College of Engineering

Department of Civil Engineering



CE 508 Physicochemical Treatment Processes			
Credit and Contact hours	3/3 (Lectures), 0 (Tutorials), 0 (Laboratory)		
Required, or Elective	Required for a MSCE degree		
Course Description	Fundamentals of process kinetics and reactor engineering. Aeration and gas transfer, coagulation and flocculation, sedimentation, filtration, and disinfection. Adsorption, ion exchange and membrane processes. Chemical sludge treatment and handling.		
Prerequisites or Co-requisites	 The course draws on knowledge of chemistry, physics and integral and differential calculus. Under graduate course: CE 448 Water and Wastewater Treatment Under graduate course: CE 443 Water and Wastewater Laboratory 		
Course Learning Outcomes	Students completing this course successfully will be able to		
	Course Learning Outcomes	Related Progra Outcomes	
	CLO1 : Review basic engineering principles for Water Quality Parameters - Physical and chemical properties of targeted pollutants and reaction kinetics	K1	
	CLO2 : Learn aeration, sedimentation, coagulation and flocculation processes. Able to explain settling equations. Tube settlers and pulsators.	K1	
	CLO3 : Design filter units along with filter backwash system. Analyze chemistry of disinfection and to know the kinetics of disinfection. Understand adsorption process and apply the knowledge of isotherms.	C2	
	CLO4: Learn and design various miscellaneous treatment processes such as Ion Exchange-processes, Application of Membrane Processes, Reverse Osmosis, Micro-filtration, Nano-filtration, Ultrafiltration and Electrodialysis.	C2	
	CLO5: Learn knowledge about generation of chemical sludge and its management. Design sludge dewatering and disposal process in real-life projects and evaluate its effectiveness.	S1	

Student Outcomes related to this Course	 K1. Recognize advanced engineering knowledge, concepts and techniques to identify, interpret and analyze complex and real-life engineering problems. S1. Provide solution for complex and real-life engineering problems through critical thinking and using modern engineering tools and identify its impact on social and ethical issues. C2. Design novel advanced Civil Engineering systems and evaluate its performance and effectiveness for engineering practice and its impact on society. 		
Topics Covered	List of Topics	Related CLOs	
	1. Introduction/Fundamental Processes and Review of Quality of Water and Wastewater.	CLO1	
	2. Aeration–principles and design of aeration systems	CLO2	
	 Coagulation and Flocculation–types of coagulants, coagulant aid, coagulation theory, optimum dose of coagulant, design criteria and design 	CLO2	
	4. Sedimentation–types of settling and settling equations, design of settling tanks.	CLO2	
	5. Filtration –theory, types, hydraulics of filter bed, design of filter units, filter backwash.	CLO3	
	6. Disinfection -disinfectants, influencing factors, methods, byproducts and kinetics.	CLO3	
	7. Adsorption –types, equilibrium kinetics and Isotherms and applications.	CLO3	
	 8. Miscellaneous treatment: Ion Exchange-processes, Application of Membrane Processes, Reverse Osmosis, Micro-filtration, Nano-filtration, Ultrafiltration and Electrodialysis. 	CLO4	
	9. chemical sludge and its management. Sludge De-watering and Disposal	CLO5	
Textbook(s) and Other Required Material	 Water Treatment: Principles and Design, 3rd ed., John Wiley & Sons. Physicochemical processes for water quality control-Walter J. Weber, John Wiley & Sons 		
Grading System	Assignments 20%		
	Project Work 20%		
	Midterm Exam20%		
	Final Exam40%		
Instructors	Prof. Ashraf Refaat, Office 2A4, refaat@ksu.edu.sa		
Date of Review	February, 2021		