

ECE 5800
Fall 2008
Severance

System Modeling and Simulation I Course Syllabus

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Office Hours:
3:30 to 4:30 pm Monday
3:30 to 4:30 pm Wednesday
3:30 to 4:30 pm Friday

Prerequisites:
All students should be either senior undergraduates or have graduate student status. A background assuming STAT 3640 (random variables) or ECE 3800 (random variables and random processes), MTH 3740 (differential equations and linear algebra) and CS 1110 (programming in C[#]) is assumed. Generally this means that you will be an engineering, science or mathematics major who can program a computer and has a good degree of mathematical maturity. If this is not the case, consult with the professor first!

Course Objectives: As a student, you should be able to...

1. formulate an accurate mathematical description of a myriad of physical and biological models
2. convert continuous time models to reasonably accurate numerical approximations
3. implement, in a high-level programming language, suitable algorithms to solve the above models
4. test, verify and validate your simulation results
5. suitably present your results along with appropriate analysis.

Text and Materials:

1. [required] *System Modeling and Simulation - an Introduction* by Frank L. Severance; John Wiley, 2001. This is available at the WMU Campus and University bookstores.
2. [required] Supplementary course handouts available at the course Web-site.
3. Suitable Visual Basic references such as...
 - [easy] *Visual Basic Coach (VB 6.0)* by Jeff Savage; Addison Wesley
 - [medium] *Programming in Visual Basic 6.0* by Julia Case Bradley & Anita C. Millspaugh; McGraw Hill
 - [harder] *Visual Basic 6 Programming - a Business Applications with a Design Perspective* by Jeffrey J. Tsay; Prentice Hall.
 - Analogous books by the same authors and publishers for Visual Basic .Net.
4. Access to a Visual Basic compiler (6.0 or .Net) and a reasonable spreadsheet program such as Excel.
5. A flash drive on which to submit your weekly assignments.

Grading:
There will be weekly programming assignments, each of which will be graded and returned at the next class period. Also there will be two tests (50 minutes each) and one comprehensive final examination (two hours). The relative weight of each will be as follows:

12 assignments:	65%
2 tests (10% each):	20%
1 final examination:	15%

Final grades will be based on over-all class performance. Questions and problems will be similar to lecture examples and assignments. Make-up tests will be given only in emergencies when arrangements have been made in advance. If there are extenuating circumstances, I need to know quickly and *before* the disaster!

Class procedure:

This class meets twice per week. These lessons will be in the traditional lecture - discussion format and your regular attendance is assumed. Class assignments will strongly emphasize computer simulations - that is, programming. The choice of computer languages is up to you, but you will find that the simulations can best be achieved using Visual Basic. As always, if and when programming problems arise, see the professor.

Course Description:

This is a course in the principles of mathematical modeling of both physical and non-physical systems and the practice of realizing these models via computer simulation. The principles will be taught in the traditional lecture/test format while the practice will require several computer assignments. This course satisfies the ABET design requirements.

- Visual Basic
 - computer programming
 - object oriented programming
 - Visual Basic as a simulation tool
- Time driven models
 - discrete signal representation
 - continuous signal representation
 - system modeling
- Autonomous systems
 - differential equations
 - initial value problems
 - boundary value problems
 - difference equations
- Stochastic signal models
 - stochastic generators
 - random walks, white noise and Brownian motion
 - ARMA processes
 - Markov models
- Time based models with external inputs
 - overt inputs
 - disturbances
 - simulations

This course will emphasize applications of modeling and simulation. You will not use pre-existing simulation software; rather you will create suitable software using a standard high-level programming language such as Visual Basic 6.0 or Visual Basic .Net. Applications will include *mechanical and biological systems, digital signal processing, motion control systems, queuing* and *ARMA models*. Loosely speaking, the course will introduce Visual Basic as a simulation tool and cover the first seven chapters of the text.

Academic Integrity:

All graded work, including homework assignments, is expected to be your own. If and when you have questions, you should consult your professor - he is very willing to help you. Failure to observe this rule may result in a failing grade for the course and referral to the Student Judiciary.