SYLLABUS

1. **Number and Name: 11:117:323 – ENVIRONMENTAL FATE AND TRANSPORT FOR ENGINEERS**

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

3. **Instructor**: Professor Weilin Huang

4. **Text:** *Environmental Systems and Processes: Principles, Modeling, and Design, by W.J. Weber, Jr., Wiley-Interscience, New York, 2001.*
   Reference: *Environmental Modeling: Fate and Transport of Pollutants in Water, Air, and Soil*, *by Jerald L. Schnoor, Wiley-Interscience, New York, 1996*.

5. **Specific Course Information**

   i) **Catalog Description:** Fundamental principles of physical and chemical processes including mass and energy balance approaches, phase partitioning, reaction kinetics, mass transfer, advection and dispersion. Topics include: (1) toxicity and risk assessment; (2) systems and processes characterization; (3) chemical thermodynamics and kinetics; (4) diffusion and mass transfer; (5) continuity equations; (6) transport in surface water and groundwater systems. It emphasizes how to simplify extremely complex systems so that solutions and conceptual design can be obtained.

   ii) **Prerequisites:** 01:640:251 01:750:227; 11:375:202 or permission by instructor

   iii) **Course Type:** Required

6. **Course Goals**

   i) **Specific Instructional Outcomes:** Students will be versed in physical and chemical aspects of pollutant fate and transport in both engineered and natural systems using mass and energy balance approaches and mathematical modeling.

   ii) **Specific Student Outcomes addressed by the course include:**

   1. **An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics**

      Instructional Activity: Temporal and spatial pollutant fate and transport in-class examples and homework assignments focused on physicochemical processes affecting pollutants in typical environmental systems.

      Assessment Activity: Grading of student homework assignments and exams focused on mathematical modeling, data analysis, and interpretation of the fate and transport of organic and inorganic pollutants in a variety of environmental systems.

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

Instructional Activity: In-class presentations and related homework assignments focused on the physicochemical processes in designed systems that meet federal and local standards of pollutants in water and air designed to protect public health, safety and welfare.

Assessment Activity: Grading of student homework assignments focused on mathematical modeling, data analysis, and interpretation of the fate and transport of organic and inorganic pollutants in a variety of environmental systems meeting design requirements under various constraints and assumptions.

3. An ability to communicate effectively with a range of audiences

Instructional Activity: Provide feedback on a student's research and communication skills by commenting on project report and poster presentation.

Assessment Activity: Grading of finalized student project and poster presentation.

7. Topics

1. Toxicity, risk assessment, environmental standards, and emerging pollutants
2. Environmental systems and processes, classification and characterization
3. Mass balance approach for batch systems, equilibrium distribution, thermodynamics, and fate of pollutants, Henry's law, Raoult's law, sorption, partitioning, and bioconcentration
4. Chemical kinetics fundamentals, oxidation and reduction, photoreactions
5. Mass balance approach for completely mixed flow reactor systems
6. Mass balance approach for ideal plug flow reactor systems, continuity equation, advection and dispersion processes, mixing process and boundary layer
7. Diffusion process and mass transfer
8. Eutrophication and stream reaeration
9. Pollutant transport in groundwater systems
10. Particle sedimentation and transport

Grading:	Homework assignments (9 sets)	30%
	Exam 1	20%
	Exam 2	20%
	Exam 3	20%
	Project and Poster Presentation	10%