SYLLABUS

1. **Number and Name: 11:117:413 – UNIT OPERATIONS AND PROCESSES: PHYSICOCHEMICAL**

2. **Credits and contact hours:** 3 credits, 2-80 min. lecture periods per week

3. **Instructor**: Weilin Huang

4. **Text:** *Water Treatment: Principles and Design*, 3rd Edition, by John C. Crittenden et al., John Wiley & Sons, Inc., New York, NY (2012)
   Reference: *Water Quality and Treatment. A Handbook of Community Water Supplies.* American Water Works Association, 5th Edition, McGraw Hill, New York (1999).

5. **Specific Course Information**

   a. **Catalog Description:** *Physical and chemical processes and operations commonly applied for water and wastewater treatment, including coagulation, flocculation, sedimentation, filtration, adsorption, ion exchange, membrane separation, precipitation, oxidation, and disinfection; principles of chemical reaction kinetics, modeling of ideal and non-ideal batch and flow-through reactors.*

   b. Prerequisites: Calculus II (01:640:152), Physical Principles (11:375:203)

   c. Course Type: Required

6. **Course Goals**

   a. Specific Instructional Outcomes: Students will be taught in the principles, design and operation of physicochemical processes for removing various contaminants from water to meet regulatory requirements. Student problem solving skills will be enhanced through the use of homework projects (9 sets), exams (3) and term project involving comprehensive analytical skills. Student research and communication skills will be refined by research paper and oral presentation (15-20 minutes) requirements.

   b. Specific Student Outcomes addressed by the course include:
   c. Ability to design a system, component or process to meet desired needs
   Instructional Activity: Successful completion of design-related in-class examples, homework assignment, and examinations focused on physicochemical processes for drinking water and wastewater treatment
   Assessment Activity: Individual grading of student homework and exams focused on modeling, design and operation of water treatment unit processes for removal of different types of pollutant

g. Ability to communicate effectively
Instructional Activity: Successful completion of a term paper focused on current status of a single physicochemical process for drinking water and wastewater treatment
Assessment Activity: Individual grading of the term paper
j. Knowledge of contemporary issues
Instructional Activity: In-class discussion and term paper/project assignments that address contemporary issues related to drinking water and wastewater treatment processes and regulation.
Assessment Activity: Homework assignments
k. Ability to use techniques, skills and modern engineering tools necessary for engineering practice
Instructional Activity: Successful completion of term paper and homework assignments
Assessment Activity: Individual grading of student projects and homework assignments

7. Topics

1	Course introduction; water quality standards, current status of regulation and technology development
2-3	Mass balance approach, ideal reactors, non-ideal reactors, tracer tests and residence time distribution, design of reactors in general
4-5	Chemical reaction kinetics, acquisition and reduction of reaction rate data
6-12	Particle-particle separation: coagulation and flocculation, sedimentation, and filtration
13-23	Mass transfer processes: Fick's laws, interphase mass transfer, aeration process and design, air stripping, adsorption, ion exchange, membrane separation
24-25	Chemical oxidation process
25-26	Disinfection process

Grading:	Homework (9 sets)	20%
	Exam 1	20%
	Exam 2	20%
	Exam 3	20%
	Project and Presentation	20%

Prepared by: Weilin Huang 04/12/2018