

**Course:** ENVIRONMENTAL SYSTEMS ANALYSIS, **Course code:** CENG 6652 (5 ECTS)

**Evaluation Schemes:** Continuous Assessment: **50%**; Final Exam: **50%**

### **Course Description**

Introduction to concepts and applications of systems analysis and modeling techniques to environmental problems will first be raised in the course. Then, integrated management strategies addressing multi-objective planning through application of optimization methods and soft computing techniques in water environment related fields is discussed. Finally; concepts of system uncertainty and sensitivity applied to environmental decision making will be introduced.

#### **1. Environmental systems analysis an over view (10%)**

- 1.1. What is water environment system analysis?
- 1.2. Why analysis (plan and manage)?
- 1.3. System planning scales
- 1.4. System modeling role in planning and management

#### **2. Optimization models and methods (30%)**

- 2.1. Overview of optimization models
- 2.2. Dynamic programming
- 2.3. Linear programming

#### **3. Soft computing techniques (50%)**

- 3.1. Soft computing an introduction
- 3.2. Data driven modelling
  - 3.2.1. Artificial neural networks
  - 3.2.2. Evolutionary algorithms:  
Genetic Algorithm
- 3.3. Qualitative modelling
  - 3.3.1. Fuzzy Optimization

#### **4. System sensitivity and uncertainty analysis (10%)**

- 4.1. Issues, concerns and terminology
- 4.2. System uncertainty analysis
- 4.3. System sensitivity analysis

#### **Reference**

- i. Modern systems analysis and design, Hoffer Jeffery A. 2014
- ii. Techniques of Environmental systems analysis, By Pantell Richard, NY, Wiley 1976
- iii. Systems analysis and water quality management, Thomas Robert, 1972
- iv. Civil and Environmental systems engineering, Re Valle, Charles