College of Engineering

Department of Civil Engineering

CE 445 Wastewater Reclamation and Reuse

Credit and Contact hours	3 / 3 (Lectures), 1 (Tutorials), 0 (Laboratory)
Required, or Elective	Elective for a BSCE degree
Course Description	Potential reuse applications. Sources of water for reuse. Treatment technologies suitable for water reuse applications. Criteria for each application. Feasibility and planning of water reuse systems. Management of biosolids resulting from wastewater treatment.
Prerequisites or Co-requisites	CE 448 (Water and Wastewater Treatment)
Course Learning Outcomes	Students completing this course successfully will be able to

Course Learning Outcomes	*Related Student Outcomes (SO)*
CLO1. Review the concepts and issues involved in wastewater reclamation, recycling and reuse.	**SO7**
CLO2. Evaluate major issues to develop water and biosolids reclamation criteria and the suitability of reclaimed water for reuse application	**SO4**
CLO3. Design and Select water and wastewater systems for water reuse processes considering public health, environmental and economic factors.	**SO2**
CLO4. Review the procedures for planning and managing water reclamation projects. (Review and Summarize Standard Procedures)	**PC1**
CLO5. Demonstrate professionally the planning procedures; management and operation procedures related to Water Reclamation and Reuse project through the presentation to peers and faculty.	**SO3**

Student Outcomes related to this Course

SO 7. an ability to **acquire** and **apply new knowledge** as needed, using **appropriate learning strategies**. [ABET 7]

SO 4. 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.[**ABET 4]

SO 2. an ability to apply **engineering design** to produce solutions that meet specified needs with consideration of **public health**, **safety**, and **welfare**, as well as **global, cultural, social, environmental, and economic factors**. [ABET 2]

PC1. an ability to explain basic concepts in **project management**, **business**, **public policy**, and explain the importance of **professional licensure**. [PC]

SO 3. an ability to communicate effectively with a **range of audiences**. [ABET 3]

<table>
<tr><td rowspan="11">Topics Covered</td><td colspan="2">List of Topics</td><td>Related CLOs</td></tr>
<tr><td colspan="2">9. 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.</td><td>CLO 1</td></tr>
<tr><td colspan="2">10. 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.</td><td>CLO 1</td></tr>
<tr><td colspan="2">11. Agricultural and Landscape Irrigation.</td><td>CLO2</td></tr>
<tr><td colspan="2">12. Industrial Water Reuse.</td><td>CLO2</td></tr>
<tr><td colspan="2">13. Groundwater Recharge with Reclaimed Water</td><td>CLO2</td></tr>
<tr><td colspan="2">14. Recreational/Environmental Enhancement</td><td>CLO2</td></tr>
<tr><td colspan="2">15. Water Reclamation Inside Buildings</td><td>CLO2</td></tr>
<tr><td colspan="2">16. Treatment Requirements for Water Reuse: constituents of municipal and industrial wastewater; health assessment of water reuse; treatment and reclamation technologies</td><td>CLO3</td></tr>
<tr><td colspan="2">17. Advanced Wastewater Treatment Technologies</td><td>CLO3</td></tr>
<tr><td colspan="2">18. 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</td><td>CLO3</td></tr>
<tr><td colspan="2">19. Review the procedures for planning and managing water reclamation projects. (Review and Summarize Standard Procedures)</td><td>CLO4</td></tr>
<tr><td colspan="2">20. Planning and Managing Water Reuse Projects: planning procedures; management and operation procedures</td><td>CLO 5</td></tr>
<tr><td>Textbook(s) and Other Required Material</td><td colspan="3">3. Metcalf & Eddy, Inc. An AECOM Company, "Water Reuse: Issues, Technology and Applications", 1st Ed., McGraw-Hill Companies, Inc., New York, NY, 2007.
4. Metcalf & Eddy, Inc. "Wastewater Engineering: Treatment, Disposal, and Reuse, Chapters 13 & 14", Fourth edition, McGraw-Hill Companies, Inc., New York, NY, 2003.</td></tr>
<tr><td>Grading System</td><td colspan="3">Homeworks 10%
Two Midterm Exams 30%
Term paper 10%
Class Discussion 10%
Final Examination 40%</td></tr>
<tr><td>Instructors</td><td colspan="3">Dr. Mohab Amin M. Kamal (Room 2A60), email; maamin@ksu.edu.sa</td></tr>
<tr><td>Date of Review</td><td colspan="3">September 2020</td></tr>
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