

# IEE 6300: Advanced Simulation Modeling and Analysis

## Course Coordinator and Instructor:

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## Catalog Description:

Advanced topics in modeling of complex systems using both discrete and continuous simulation. Emphasis on the simulation of manufacturing systems.

## Course Objectives:

Use of computer simulation as a modeling tool, with emphasis on most current simulation languages and simulators is presented. Industrial case studies are introduced, and in a lab environment, simulation models are developed. Statistical analysis of input data and simulation results are examined.

## Text:

1. Discrete-Event System Simulation; Banks, Carson and Nelson; 5<sup>th</sup> Edition, Prentice Hall; 2010.
2. Notes on Simulation Modeling using ProModel; Houshyar;

## References:

1. *Simulation Modeling & Analysis; Law and Kelton; 3<sup>rd</sup> Edition, 2000.*
2. *Simulation with Arena, Kelton, Sadowski, and Sadowski, McGraw Hill; 2009.*
3. *System Improvement Using Simulation; Harrell, Bateman, Cogg, and Mott; ProModel Corp*
4. *ProModel Student Version, User's Guide, and Reference Guide.*
5. *Introduction to Simulation Using SIMAN, Pegden, Shannon, Sadowski, 2<sup>nd</sup> Edition, 1995.*

**Prerequisite:** IEE 3300 or equivalent.

## Evaluation:

<b>1<sup>st</sup> Exam</b>	<b>30 points</b>
<b>2<sup>nd</sup> Exam</b>	<b>40 points</b>
<b>Homework Assignment</b>	<b>5 points</b>
<b>Active participation</b>	<b>5 points</b>
<b>Quiz</b>	<b>20 points</b>
<b>Total Score</b>	<b>100 points</b>

<b>Grading Scale:</b>	<b>93 - 100</b>	<b>A</b>	<b>88 - 92</b>	<b>BA</b>
	<b>83 - 87</b>	<b>B</b>	<b>78 - 82</b>	<b>CB</b>
	<b>73 - 77</b>	<b>C</b>	<b>68 - 72</b>	<b>DC</b>
	<b>60 - 67</b>	<b>D</b>	<b>Below 60</b>	<b>E</b>

## Computer Usage:

Extensive use of computer software is required throughout this course. Students are encouraged to solve problems on statistical analysis manually, and then reconfirm their results using computer.

**Attendance Policy:**

Attendance is not mandatory. But, student will receive a score of zero for any assessment item not submitted because of absence -this includes the assignments, report submissions, tests, and the final exam. Extreme circumstances will be considered on an individual basis, however, when possible arrangements must be made prior to the due date, and supporting documentation is necessary. Moreover, you are expected to actively participate in the discussion. Please note that you will be graded on your participation, so don't keep quiet!

**Homework:**

Recommended homework problems will be given in class. You are welcome to solve any problem using software, unless I have specified otherwise. If you use software to solve a problem you must submit sufficient documentation to illustrate your approach to the problem, along with the appropriate output to justify your results.

**Quiz:**

Starting with the second week, every week there will be an unannounced 10-20 minutes quiz on the subject matters covered in the previous sessions. Therefore, you are responsible for the material up to the day of the quiz. Quiz could be open-book, open-note or closed-book, closed-notes. Use of cell phones is not permitted.

**Tests:**

The tests will be administered during the lecture period on the days indicated in the schedule. You are responsible for the material up to the day of the test. Test could be open-book, open-note or closed-book, closed-notes. Use of cell phones is not permitted.

**Notes:**

1. The lectures will focus on the main topics, but students are responsible for reading and understanding the whole chapter.
2. The style of teaching is based on the notion of *Critical Thinking*. As such, students are expected to review the chapter prior to coming to class. In doing so, the class time will be dedicated to answering questions and solving problems. Therefore, rather than an elaborate lecture plan, a brief review of the main topics will be conducted in class, but you should study them in detail, and ask questions, if necessary.

**Academic Honesty Policy:**

The Faculty Senate's Professional Concerns Committee recommends all instructors include the following paragraph in each syllabus they prepare.

"You are responsible for making yourself aware of and understanding the policies and procedures in the Undergraduate and Graduate Catalogs that pertain to Academic Honesty. These policies include cheating, fabrication, falsification and forgery, multiple submission, plagiarism, complicity and computer misuse. [The policies can be found at <http://catalog.wmich.edu> under Academic Policies, Student Rights and Responsibilities.] If there is reason to believe you have been involved in academic dishonesty, you will be referred to the Office of Student Conduct. You will be given the opportunity to review the charge(s). If you believe you are not responsible, you will have the opportunity for a hearing. You should consult with your instructor if you are uncertain about an issue of academic honesty prior to the submission of an assignment or test."

In addition, instructors are encouraged to direct students to <http://osc.wmich.edu> and [www.wmich.edu/registrar](http://www.wmich.edu/registrar) to access the Code of Honor and general academic policies on such issues as diversity, religious observance, student disabilities, etc.

# Schedule Outline

## Topics

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Chapter 1: Introduction to Simulation

Chapter 2: Simulation Examples

Chapter 3: General Principles

*Learning ProModel*

Chapter 5: Statistical Models in Simulation

Chapter 7: Random-Number Generation

*Learning ProModel*

Chapter 8: Random-Variate Generation

Chapter 9: Input Modeling

*Learning ProModel*

Chapter 10: Verification and Validation of Simulation Models

*Learning ProModel*

### ***First test***

Chapter 11: Output Analysis for a Single Model

Chapter 12: Comparison and Evaluation of Alternative System Designs

*Review for the final exam*

### ***Second Exam***

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## I. Introduction to Discrete-Event System Simulation

### Chapter 1: Introduction to Simulation

- 1.1 *When Simulation Is the Appropriate Tool*
- 1.2 *When Simulation Is Not Appropriate*
- 1.3 *Advantages and Disadvantages of Simulation*
- 1.4 *Areas of Application*
- 1.5 *Systems and System Environment*
- 1.6 *Components of a System*
- 1.7 *Discrete and Continuous Systems*
- 1.8 *Model of a System*
- 1.9 *Types of Models*
- 1.10 *Discrete-Event System Simulation*
- 1.11 *Steps in a Simulation Study*

### Chapter 2: Simulation Examples

- 2.1 *Simulation of Queueing Systems*
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