ITE6011 System Modeling and Simulation

L	T	P	J	C
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Pre-requisite: Nil

Objectives:

- To Understand how computer simulation can be used to model complex systems and solve related decision problems
- To understand and apply statistical methods used in simulation analysis
- To be able to run a simulation project from start to finish.

Expected outcome:

On completion of this course, students will be able to

- Identify different types of simulation models (e.g., stochastic-dynamic, Monte Carlo) and give examples of situations or problems where they are appropriate
- Identify the basic steps that are used in a simulation project.
- Implement and verify the model in a computer system.
- Evaluate and analyze the model output, compare alternatives and make appropriate suggestions for the real system

Module	Topics	L Hrs	SLO
1	**Introduction:** Simulation Terminologies, Application areas, Discrete and Continuous Systems, Components of a system, Model -Types of Simulation, Steps in a Simulation study, Concepts in Discrete Event Simulation **Mathematical models**: Statistical Model, Concepts, Discrete Distribution, Continuous Distribution, Poisson Process, Empirical Distributions	7	1,2
2	**Queueing Models and Random Numbers:** Characteristics, Notation, Queueing Systems, Markovian Models, Properties of random numbers, Generation of Pseudo Random numbers, Techniques for generating random numbers, Testing random number generators, Generating Random-Variates, Inverse Transform technique, Acceptance- Rejection technique, Composition & Convolution Method.	6	1,2
3	**Input Modeling:** Data collection, Assessing sample independence, Hypothesizing distribution family with data, Parameter Estimation, Goodness-of-fit tests, Selecting input models in absence of data	6	1,2
4	**Verification and validation:** Building, Verification of Simulation Models, Calibration and Validation of Models, Validation of Model Assumptions, Validating Input, Output Transformations.	6	1,2
5	**Output analysis for a Single system:** Types of Simulations with Respect to Output Analysis, Stochastic Nature of Output Data, Measures of Performance and Their Estimation, Terminating Simulations, Steady state simulations, Comparing Alternative System Configurations	6	14
6	**Simulation of computer systems and case studies:** Simulation Tools, Model Input, High level computer system simulation, CPU – Memory Simulation, Comparison of systems via simulation, Simulation Programming techniques, Development of Simulation models, Using tools	6	14
7	**Simulation of Computer Networks:** Introduction, Traffic Modeling, Media Access Control, Token	6	14

	Passing Protocols, Ethernet, Data Link Layer, TCP, Model Construction, Example		
8	**Recent developments – Expert Talk**	2	14
Total Lecture Hours # Mode: Flipped Class Room, Use of computer models, Visit to Industry, Min of 2 lectures by industry experts		45	

Text Book:

1. Jerry Banks, John S. Carson, Barry L. Nelson and David M. Nicol, "Discrete Event System Simulation", Fifth Edition, PHI, 2013.

References:

1. Sheldon M.Ross, "Simulation", Fifth Edition, Academic Press Elsevier, 2012.
2. Averill M. Law, "Simulation Modeling and Analysis", Fourth Edition, McGraw Hill, 2007.

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