Course Specifications

General Information

Course name	Modelling & Simulation
Course number	ITCS4324
Faculty	
Department	
Course type	College Needs
Course level	4
Credit hours (theoretical)	3
Credit hours (practical)	0
Course Prerequisites	

Course Objectives

1 - To improve the students' ability of using modeling and simulation techniques to solve different simple and complex real life problems

2 - To improve the student thinking toward building models that represents a real life models and know the restrictions and limitations on those models

3 - To build the students ability to use their programming skills in solving models by simulation

4 - To be able to validate and verify model inputs and outputs using probability and statistic techniques

Intended Learning Outcomes

Knowledge and Understanding	* a1 Knowledge and understanding of various distributions: Poisson distribution, Exponential distribution, Bernoulli Distribution, etc * a2 Recognizing the appropriate methods and mathematical tools for mathematical modeling * a3 Understanding the methodology of simulation and its types * a4 Knowledge and understanding of different simulation software
Intellectual Skills	* b1 Make a mathematical modeling of real-world systems * b2 Implement the simulation and modeling software in solving real world systems * b3 Write discrete-event programs * b4 Improve skills as a by implementing several modeling of real-world systems
Professional Skills	* c1 Show logical thinking in simulation strategies * c2 Enhance knowledge and practical ability with some of the simulation software discussed
General Skill	* d1 Write Essays concerning simulation types * d2 Search the Internet for up to date simulation software * d3 Prepare posters to illustrate the different between the discrete and continuous simulation

Course Contents

1 - Introduction to Simulation: When Simulation Is the Appropriate/ Not Appropriate Tool, Advantages and Disadvantages, Types of Models, Discrete and Continuous Systems
2 - Simulation Examples and principles: Simulation of Queueing Systems and Inventory Systems, Concepts in Discrete-Event Simulation
3 - Simulation Software: History of Simulation Software
4 - Statistical Models in Simulation: Discrete and Continuous Distributions, Poisson Process, Empirical Distributions
5 - Queueing Models: Characteristics of Queueing Systems, Queueing Notation Long-Run and Steady-State Behavior of Infinite-Population Markovian Models and Finite-Population Models (M/M/c/K/K), Networks of Queues
6 - Random-Number Generation: Techniques for Generating Random Numbers, Tests for Random Numbers
7 - Random-Variate Generation: Inverse-Transform Technique, Acceptance–Rejection Technique
8 - Input Modeling: Data Collection, Identifying the Distribution with Data and Goodness-of-Fit Tests, Selecting Input Models without Data
9 - Verification and Validation of Simulation Models: Model-Building, Verification, and Validation, Verification of Simulation Models, Calibration and Validation of Models
10 - Output Analysis for a Single Model: Types of Simulations with Respect to Output Analysis, Stochastic Nature of Output Data

Teaching and Learning Methods

1 - Class lectures, lecture notes, quizzes, homework's and projects are designed to achieve the course objectives
2 - You should read the assigned chapters before class, and participate in class
3 - You are responsible for all material covered in the class
4 - Please communicate with me regarding any concerns or issues related to the course topic by either in class, phone or email
5 - The web page is a primary communication vehicle. Lecture notes and syllabus are available on the web

Students Assessment

Assessment Method	TIME	MARKS
Assignments		10
First Midterm Exam	8th week	20
Second Midterm Exam	12th week	20
Final Exam	16th week	50

Books and References

Essential books	Banks J., Carson J., Nelson B., and Nicol D. Discrete Event System Simulation, 4th Edition, Prentice-Hall, 2005
Recommended books	Averill M. Law and W. David Kelton, Simulation modeling and analysis: Third edition, 2002
Other References (Periodical, web sites, ... etc.)	http://www.bcnn.net/

Knowledge and Skills Matrix

Main Course Contents	Study Week	Knowledge and Understanding	Intellectual Skills	Professional Skills	General Skill
Introduction to Simulation: When Simulation Is the Appropriate/ Not Appropriate Tool, Advantages and Disadvantages, Types of Models, Discrete and Continuous Systems	1	a1,a3	b1	c1	d1
Simulation Examples and principles: Simulation of Queueing Systems and Inventory Systems, Concepts in Discrete-Event Simulation	2	a2,a4	b2	c1	d2
Simulation Software: History of Simulation Software	3	a1,a4	b3	c2	d1-d3
Statistical Models in Simulation: Discrete and Continuous Distributions, Poisson Process, Empirical Distributions	4-5	a2,a3	b2,b4	c1	d3
Queueing Models: Characteristics of Queueing Systems, Queueing Notation Long-Run and Steady-State Behavior of Infinite-Population Markovian Models and Finite-Population Models	6-7	a3,a4	b1,b4	c1,c2	d1-d3
Random-Number Generation: Techniques for Generating Random Numbers, Tests for Random Numbers	8-9	a1	b3	c2	d3
Random-Variate Generation: Inverse-Transform Technique, Acceptance–Rejection Technique	10	a3	b4	c2	d3
Input Modeling: Data Collection, Identifying the Distribution with Data and Goodness-of- Fit Tests, Selecting Input Models without Data	11-12	a2,a4	b1,4	c2	d1-d3
Verification and Validation of Simulation Models: Model-Building, Verification, and Validation, Verification of Simulation Models, Calibration and Validation of Models	13-14	a3	b2	c1	d1-d3
Output Analysis for a Single Model: Types of Simulations with Respect to Output Analysis, Stochastic Nature of Output Data	15	a4	b4	c2	d3