

<p>Kingdom of Saudi Arabia Ministry of Higher Education <b>Qassim University</b> College of Engineering</p>		<p>المملكة العربية السعودية وزارة التعليم العالي جامعة القصيم كلية الهندسة</p>
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## CE 673 Biological Treatment Processes

**College:** Engineering

**Department:** Civil

**First: Course Definition**

**1- Course Code:** CE 673

**2- Units:** 3

**3- Semester:**

**4- Prerequisite:**

**5- Co-requisite:**

**6- Location** (if not on main Campus):

**Second: Course Objectives**

- 1- To recognize the various biological processes and their contribution to climate change.
- 2- To assess biological processes in the context of environmental, economic and social factors.
- 3- To describe variety of activated sludge process configurations that can be used to accomplish biological nitrogen removal (BNR) and Biological nitrogen phosphorus removal (BNPR).
- 4- To discuss the operation of biological treatment processes.
- 5- To design biological wastewater treatment systems using typical process and kinetic parameters available in design manuals.
- 6- To select and design advanced wastewater processes to produce water suitable for a specified end use (i.e. water recycling systems).
- 7- To design biological systems with a focus on sustainability.

**1- Topics to be covered**

Subject	No of Weeks	Units
Biological wastewater treatment objectives, methods, and	1	3

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implementation considerations		
Wastewater characteristics, regulations, objectives	1	3
Activated sludge processes	1	3
Activated sludge modeling	1	3
Trickling filters	1	3
Aerated lagoons	1	3
Rotating biological contactors	1	3
Stabilization ponds	1	3
Principles of bulking control, selector design	1	3
Biological nitrogen removal processes	1	3
Biological phosphorous removal	1	3
Solids and sludge sources, characteristics, and quantities, regulations	1	3
Sludge thickening, and dewatering	1	3
Design of sludge treatment facilities - anaerobic digestion and aerobic digestion	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:***

- Biological characteristics of water and wastewater treatment.
- Treatment of wastewater by suspended growth systems (activated sludge, aerated lagoon).
- Treatment of wastewater by attached growth systems (tricking filter, rotating biological contactor) system.
- Stabilization pond.
- Sludge characteristics, disposal and treatment.
- Decentralized wastewater treatment.
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**ii) Teaching strategies to be used to develop that knowledge**

- Class lectures.
- Term projects.
- 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**

- Selection the optimum biological treatment process for water and wastewater treatment.
- Differentiation among a variety of factors that influence biological wastewater treatment.
- Design biological treatment unit for water and wastewater.

**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 <sup>rd</sup>	15 %
2	Mid Term Exam -1	7 <sup>th</sup>	15 %
3	Term Project – 2	10 <sup>th</sup>	15 %
4	Term Project – 3	13 <sup>th</sup>	15 %
5	Final Exam	16 <sup>th</sup>	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)**

- Tchobanoglous, G., Burton, F. L. and Stensel, H. D. "Wastewater Engineering, Treatment and Reuse," 4<sup>th</sup> edition, McGraw Hill, Inc., 2002. ISBN-13: 978-0070418783.
- Rittman and McCarty "Environmental Biotechnology: Principle and Application", McGraw-Hill publisher, 2000, ISBN-13: 978-0072345537.

**ii) Course Notes**

- NA
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**iii) Recommended Books**

- Grady C., Diagger G., Love N., Filipe C., "Biological Wastewater Treatment, Third Edition, CRC Press; 3 edition (2011), ISBN: 978-0849396793.
- Water Environment Federation, "Operation of Municipal Wastewater Treatment Plants" (3-Volume Set), Publisher: McGraw-Hill Professional; 6 edition (2007), ISBN: 978-0071543675.

**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
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**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.
- 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.

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- 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.