EMBRY-RIDDLE AERONAUTICAL UNIVERSITY
Department of Computing and Mathematics
COURSE OUTLINE FOR

Course No.: CS350 **Title: Computer Modeling and Simulation**
Cr Hrs: 3

Lecture Hours: 3 **Laboratory Hours: 0**

COURSE DESCRIPTION:

Introduction to the basic aspects of modeling and simulation applied to problem solving and decision making in aviation and aerospace. The topics include statistical models, queuing theory, random variate generation, simulation languages, object-oriented programming, design and analysis of experiments, verification and validation of simulation models. The focus is on discrete systems, and the programming will use object-oriented simulation language. Required is familiarity with concepts of probability and statistics and the proficiency in a high-level language programming. Required knowledge of statistics is limited to parameters of random distributions, estimates from a sample, hypotheses testing, and the most useful distributions. Required proficiency in high level programming includes compilation/linking process, procedures, modules, parameter passing, and data structures. Expected is familiarity with some aviation topics including elements of the airport operations, and air traffic control procedures.

GOALS:

The purpose of the course is to have students understand the general theoretical concepts of computer modeling and simulation applied to discrete simulation for decision support. The students must understand the sequence of activities related to computer simulation (problem statement, data acquisition, model design, simulation experiment, verification, validation, documentation), appreciate the application of simulation techniques and methods in aviation and aerospace industry and research. Additionally, the course introduces mathematical and statistical models, simulation languages, gives a review of queuing applications and a heavy hands-on experience with the object-oriented software development for simulation.

PERFORMANCE OBJECTIVES:

As the result of the course instruction, the students will be able to:

1. Identify basic paradigms in system modeling.

2. Apply the object-oriented methodology for software development.

3. Recognize different simulation concepts and tools.

4. Write discrete simulation programs utilizing event and process oriented approach with a time scheduling mechanism.

5. Analyze statistical data and generate random numbers of a required distribution and parameters.

6. Understand concepts of verification and validation.

7. Apply rudimentary queuing theory to estimate discrete system behavior.

8. Relate the course experience to aviation applications.

Department of Computing and Mathematics
COURSE OUTLINE FOR CS350, Continued

TEXTBOOK:

Object-Oriented Modeling and Simulation with MODSIM III; J. Marti; CACI Products Company, 1999
Discrete Event Simulation - A Practical Approach; U.W. Pooch, J.A. Wall; CRC Press, 1993

SUGGESTED SUPPLEMENTAL MATERIALS:

a. *Object Oriented Design with Applications*; G. Booch; Benjamin Cummings, 1991,
b. *Simulation - A Problem Solving Approach*; S.V. Hoover, R.F.Perry; Addison-Wesley, 1989,
c. *Discrete Event System Simulation*; J. Banks, J.S. Carson; Prentice Hall, 1984,
d. *System Simulation - Programming Styles and Languages*, W.Kreutzer; Addison Wesley, 1986,
e. *Simulation Modeling and Analysis*; A.M. Law, W.D. Kelton; McGraw Hill, 1982,
f. *Introduction to Simulation*; J.A.Payne; McGraw Hill, 1982,
g. *Simulation Modelling with Pascal*; R.M.Daview, R.M. O'Keefe; Prentice Hall, 1989,
h. *Computer Simulation*; H.J. Watson, J.H. Blackstone; John Wiley, 1989,
i. *Simulation Model Design and Execution*, Paul A. Fishwick, Prentice Hall, 1995
j. An access to the current articles in such magazines as: SCS Simulation, Transactions of ACM, IEEE Computer, etc.
k. An access to a workstation computer laboratory with a high-level object-oriented language environment, with animated simulation output.

PREREQUISITE KNOWLEDGE AND TOPICS:

TOPIC	CLASS HOURS	COURSE OBJECTIVES
1. Systems, Models, and Computer Simulation Concepts	6	Identify basic paradigms in system modeling. Recognize different simulation concepts and tools.
2. Object Oriented Concepts and Implementation	9	Apply the object-oriented methodology for software development. Relate the course experience to aviation applications.
3. Process Model of Simulation	6	Apply the object-oriented methodology for software development. Write discrete simulation programs utilizing event and process oriented approach with a time scheduling mechanism.

TOPIC (cont.)	CLASS HOURS	COURSE OBJECTIVES (cont.)
4. Animation Graphics in Simulation	6	Recognize different simulation concepts and tools. Write discrete simulation programs utilizing event and process oriented approach with a time scheduling mechanism. Relate the course experience to aviation applications.
5. Statistical Models and Random Variate Generation	6	Analyze statistical data and generate random numbers of a required distribution and parameters.
6. Statistical Analysis of Simulation Data	6	Analyze statistical data and generate random numbers of a required distribution and parameters.
7. Queuing Theory Primer	3	Apply rudimentary queuing theory to estimate discrete system behavior.
8. Verification and Validation	3	Understand concepts of verification and validation.

LABORATORY AND COMPUTER USAGE:

An access to a workstation computer laboratory with a high-level object-oriented language environment, supporting presentation of an animated simulation output.

GRADING SYSTEM:

- 3-5 individual homework programming assignments
- team project: deliverable components of the 6-week long class project prepared by a team of 5-7 students
- Tests: three midterm tests and optional comprehensive final make-up test.
- Quizzes: 5-7 short (unannounced) quizzes will be given at the end of lecture to check the class progress.

Grading percentages:
Programming assignments 20%, quizzes 10%, project 20%, tests 50%

Letter grade:
A - above 90%, B - above 80%, C - above 70%, D - above 60%, F - below 60%

ESTIMATED CONTENT:

Skills: 25 %
Content: 75 %