

CSE 561  
Modeling & Simulation Theory and Application  
Spring 2006

<b>General:</b>	Building/Classroom: BYAC-220 Lecture Days & Hours: Tu, Th., 3:15 – 4:30 pm Course Portal: <a href="http://my.asu.edu">http://my.asu.edu</a> (SLN: <a href="#">95089</a> / ONLINE)
<b>Instructor</b>	Hessam S. Sarjoughian Computer Science & Engineering Dept. Bldg/Room: BY/476 Phone: (480) 965-3983 Fax: (480) 965-2751 Email: <a href="mailto:hss@asu.edu">hss@asu.edu</a> URLs: <a href="http://www.eas.asu.edu/~hsarijou/index.htm">http://www.eas.asu.edu/~hsarijou/index.htm</a> Office hours: Tue. & Thur. 4:30 - 6:00 pm; and by appointment
<b>Teaching Support</b>	TA: TBD Email: TBD Bldg/Room: TBD
<b>Textbooks</b>	<b>Required Notes:</b> <ul style="list-style-type: none"><li>• Introduction to DEVS Modeling &amp; Simulation with JAVA: Developing Component-based Simulation Models, B.P., Zeigler and H.S. Sarjoughian (available from course webpage)</li></ul> <b>Reference Textbook:</b> <ul style="list-style-type: none"><li>• <i>Theory of Modeling &amp; Simulation</i>, 2<sup>nd</sup> Ed., B.P. Zeigler, H. Praehofer, T.G. Kim, 2000</li></ul> <b>Other Related Reference Textbooks:</b> <ul style="list-style-type: none"><li>• <i>Model-Based Systems Engineering: an introduction to the mathematical theory of discrete systems and to the tricategory theory of system design</i>, W. Wymore, 1993</li><li>• <i>Simulation Model Design and Execution: Building Digital Worlds</i>, P. Fishwick, 1995</li><li>• <i>Simulation Modeling and Analysis</i>, 3<sup>rd</sup> Edition, A. Law and W. Kelton, 1999</li></ul> <b>Reference Textbooks on Java:</b> <ul style="list-style-type: none"><li>• Java Tutorial, <a href="http://java.sun.com">java.sun.com</a></li><li>• <i>Onto Java online</i>, 3<sup>rd</sup> Edition, P.A. Winston and S. Narasimhan <a href="http://www.ai.mit.edu/people/phw/OnToJava/">http://www.ai.mit.edu/people/phw/OnToJava/</a> [beginner and intermediate levels]</li><li>• <i>Thinking in Java</i>, B. Eckel, <a href="http://www.mindview.net/">http://www.mindview.net/</a>, [intermediate and advanced levels]</li></ul>
<b>Software</b>	<b>Tool and Documentation:</b> DEVJAVA and SESM simulation and modeling software tools will be used. Eclipse ( <a href="http://www.eclipse.org/">http://www.eclipse.org/</a> ) or JBuilder ( <a href="http://www.borland.com/jbuilder/index.html">http://www.borland.com/jbuilder/index.html</a> ) IDEs can be used for simulation model development. For further details refer to the course webpage on <a href="http://my.asu.edu">http://my.asu.edu</a> .

**Prerequisites:**

Graduate standing. Programming maturity is assumed. Prior object-orientation modeling experience is helpful, although not assumed.

**Course Objectives:** Present concepts of computer-based modeling and simulation applicable to various domains of engineering and science. Provide theoretical concepts, methods, and hands-on experience with object-oriented modeling and simulation. Students are expected to gain a sound foundation and associated experience for computer-based tool set for constructing, simulating and analyzing models of complex systems using modeling & simulation tools.

**Course Description:**

The course covers modeling and simulation concepts and discrete-event in particular. Application of theories, methods, and practices are covered during the semester. The course materials are divided into two parts. The first part provides background review and discussion on systems modeling concepts and overview of object-oriented programming languages. This first part contains comprehensive discussions on how to formulate and execute (simulate) models in a software engineering-like lifecycle. During this part, students are engaged in details study of modeling elements, simulation protocols, and their relationships including verification and validation. In-class description of modeling and simulation techniques will be illustrated by examples developed in the SESM/CM (Scaleable Entity Structure Modeler with Complexity Measures) modeling and DEVSJAVA simulation environments. During the semester students will gain hands-on experience (via homework assignments and projects). Students will create increasingly more complex models, which can be subsequently simulated and analyzed. The second part focuses on selected advanced topics aiding individual and team members' projects. An important part of the course experience is through the class project. Each project involves demonstrating the application of course concepts, theory, and techniques (see Project section below) to student's application of interest. Students may also choose to focus on M&S methodologies and theories.

**Online Students:**

Lectures will be made available via video streaming. Information is available on the Course webpage.

**Homework Assignments/Exams:**

There will be 4-6 homework assignments. Homework assignments include conceptualizations, model formulations, simulations, etc. Late homework will be accepted only in exceptional circumstances which need to be discussed with the instructor for approval and as long as the solution is not discussed or made available. Use standard size paper and include your name and homework assignment number at the top or on the cover page. Midterm and final exams will be based on the course materials – i.e., lectures, homework assignments, and readings. Final exam is comprehensive with emphasis on materials covered after the midterm exam. See table below for dates and locations.

	% final grade	Date/Time	Location (on-campus)	Location (off-campus)
<b>Homework</b>	20%	NA	BYAC-220	Remote Site
<b>Mid. Exam</b>	20%	03/21/2006 <sup>§</sup> 3:15 – 4:30 pm	BYAC-220	Remote Site
<b>Final Exam</b>	20%	05/09/2006 2:40 – 4:30 pm	BYAC-220	Remote Site

§ Tentative

**Project:**

Early in the semester, students will consult with the instructor to determine a project topic that benefits from their overall academic objectives or current professional activities (see table below for due dates). Possible application domains are numerous, including communication, manufacturing, defense, and business (see Blackboard and ACIMS website for a sample of previous project topics). Projects can be carried out either individually or as two-member teams. Projects requiring the participation of individuals with different skill sets and disciplinary backgrounds is encouraged, but not required.

	% final grade	Preliminary Project Description (due date, % grade)	Final Project Report & Presentation (due date, % grade)
<b>Project</b>	40%	03/23/2006, 30%	05/02/2006, 70%

**Final project report format and grading:**

- Introduction and problem description: **20%**
- Analysis and simulation model formulation: **30%**
- Simulation models, approach, and results: **40%**
- Conclusions: **10%**
- Presentation: **10%**

### **Grading Policy:**

Course grade is based on 10-point scale (it may be relaxed at the discretion of the instructor). Students are **responsible** for all material covered and discussed during lectures as well as announcements made either during class, email, and/or Blackboard. Examinations may not be taken separately except in special situations with prior arrangement **at least one week in advance**. Participation is an essential part of the course and highly encouraged.

<b>% total score</b>	≥97	≥93	≥90	≥86	≥83	≥80	≥75	≥70	≥60	<60
<b>Letter grade</b>	A+	A	A-	B+	B	B-	C+	C	D	E
<b>Points for GPA</b>	4.33	4.00	3.67	3.33	3.00	2.67	2.33	2.00	1.00	0.00

Grade distribution of the course is shown below.

	<b>Homework</b>	<b>Midterm Exam</b>	<b>Final Exam</b>	<b>Project</b>
<b>Grade Distribution</b>	20%	20%	20%	40%

**Withdrawals:** In Person withdrawal deadline **March 31<sup>st</sup>**; Interactive SunDial withdrawal deadline **April 2<sup>nd</sup>**; complete withdrawal deadline **May 2<sup>nd</sup>**. Ceasing attendance does not automatically drop you from the course. If you are still on the class role at the end of the semester, you will receive zero for any work not submitted and will be graded accordingly.

### **Academic Integrity and Ethics:**

ASU's Code of Academic Integrity (<http://www.asu.edu/studentlife/judicial/integrity.html> and <http://www.asu.edu/studentlife/judicial>) states that students shall not "represent the work of others as their own." The Computer Science and Engineering department requires all students to adhere to ASU's policy on Academic Honesty. This policy will be applied to all work submitted for grade, including term paper, exams, and homework assignments. The minimum penalty for submitting work that is not your own is an E grade. Note: You are encouraged to discuss class assignments with your instructor and your fellow students. However, any work submitted as part of course work must be your own work. I.e., final work submitted by student must represent his/her own individual efforts unless stated otherwise by the instructor. University policy states that any act of cheating will result in receiving an XE for the course indicating failure due to disciplinary action.

### **Topics Covered\*:**

#### **Part I: Core Materials [9-10 wks]**

1. Introduction to modeling and simulation
2. Modeling theories, worldviews, and application domains
3. Conceptual model development and simulation approaches
4. DEVSJAVA description and use
5. System-theoretic and object-oriented modeling principles and methods
6. Modeling approaches and simulation techniques
7. Hierarchical, modular, component-based modeling
8. Scalable System Entity Structure Modeler (SESM) description and use
9. Design of simulation experiments
10. Discrete event simulation protocol concepts and techniques
11. Simulation design complexity

#### **Part II: Advanced Materials [4-5 wks]**

1. Modeling and simulation process, verification, and validation
2. Model composability and simulation interoperability
3. Agent-based simulation modeling

\* subject to change.