

Course:

ISE 433/533 Industrial Computer Simulation– 4/3 credit hours, Call number 04017/04033

Catalog description:

Prereq: ISE306, ET181, Simulation of industrial engineering systems using discrete event modeling. Process modeling approach to simulation. Coverage of basic (entities, processes, and resources), intermediate (queues, seize and release), and advanced (entity transport) modeling concepts. Statistical analysis of simulation results. Animation of simulated model. Application of simulation in manufacturing, production, and service areas. Lab projects using state-of-the-art simulation software. 4 lectures

Sessions:

Lectures: M 2:10-3:00, Stocker 171
Lab lectures: W 2:10-3:00, Stocker 414
Lab sessions: W 3:10-5:00, Stocker 414

Instructor:

Dr. Dusan Sormaz, Room 277, Stocker Center, phone: (740) 593-1545
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Office Hours:

M 1:00-2:00pm, 4:00-5:00pm; T 3:00-5:00pm or by appointment

Textbooks:

Andrew F. Seila, Vlatko Ceric, Pandu Tadikamalla, *Applied Simulation Modeling*, Thomson, 2003. – required

Book web site http://www.duxbury.com/cgi-brookscole/course_products_bc.pl?fid=M2b&discipline_number=17&product_isbn_issn=0534381596

David Kelton, Randall P. Sadowski, Deborah A. Sadowski, *Simulation with Arena*, Second Edition, McGrawHill, 2004. – optional

Jerry Banks, John S. Carson, Barry L. Nelson, David M. Nicol, *Discrete-Event System Simulation*, Third edition, Prentice Hall, 2001. – reference

Course web site: <http://imse.ent.ohiou.edu/scripts/classes/view.php?courseName=ISE433-533>

The Course Objective:

The objective of this course is to teach students methods for modeling of systems using discrete event simulation. Emphasis of the course will be on modeling and on the use of simulation software. The students are expected to understand the importance of simulation in manufacturing and service industries. Modeling techniques for entities, queues, resources and entity transfer will be explained. By the end of the course students will be able to formulate simulation model for a given problem, implement the model in software and perform simulation analysis of the system.

Course prerequisite skills:

- Engineering problems solving
- Basic algebra skills

- Differentiate between discrete and continuous sample
- Understand probability theory and randomness
- Knowledge of statistical theory
- Knowledge of common discrete and continuous distributions including: uniform, binomial, multinomial, hyper geometric, negative binomial, geometric, Poisson, normal, gamma, exponential, chi-square
- Understand material and information flow
- Communicate effectively through the use of a written technical report
- A working knowledge of a high level computer language
- Assess conditional probabilities for independent and dependent events
- Understand basic statistics such as the mean and the variance or standard deviation
- Use queuing theory to solve simple queuing problems
- Calculate the mean and variance of a sample data set
- Determine the best sample measure of central tendency for a sample from a known population distribution
- Be able to read a standardized Z-normal table
- Comfortable using a spreadsheet for basic statistical analysis functions

Course outcomes:

Outcomes of the course are related to the educational objectives of the IMSE department. Upon the completion of the course students will be able to:

(IMSE Objective: the ability to apply concepts of engineering science, mathematics, physics and chemistry)

- Explain how numbers are generated from probability distributions by converting [0-1] numbers using the inverse transform technique
- Perform data input analysis using statistical software

(IMSE Objective: the ability to apply appropriate industrial engineering methods and techniques to complex systems)

- Explain the differences between discrete-event simulation and continuous simulation and when to use each of them
- Explain the advantages and disadvantages of using simulation for decision making
- Use the basic building blocks of simulation models (source - queue - server -- sink)
- Use common model concepts (variables, attributes, balking, labels, reliability, ...)
- Apply complex modeling concepts (e.g., vehicle routing and material handling)

(IMSE Objective: the ability to code and to utilize software relevant to industrial and manufacturing systems engineering)

- knowledge of a commercial simulation package (Arena, TaylorED, Promodel, or similar)

(IMSE Objective: the ability to design, conduct and analyze experiments)

- Design simulation experiments for non-terminating systems
- Design simulation experiments for terminating systems
- Apply appropriate data collection techniques
- Interpret the results from simulation experiments
- Perform result analysis for comparing similar systems

(IMSE Objective: appreciation of the relevance of industrial engineering fundamentals and practice to non-traditional areas)

- simulate service oriented systems

(IMSE Objective: design, develop, implement and improve integrated systems of people, materials, information, equipment and energy)

- simulate manufacturing systems

Computer usage:

Students will be using Arena 7.0.1 simulation software. The CD-ROM of the software is the part of the required textbook. One-hour weekly lab lecture and two-hour weekly lab sessions will be held in Stocker 414. Arena software, student edition will be available in all public college labs (Stocker 127, 264, 305, 308, and 414) and research edition in departmental labs (Stocker 292a and 292b).

Requirements:

Readings - Please read the chapters before the class in which they will be covered.

Modeling projects - There will be weekly modeling projects in which you will use Arena to solve simulation problems from the textbook.

Midterm exam - Exam will be held about the middle of the quarter (tentatively week 10/11-13). It will be paper-and-pencil exam.

End-term exam - The end-term exam will be held in the last week lab session. The end-term exam will be held in computer lab and you will build and implement simulation models for given problems.

Final project - Group project in which you will perform simulation study of a manufacturing system with application of advanced modeling concepts.

Extra credit assignments – Few reading/summary assignments outside textbook.

Grading Policy:

Modeling projects 35%

Midterm exam 20%

Final project 15%

End-term exam 30%

Extra credit assignments 10% extra credit

Attendance Policy:

Attendance to all sessions is required. No enforcement policy will be in effect, but students are responsible for all material covered in the class.

Academic Misconduct:

Modeling projects will be individual work of each student. No unauthorized collaboration of any kind is permitted during any of the examinations, or modeling projects. All suspected cases will be treated according to the University Policy as stated in the Catalog and the Student Handbook.

Simulation Modeling Project Guidelines

The following guidelines need to be followed when modeling projects are implemented:

1. Have a ZIP disk (100MB or 250MB or 750 MB) for the course. Label this disk with your full name.
2. Create *ise433* folder on the disk. Create folder for each assignment (model), for example *problem4-2*.
3. File naming convention: each files needs to include *ise433* and your initials, then after that chapter and problem that is solved, for example *ise433-dns-problem4-2.doe*, or *ise433-dns-problem4-2.doc*, or *ise433-dns-problem4-2.out*, and so on.
4. Each project needs to include MS word file in which modeling approach is explained.
5. When building model all variables need to include modeler's initials, they need to be mnemonic and first letter of each English word needs to be capitalized. For example, if Dusan N. Sormaz wants to make a create block for arrival of cars into the model, the block name would be *dnsCarArrival*. If an entity for cars needs to be created, its name should be *dnsCar* (note singular here).
6. All modeling projects will be submitted on ZIP disk only. ZIP disks will be returned to students next morning.

Tentative Schedule:

1. Week (9/6-8): Lab lecture: Introduction to Simulation (Chapter 1)
Lab: Introduction to Arena (Chapter 7 – section 7.1 and 7.2)
2. Week (9/13-15): Lecture: Static Simulations (Chapter 2)
Lab: Input Analysis, Excel (Chapter 2)
3. Week (9/20-22): Lecture: Dynamic Simulations (Chapter 4)
Lab: Modeling simple queuing models in excel (Chapter 4)
4. Week (9/27-29): Lecture: Modeling Concepts for Discrete-event Simulation (Chapter 5)
Lab: Modeling simple queuing models in Arena (Chapter 5)
5. Week (10/4-6): Lecture: System Modeling Paradigms (Chapter 6)
Lab: Manufacturing example in Arena (Chapter 6)
6. Week (10/11-13): Lecture: Simulation in Arena (Ch. 7 – Sections 7.3-5), Output Analysis
Lab: Midterm Exam
7. Week (10/18-20): Lecture: Graphical Simulation Modeling (Chapter 8)
Lab: Copy center model and fuel depot model (Chapter 8)
8. Week (10/25-27): Lecture: Problem Solving Using Simulation (Chapter 9)
Lab: Manufacturing Systems Model (Section 9.3)
9. Week (11/1-3): Lecture: Problem Solving Using Simulation (Chapter 9)
Lab: Entity Transfer and Transportation (Section 9.4)
10. Week (11/8-10): Lecture: Other modeling techniques (Handout)
Lab: End-term exam
11. Week (11/15) Course overview, Final project consultation

Wednesday, 11/10/04 End-term exam starts at 2:10pm

Saturday, 11/20/04 Final project is due at 2:30pm