

<p>Kingdom of Saudi Arabia Ministry of Higher Education Qassim University College of Engineering</p>		<p>المملكة العربية السعودية وزارة التعليم العالي جامعة القصيم كلية الهندسة</p>
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CE 671 Microbiology in Environmental Engineering

College: Engineering

Department: Civil

First: Course Definition

1- Course Code: CE 671

2- Units: 3

3- Semester:

4- Prerequisite:

5- Co-requisite:

6- Location (if not on main Campus):

Second: Course Objectives

- 1- To recognize, name and predict important properties of key classes of microorganisms.
- 2- To comprehend the organization and behavior of different types of microbial cells.
- 3- To recognize the diversity of microbial biochemical reactions.
- 4- To explain ways in which microbial communities shape the environment and vice versa.
- 5- To make quantitative estimates of the impact of microbes on natural and engineered processes.

1- Topics to be covered

Subject	No of Weeks	Units
Introduction, History of Microbiology, Microorganisms	1	3
Metabolism, Biosynthesis, and Assimilation of Inorganic Nutrients	1	3
Biosynthesis and Fueling, and Central Metabolism	1	3
Fermentation and Respiration	1	3
Electron Acceptors and Energetic Considerations	1	3

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Autotrophy, CO ₂ -Fixation, Phototrophy, and Lithotrophy	1	3
Chemolithotrophic Organisms and Biogeochemical Cycles	1	3
Regulation and Microbial Ecology	1	3
Estimation of Diversity	1	3
Microbial Activity in the Environment, and Growth and Biodegradation	1	3
Microbial Population Interactions	1	3
Predation and Microbial Community Structure	1	3
Organic Pollutants and Factors Affecting Biodegradation	1	3
Indicator Organisms	1	3

2- Course components (Total hrs in the Semester: 42)

Lecture	Exercise	Other
42	-	0

3- Intended Learning Outcomes of the Course (ILO's)

a. Knowledge

i) Description of the knowledge to be acquired:

- General introduction to the diverse roles of microorganisms in natural and artificial environments.
- Water microbiology.
- Biogeochemical cycling.
- Aerobic and anaerobic microorganisms.
- Microbiology in context of environmental and civil engineering.
- Origins of microbiology and the basic principles of biology.
- Classification, structure and biochemistry of microorganisms.
- Nutrient cycles in water and wastewater systems.
- Introduction to water-borne pathogens and parasites and their effects on.
- Recycling to minimize the risk of disease transmission and environmental pollution.
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ii) Teaching strategies to be used to develop that knowledge

- Class lectures.
- Term projects.

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- Students' presentations.
- Group discussion.

- iii) Methods of assessment of knowledge acquired**
- Exams.
 - Quizzes.
 - Homework assignments.
 - Term projects.

b- Cognitive (Intellectual) Skills

- i) Cognitive skills to be developed***
- Distinguish the role of various metabolic pathways in microorganisms and classification their role in various environmental engineering processes.
 - Differentiation among a variety of factors that influence cell synthesis and description the influence of these factors on the design of a variety of biological processes.
 - Design basic biological processes used by environmental engineers using newly gained knowledge of microbial cell structure and function.

- ii) Teaching strategies to be used to develop these cognitive skills***
- Class lectures.
 - Case studies analysis.
 - Term projects.
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- iii) Methods of assessment of students' cognitive skills***
- Students' seminars and presentations.
 - Term projects.
 - Written reports.
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c. Interpersonal Skills and Responsibility

- i) Description of the interpersonal skills and capacity to carry responsibility to be developed***
- Decision making based on engineering analysis.

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- Communication skills.
- Team work.
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- ii) Teaching strategies to be used to develop these skills**
- Class lectures.
 - Term projects.
 - Case studies analysis.
- iii) Methods of assessment of students' interpersonal skills and capacity to carry responsibility**
- Term project.
 - Written reports.
 - Students' seminars and presentations.

d. Communication, Information Technology and Numerical Skills

- i) Description of the skills to be developed in this domain**
- Literature research.
 - Problems modeling.
 - Utilization of computer applications in analysis and design.

- ii) Teaching strategies to be used to develop these skills**
- Class lectures.
 - Case studies analysis.
 - Computer lab sessions.
 - Term projects.
- iii) Methods of assessment of students numerical and communication skills**
- Term projects.
 - Written reports.
 - Students' seminars and presentations.
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e. Psychomotor (if applicable) & Other Non-cognitive Skills

- i) Description of the psychomotor or other skills to be developed and the level of performance required**
- NA

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ii) Teaching strategies to be used to develop these skills-

- NA

iii) Methods of assessment of student's psychomotor skills

- NA

4- Student Assessment Schedule

<i>Serial</i>	<i>Assessment tool (test, group project, examination etc.)</i>	<i>Week due</i>	<i>Weight</i>
1	Term Project – 1	3 rd	15 %
2	Mid Term Exam -1	7 th	15 %
3	Term Project – 2	10 th	15 %
4	Term Project – 3	13 th	15 %
5	Final Exam	16 th	40 %

5- Student Support

- Providing electronic library of textbooks and scientific periodicals.
- Providing the necessary computer applications for the course.

6- Learning Resources

i) Essential Books (References)

- Lester, J.N. and Birkett, J.W. (1999) Microbiology and Chemistry for Environmental Scientists and Engineers. 2nd Edition, E & FN Spon, London. ISBN 0-419-22680-X.
- Ivanov, V. "Environmental Microbiology for Engineers," CRC Press, 2010. ISBN: 978-1420092349.
- Madigan, M., J. Martinko, and J. Parker. *Brock Biology of Microorganisms*. 10th ed. New York: Prentice Hall, 2002. ISBN: 0130662712.

ii) Course Notes

- NA

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iii) Recommended Books

- American Public Health Association (APHA). "Standard Methods for the Examination of Water & Wastewater". Publisher: American Public Health Association. (October 2005). ISBN-13: 978-0875530475.
- Feachem, R.G., Bradley, D.J., Garelick, H. and Mara, D.D. (1983) Sanitation and Disease: Health Aspects of Excreta and Wastewater Management. World Bank Studies in Water Supply and Sanitation 3. John Wiley & Sons, Chichester. ISBN 0 471 90094.
- Horan, N.J. (1990) Biological Wastewater Treatment Systems: Theory and Operation. John Wiley & Sons Ltd, Chichester. ISBN 0-471-92425-3.
- Hurst, C.J. (2002) Manual of Environmental Microbiology. 2nd Ed. ASM PRESS, Washington, D.C. ISBN 1-55581 - 199 - X.

iv) Electronic Books & Web Sites:

- Scientific journals and forums.
- Instructor's instruction.
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v) Periodicals

- ASCE scientific journals.
- EPA and IWA publications.

7- Course Evaluation and Improvement Processes

i) Strategies for Obtaining Student Feedback on Effectiveness of Teaching

- Students' questioners.
- Students' evaluation of course and instructor.
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ii) Other Strategies for Evaluation of Teaching by the Instructor or by the Department

- Public faculty seminars.
- Assessment by external evaluators of students achievements.
- **Instructor (Course) Report**
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iii) Processes for Improvement of Teaching

- Assessment of students' work by external examiners.

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- Analysis of students' evaluation of course and instructor.
- Seminars by industry professionals.
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- iv) Processes for verifying standards of student achievement***
- Check marking by an independent faculty member of a sample of student work.
 - Periodic exchange and remarking of a sample of assignments/exams with a external evaluator.
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- v) Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement.***
- Assessment and evaluation of the level of achieving the course outcomes through a continuous improvement process (part of a quality assurance system established by the university),
 - Consequently, actions are to be taken to improve the course delivery when necessary.
 - Review of the course objectives, outcomes and curriculum every 2 years.