SYLLABUS

1. **Number and Name: 11:117:495 – ENVIRONMENTAL SYSTEMS ANALYSIS FOR ENGINEERS**

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

3. **Instructor:** Christopher G. Uchrin

4. **Required Text:** none
   Reference Texts: Chapra, S.C., *Surface Water-Quality Modeling*, McGraw-Hill, NY, 1997, 844 pp.
   Thomann, R.V., and J.A. Mueller, *Principles of Surface Water Quality Modeling and Control*, Harper & Row, NY, 1987, 644 pp.
   Schnoor, J.L., *Environmental Modeling: Fate and Transport of Pollutants in Water, Air,and Soil*, John Wiley & Sons, NY, 1996, 682 pp.

5. **Specific Course Information**
   a. **Catalog Description:** *Principles of procedural and heuristic systems analysis. Techniques of simulation and optimization. Solutions of bioenvironmental engineering problems by systems analysis methods.*

   b. **Prerequisites:** Permission of instructor

   c. **Course Type:** Technical elective

6. **Course Goals**

   a. **Specific Instructional Outcomes:** Students will be versed in the principles of surface water hydrology and pollution. Student problem solving skills will be enhanced through the use of homework projects and an engineering project involving considerable analytical and numerical skills.

   b. **Specific Student Outcomes addressed by the course include:**

      e. Ability to identify, formulate and solve engineering problems
      Instructional Activity: Successful completion of design project focused on surface a water pollution application
      Assessment Activity: Individual grading of student projects focused on:
      1. Theoretical development and application
      2. Technical accuracy
      3. Conclusions
      4. Presentation

      g. Ability to communicate effectively
      Instructional Activity: Successful completion of design project

focused on surface a water pollution application
Assessment Activity: Individual grading of student projects
k. Ability to use techniques, skills and modern engineering tools necessary for engineering practice
Instructional Activity: Successful completion of design project and homework assignments incorporating advanced mathematical (computer) modeling techniques focused on surface water quality
Assessment Activity: Individual grading of student projects and homework assignments focused on using advanced engineering tools specifically for technical accuracy and visuals

7. Topics:

Lecture	Topic
1-2	I. INTRODUCTION: Definitions; Deterministic, phenomenological and stochastic models; modeling flow chart; Conceptual models; Simulation versus modeling
3	II. THE MASS BALANCE: Definition; Batch systems and applications
4-5	Completely mixed flow systems
6	Cells in series
7	Ideal plug-flow systems
8-10	Plug-flow with dispersion systems
11	III. MODEL ERROR ASSESSMENT AND RELIABILTY: Comparison of model predictions to true values; Diagnostic checks; quantification of error; Estimation of prediction reliability
12	IV. MULTI-DIMENSIONAL SYSTEMS: Total systems mass balance
13	Two-dimensional steady-state application
14-15	Finite section approximations/finite differences
16-17	V. MULTI-COMPONENT COUPLED SYSTEMS MODELS: Biochemical Oxygen Demand (BOD) – Dissolved Oxygen (DO) in streams
18	Sediment oxygen demand
19-20	Algal photosynthesis and respiration
21-22	Lake eutrophication modeling
23	BOD-DO dynamics in dispersive systems
24-26	Ecosystem (food-web) models

Grading:	Homework	25%
	Exam 1	20%
	Exam 2	20%
	Final Exam/project report	35%

Prepared by: Christopher Uchrin 05/25/2017