with official KUST absence, family crises and illness are excused from the classes. Three occasions of lateness count as one absence. The student who misses 10 percent of the classes will be placed on probation.

Make up policy:

Since all examination are announced in advance, zero grade will be given to any missed examination unless a student has an acceptable reason, such as illness, for not being able to take the examination during all those days when the examination was announced.

Academic dishonesty:

Plagiarism in any form will not be tolerated. All submitted assignments will be screened for plagiarism. Any submitted assignment exceeding a total of 25% "match" and/or 15% of the text from a single source will be considered plagiarized, and will result in an automatic zero. Students found guilty of any type of academic dishonesty are subject to failure in this course, plus further punishment by the University Consul.

What counts as plagiarism?

- Copying and pasting information from a web site or another source, and then revising it so that it sounds like your original idea.
- Doing an assignment/essay/take home test with a friend and then handing in separate assignments that contain the same ideas, language, phrases, etc.
- Quoting a passage without quotation marks or citations, so that it looks like your own.
- Paraphrasing a passage without citing it, so that it looks like your own.
- Hiring another person to do your work for you.

Course calendar

Course calendar: Please check the academic calendar for spring 2016

Week	Beg/End Dates	Topics (Chapters)	Course Assignments per chapter
1	**(28-2 to 3-3) / 2016**	**Chapter 1: Review of Basic Microbiological Concepts** • A glimpse of history • Env. Micro. relation to other fields • Env. Micro. and microbes, Why? • Microbiology – Human perspectives • Applications • Past and future challenges • Future challenges • Model microorganisms • Microorganism in environment • Bacterial growth	Expected learning outcome (ELO) 1
2	**(6-3 to 10-3) / 2016**	**Chapter 2: Microbial Environments** • Earth environments • Aeromicrobiology • Aquatic environment • Extreme environment	ELO 1 and 5
3	**(13-3 to 17-3) / 2016**	**Chapter 3: Detection, Enumeration and Identification** • Environmental sample collection and management • Microscopic techniques • Cultural methods	Quiz 1 (Chapter 1 to 3.1) ELO 1, 2 and 5
	(20-3 to 24-3) / 2016	**Nawroz Holiday**	
4	**(27-3 to 31-3) / 2016**	**Chapter 3: Detection, Enumeration and Identification (continues)** • Physiological methods • Immunological methods • DNA/RNA analysis techniques	ELO 1, 2 and 5
5	**(3-4 to 7-4) / 2016**	**Chapter 4: Biogeochemical cycles** • Carbon cycle • Nitrogen cycle • Sulfur cycle • Iron cycle	ELO 1 and 3

6	**(10-4 to 14-4) / 2016**	**Chapter 5: Remediation of Organic and Metal Pollutants** • Microorganisms and organic pollutants • Bioavailability • Bioaccumulation • Biodegradation	Assignment 1 submission ELO 1, 3 and 4
7	**17-4 to 21-4**	**Chapter 5: Remediation of Organic and Metal Pollutants (continues)** • Microorganisms and metal pollutants • Bioavailability • Bioaccumulation • Biodegradation	Quiz 2 (Chapter 3.2 to 5.2) ELO 1, 3 and 4
	(24-4 to 28-4) / 2016	**Mid-term**	(Chapter 1 to 5.2)
8	**(2-5 to 5-5) / 2016**	**Chapter 5: Remediation of Organic and Metal Pollutants (continues)** • Microbial diversity • Microbial communication • Characterization of Env. Microorg.	ELO 1 and 3
9	**(8-5 to 12-5) / 2016**	**Chapter 6: Water- and Foodborne Pathogens** • Environmental transmitted pathogens • Bacteria pathogens • Parasites • Viruses	ELO 1, 2 and 5
10	**(15-5 to 19-5) / 2016**	**Chapter 6: Water- and Foodborne Pathogens (Continues)** • Indicator organisms • Total coliforms • Fecal coliforms and *E. coli* • Bacteriophages	Quiz 3 (Chapter 5.3 to 6.2) ELO 1, 2 and 5
11	**(22-5 to 26-5) / 2016**	**Chapter 6: Water- and Foodborne Pathogens (Continues)** • Risk assessment • Hazard identification • Dose Response curve • Risk characterization	Assignment 2 submission ELO 1 and 4

12	**(29-5 to 2-6) / 2016**	**Chapter 7: Microorganisms and Industry** • Wastewater treatment • Genetic engineering and antibiotics • Bioremediation	Quiz 4 (Chapters 6.3 and 7) ELO 1, 3 and 5
13	**(5-6 to 9-6) / 2016**	**Chapter 8: Drinking water Treatment** • Water treatment processes • Water treatment requirements • Disinfection • Monitoring (Real-Time)	ELO 1 and 3
14	**(12-6 to 16-6) / 2016**	**Chapter 9: Urban Microbiology** • Domestic microbiology • Indoor microbiology • Global emerging microbial issues • Oil spills	ELO 1 and 5 Quiz 5 (Chapters 8 and 9)
15	**(19-6 to 23-6) / 2016**	**Review Week for Academic Courses**	
16	**(24-6 to 30-6) / 2016**	**Final Examination for Academic Course**	**All Chapters**