

ENG EC514 Simulation

2008-2009 Catalog Data:

ENG ME 514/EC 514 Simulation Prereq: ENG EK 127 or knowledge of a general programming language, ENG ME 308 or CAS MA 381, or knowledge of probability and statistics. Modeling of discrete event systems and their analysis through simulation. Systems considered include, but are not limited to, manufacturing systems, computer-communication networks, and computer systems. Simulating random environments and output analysis in such contexts. A simulation language is introduced and is the main tool for simulation experimentation. Includes lab. 4 cr.

Class/Lab Schedule: 4 lecture hours per week

Status in the Curriculum: Systems elective

Textbook(s) and/or Other Required Material: W. D. Kelton, R. P. Sadowski, D. A. Sadowski *Simulation with Arena*, McGraw-Hill, 4th Ed., 2006.

Reference: A. M. Law, W.D. Kelton, *Simulation Modeling and Analysis*, 1991, McGraw-Hill, 2nd Ed., 2002

Coordinator: Pirooz Vakili, Associate Professor of Mechanical Engineering

Prerequisites by topic:

1. Working knowledge of a general purpose programming language.
2. Knowledge of probability and statistics at the level taught in a typical undergraduate course.

Goals:

To introduce discrete event computer simulation as a decision support methodology for effective operation of manufacturing (and computer and communication) systems. Problems such as kanban control of production lines and supply chain management and appropriate statistical evaluation of simulated data are discussed.

Computer Usage:

This course uses a special purpose simulation software (ARENA from Rockwell Software) running on desktop PC's. In addition, a spreadsheet (Microsoft Excel) is used for simulating and analyzing simple models and to illustrate basic concepts. A Web-based real-time simulation of a virtual factory (Littlefield Technologies from Responsive Learning Technologies) is used for some assignments. 80% of the classes are held in a computer laboratory.

Course Learning Outcomes:

As an outcome of completing this course, students will:

- i. Gain an increased understanding of the requirements for satisfactory design of (manufacturing) systems and their operation.
- ii. Develop an understanding of and gain experience in using simulation methodology to solve design and operations problems in manufacturing.
- iii. Gain experience with using simulation software for model development and analysis.
- iv. Develop experience with application of statistical data analysis methods for arriving at and supporting design and operations decisions.
- v. Gain experience in using simulation as a decision support tool to solve actual industrial problems.
- vi. Gain experience and confidence in working in a team environment.
- vii. Gain a facility for producing well-organized and clearly written engineering reports.
- viii. Gain a facility for producing well-organized and clear presentations.

Course Learning Outcomes mapped to Program Outcomes:

Program:	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
Course:	iv	iv	ii,v		i,ii		vii, viii			i	i,ii, iv			i	i,ii, iv,v	
Emphasis:	3	4	3	1	4	1	4	1	1	1	4	1	1	4	5	1

Topics:

I. Simulation for Analysis of Systems : An Introduction

1. Systems, Models and Simulation: Application examples

II. Random Variate Generation

1. Review of Basic Probability and Statistics
2. Generation of Uniform and non-uniform random numbers

III. Discrete-Event Simulation

1. Fundamentals of discrete event simulation
2. Introduction to ARENA

IV. Performance Evaluation and Optimization in Simulation

1. Output analysis
2. Comparing alternative system designs
3. Design of Experiments and performance optimization
4. Variance reduction techniques

V. Building Simulation Models

1. Verification and validation
2. Selecting appropriate input distributions

Contribution of Course to Meeting the Professional Component:

Engineering topics: 100%

Prepared by: Professor Pirooz Vakili

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