

CE 445

Wastewater Reclamation and Reuse

Department of Civil Engineering King Saud University

<p>Course Description: CE 445: Wastewater Reclamation and Reuse (An elective course for a BScE degree)</p>	<p>Potential reuse applications. Sources of water for reuse. Treatment technologies suitable for water reuse applications. Criteria for each type of reuse application. The overall procedures for determining the feasibility and planning of water reuse systems as well as the management structure of reuse projects. The management of the biosolids resulting from the treatment of wastewater and related regulations governing their use and disposal. Each student has to prepare and work on a mini-research/project throughout the course and present/submit it at the end of the course. 3(3,1,0)</p>
<p>Prerequisite</p>	<p>CE 442 (Water and Wastewater Treatment). Topics: 1. Physical, chemical and microbiological water quality parameters 2. Water-quality criteria and standards. 3. Water and wastewater treatment processes. 4. Sludge treatment methods and disposal.</p>
<p>Course learning Objectives</p>	<p>Students completing this course successfully will be able to</p> <ol style="list-style-type: none"> 1. Understand the basic concepts and issues involved in wastewater reclamation, recycling and reuse. 2. Understand major issues involved in developing water and biosolids reclamation criteria. 3. Select appropriate treatment technologies for reclaiming and reusing wastewater. 4. Assess the suitability of reclaimed water for any reuse application. 5. Apply knowledge of water and wastewater engineering for designing water reclamation processes. 6. Understand the procedures for planning and managing water reclamation projects. 7. Communicate skillfully through reading, writing, and oral presentation.
<p>Topics Covered</p>	<ol style="list-style-type: none"> 1. Introduction: definitions of terms related to water reclamation and reuse; potential uses of reclaimed water; benefits of water reuse; reasons for the growing use of reclaimed water; examples of water reuse in different parts of the world. (5 hr) 2. Water Reclamation and Reuse Criteria: factors affecting the development of water reclamation and reuse criteria; elements/components of water reclamation and reuse criteria / guidelines; water reclamation and reuse criteria in different countries and assessment. (4 hr) 3. Agricultural and Landscape Irrigation. (3 hr) 4. Industrial Water Reuse. (2 hr) 5. Groundwater Recharge with Reclaimed Water. (2 hr) 6. Recreational/Environmental Enhancement. (2 hr) 7. Water Reclamation Inside Buildings. (2hr) 8. Treatment Requirements for Water Reuse: constituents of municipal and industrial wastewater; health assessment of water reuse; treatment and reclamation technologies. (10 hr) 9. Reuse and Disposal of Wastewater Sludges and Biosolids: characteristics and composition of wastewater sludge/biosolids; sludge/biosolids processing; reuse and disposal of sludge/biosolids; land application of biosolids: regulations and methods of application. (10 hr) 10. Planning and Managing Water Reuse Projects: planning procedures; management and operation procedures. (8 hr)
<p>Class/ tutorial</p>	<p>Three lecture sessions and one tutorial session per week (50 minutes each)</p>

Schedule	session).
Field Trips	At least two field trips are made to wastewater reclamation facilities to emphasize the content of the course and appreciate the value of water utilization. A written report is required for each visit.
Term Paper	Each student needs to select a topic related to water reclamation and reuse, and write a term paper on it. An oral presentation is required.
Contribution of Course to Meeting the Professional Component	<ol style="list-style-type: none"> 1. Students recognize the importance of water reuse and recycling, and develop their understanding of the concept of waste utilization.. 2. Students are able to prepare feasibility and planning studies related to water reuse projects. 3. Students can assess the impact of engineering solutions for environmental problems on health and well being of humans and other environmental components. 4. Students are able to express their ideas clearly and concisely, and prepare and make oral and written presentations.
Relationship of Course to Program Outcomes	<p>Upon completion of this course, students will:</p> <ul style="list-style-type: none"> • Understand issues regarding water and biosolids reuse criteria, and factors affecting their development and application. • Be able to identify and select water reclamation processes needed to satisfy criteria for potential reuse applications. • Understand basic and modern issues involved in procedures for planning and managing water reuse projects. • Know modern issues and techniques related to water reclamation and reuse. • Know the impact of water reuse in the global and societal context. • Be able to articulate ideas and issues related to water reclamation and reuse through the preparation of a mini-research/project and making written oral presentations.
Textbook(s): Other Supported Material:	<ol style="list-style-type: none"> 1- Metcalf & Eddy, Inc. An AECOM Company, "Water Reuse: Issues, Technology and Applications" 1st Ed . 2007. 2- Metcalf & Eddy, Inc. "Wastewater Engineering: Treatment, Disposal, and Reuse, Chapters 13 & 14", Fourth edition, McGraw-Hill Companies, Inc., New York, NY, 2003. 3- Water Pollution Control Federation "Water Reuse, Manual of Practice SM-3, Ch. 4", 2nd edition, Water Pollution Control Federation, Alexandria, 1989. 4- U.S. Environmental Protection Agency (EPA) "Guidelines for Water Reuse, Ch. Two", EPA/625/R-92/004, U.S. Environmental Protection Agency and U.S. Agency for International Development, Washington, DC, 1992.
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Grade Distribution

Mid-term Exams (two)	30%
Reports on field visits	10%
Homework	10%
Term paper	10%
Final Exam	40%

Homework and Reports

Homework, visit reports, and term paper must be done independently and submitted on time. Late submission will be penalized. Submission must be neat and neat and clean on A4 paper.