



Universidad de Puerto Rico
Recinto Universitario de
Mayagüez
Colegio de Ingeniería

University of Puerto Rico
Mayagüez Campus
College of Engineering

Departamento de Ingeniería
Industrial

Department of Industrial Engineering

Course Syllabus

General Information

Course Number: InIn 6026
Course Title: **Systems Simulation**
Credit-Hours: Three

Course Description

Principles of feedback dynamics; levels, rates, delays. Simulation languages and their applications in industrial and service systems. Analysis and interpretation of results. Recommendation and justification of proposed alternatives.

Textbook and References

- T- Kelton, W. D., Smith, J. S., and Sturrock, D. T., 2014, **Simio & Simulation – Modeling, Analysis, and Applications**, Third Edition, McGraw-Hill Corp.
- R1- Kelton, W. D., Sadowski, R. P., and Sturrock, D. A., 2007, **Simulation with Arena**, 4th Edition, McGraw-Hill Corp.
- R2- Law, A.M., and Kelton, W. D., 2000, **Simulation Modeling And Analysis**, 3rd Edition, McGraw-Hill Corp.
- R3- Banks, J., Carson II, J. S., Nelson, B. L. and Nicol, D. M., 2010, **Discrete-event System Simulation**, 5th Edition, Prentice Hall, Inc.

Purpose

This is a course primarily designed for graduate students whose major concentration is management systems. It is appropriate for engineering graduate students with a basic knowledge of Probabilistic Models in Operations Research. Students must be interested in acquiring proficiency in a simulation language integrating both the input and output data analysis phases. The purpose of the course is to prepare each student for (1) modeling a real-world situation using a simulation language; (2) improving probative a real-world situation identifying bottlenecks, evaluating multiple scenarios and selecting the best under a set of time and money restrictions; (3) formulating conclusions firmly attached to statistical analysis; (4) submitting and enhancing recommendations using animation tools; and (5) conducting meritorious research in probabilistic models using simulation. This course is a requirement in the management system options of the M.S. in Industrial Engineering and the M.E. in Management Systems.

Course Goals

At the completion of the course, the students will:

- Become familiar with the concepts of simulation and system analysis.
- Develop skills in simulation to IE problems.
- Develop skills in input analysis.
- Develop skills in output analysis.
- Develop required skills to interpret simulation output.
- Understand advantages and limitations of simulation.
- Develop skills in technical writing.

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Requirements

All students are expected to come to class all the time, on time, and prepared; do all assigned readings and related homework; actively participate in class discussions; and satisfy all assessment criteria to receive credit for the course.

Department and Campus Policies

Class attendance: Class attendance is compulsory. The University of Puerto Rico, Mayagüez Campus, reserves the right to deal at any time with individual cases of non-attendance. Professors are expected to record the absences of their students. Frequent absences affect the final grade, and may even result in total loss of credits. Arranging to make up work missed because of legitimate class absence is the responsibility of the student. (Bulletin of Information Undergraduate Studies)

Absence from examinations: Students are required to attend all examinations. If a student is absent from an examination for a justifiable reason acceptable to the professor, he or she will be given a special examination. Otherwise, he or she will receive a grade of zero or "F" in the examination missed. (Bulletin of Information Undergraduate Studies)

Final examinations: Final written examinations must be given in all courses unless, in the judgment of the Dean, the nature of the subject makes it impracticable. Final examinations scheduled by arrangements must be given during the examination period prescribed in the Academic Calendar, including Saturdays. (see Bulletin of Information Undergraduate Studies).

Partial withdrawals: A student may withdraw from individual courses at any time during the term, but before the deadline established in the University Academic Calendar. (see Bulletin of Information Undergraduate Studies).

Complete withdrawals: A student may completely withdraw from the University of Puerto Rico, Mayagüez Campus, at any time up to the last day of classes. (see Bulletin of Information Undergraduate Studies).

Disabilities: All the reasonable accommodations according to the Americans with Disability Act (ADA) Law will be coordinated with the Dean of Students and in accordance with the particular needs of the student.

Ethics: Any academic fraud is subject to the disciplinary sanctions described in article 14 and 16 of the revised General Student Bylaws of the University of Puerto Rico contained in Certification 018-1997-98 of the Board of Trustees. The professor will follow the norms established in articles 1-5 of the Bylaws.

Campus Resources

General Library and University Computer Center is available to obtain professor=s reference materials. The University=s Counseling Office has a tutorial program for students who need extra help.

Course Syllabus

Contact Hours	Topic	References
1	Introduction to Modeling, System Analysis and Simulation	T 3-66, R1 3-43, R2 1-10, R3 3-128
3	Selecting input probability distributions - Discrete and Continuous. Goodness of fit tests: χ^2 and Kolmogorov Smirnov.	T 67-86, R1 38, 86, 152-174, 264, 614 R2 292-397, R3 307-346
4	Random number generators, Testing of random number generators, and Generating random variables.	T 87-96, R1 497-507 R2 402-491, R3 272-300
4	Basic Modeling with SIMIO	T 97-150
6	Intermediate Modeling with SIMIO	T 151-202
4	Working with Model Data	T 203-234
4	Animation and Entity Movement	T 235-270
6	Model Verification and Validation	R1 300, 540 R2 264- 290, R3 354-381
4	Terminating Statistical Analysis	R1 255-279, 517-522 R2 505-518, R3 393-400, 424
4	Comparing Alternative System Configuration	R1 40, 265 R2 553-579, R3 432-477
4	Steady-state Statistical Analysis	R1 183, 283-313, 522-524 R2 518-545, R3 402-424
4	Advanced Modeling with SIMIO	T 271-280, T 289-297, T 301-309
2	Variance Reduction Technique	T 90, T 114, R1 508-517 R2 581-617
6	Experimental Design and Optimization	T 115, T 281-289, T 297-300, R1 524, 543 R2 622-666
56	Total number of contact hours	

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Course Goals	A - K	IE Outcomes
<ul style="list-style-type: none"> ▪ Students become familiar with the concepts of simulation and system analysis. 	C, I, J	7
<ul style="list-style-type: none"> ▪ Develop skills in simulation to IE problems. 	A, C, D, L	1, 6, 7
<ul style="list-style-type: none"> ▪ Develop skills in input analysis 	A, C, D, L	1, 6, 7
<ul style="list-style-type: none"> ▪ Develop skills in output analysis. 	A, C, D, L	6, 7
<ul style="list-style-type: none"> ▪ Develop required skills to interpret simulation output. 	B	6, 7
<ul style="list-style-type: none"> ▪ Understand advantages and limitations of simulation. 	E	8
<ul style="list-style-type: none"> ▪ Develop skills in technical writing. 	G	8, 9

Revised by Dr. Sonia M. Bartolomei Suárez, Agosto2015