Modeling the Earth’s Systems: Dynamics in Ecology and the Environment

CBE 40472/60572, Spring 2008

Instructor: Mark A. Stadtherr

Textbook: Interactive CD-based study materials prepared by Prof. Roger Schmitz will be used, including interactive computer simulations. Use of Mathcad will be required for some simulation exercises.

Prerequisites: Students should be familiar with basic concepts in the areas of differential equations and matrices.

Course Description and Goals:

Engineering students today are frequently taught to be environmentally conscious in designing new products or processing systems. However, their attention is rarely focused on the Earth’s own natural systems, and on how these systems interact with manmade systems. Thus the focus of this course is on the Earth’s natural processes and systems. The Earth’s systems are dynamic, changing with time in response to a variety of disturbances. A primary goal in this course will be to develop a basic understanding of some of these dynamic processes, and to show how one can use mathematical models to aid in this understanding and to estimate the impact of manmade disturbances. A broader goal is to develop an awareness, on a scientific level, of current environmental and ecological problems, and to enable the student to better seek answers to these problems.

Topics (anticipated):

I. Dynamics of Populations, Communities and Ecosystems
   1. Population dynamics – single species
   2. Interacting populations – competitors
   3. Predator-prey models
   4. Food chains
   5. Large communities

II. Dynamics of the Earth’s Natural and Altered Environments
   1. Biogeochemical cycles
   2. Energy and the carbon cycle
   3. Earth’s temperature
   4. Nitrogen, phosphorus and sulfur cycles
   5. The troposphere
   6. Ozone in the stratosphere