K. S. INSTITUTE OF TECHNOLOGY

#14, Raghuvanahalli, Kanakapura Main Road, Bengaluru-560109

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Course : System Modelling and Simulation		
Type: Elective	**Course Code: 18CS645**	**Semester and Section : VI A& B**
Course Incharge : Dr Rekha B Venkatapur	**Academic Year 2020-21**	

No of Hours per week

Theory (Lecture Class)	Practical/Field Work/Allied Activities	Total/Week	Total teaching hours
3+1=4	5	3+1=4	40

Marks

Internal Assessment	Examination	Total	Credits
40	60	100	3

Aim/Objective of the Course:

This course enables students to:

Apply the General principles of simulation which are used for model development in engineering applications.

Course Learning Outcomes:

After completing the course, the students will be able to,

Bloom's Level		
18CS645.1	Identify the System components and apply analytical modeling methods to simulate the activities of systems- Queuing, inventory & reliability.	**Applying (K3)**
18CS645.2	Make use of the characteristics of a Discrete system and Event scheduling time advance algorithm to model the Single Queuing Simulation in Java. Identify useful statistical models, discrete and continuous distributions.	**Applying (K3)**
18CS645.3	Model the behaviour of M/G/1 queue behaviour with measures of performance of queuing systems, Random number and variate generation, Tests for random numbers.	**Applying (K3)**
18CS645.4	Identify the steps in Input Modelling by choosing parameters, Solve Goodness of fit tests problems.	**Applying (K3)**
18CS645.5	Apply effective verification, calibration and validation of methods, Plan Optimization through Simulation.	**Applying (K3)**

Syllabus Content:

Module 1	**CO1 8 hrs** PO1-3 PO2-1
Introduction: When simulation is the appropriate tool and when it is not appropriate, Advantages and disadvantages of Simulation; Areas of application, Systems and system environment; Components of a system; Discrete and continuous systems, Model of a system; Types of Models, Discrete-Event System Simulation examples: Simulation of queuing systems. General Principles, Simulation Software: Concepts in Discrete-Event Simulation. The Event-Scheduling	

/ Time-Advance Algorithm, Manual simulation Using Event Scheduling LO: At the end of this session the student will be able to, 1. Demonstrate the system concept and apply functional modeling method to model the activities of a static system	PO3-1
Module 2: Statistical Models in Simulation :Review of terminology and concepts, Useful statistical models, Discrete distributions. Continuous distributions, Poisson process, Empirical distributions. Queuing Models: Characteristics of queuing systems, Queuing notation, Long-run measures of performance of queuing systems, Long-run measures of performance of queuing systems cont., Steady-state behaviour of M /G/1 queue, Networks of queues, LO: At the end of this session the student will be able to, 1. Describe the behavior of a dynamic system and create an analogous model for a dynamic system.	**CO2** **8h hrs.** PO1-3 PO2-1 PO3-1 PO9-2
Module 3: Random-Number Generation: Properties of random numbers; Generation of pseudo-random numbers, Techniques for generating random numbers, Tests for Random Numbers, Random-Variate Generation: ,Inverse transform technique Acceptance-Rejection technique. LO: At the end of this session the student will be able to, 1. Identify different techniques to generate random numbers and variates as required for simulation.	**CO3** **8 hrs** PO1-3 PO2-2 PO3-3 PO9-2
Module 4: Input Modeling: Data Collection; Identifying the distribution with data Parameter estimation, Goodness of Fit Tests, Fitting a non-stationary Poisson process, Selecting input models without data, Multivariate and Time-Series input models. Estimation of Absolute Performance: Types of simulations with respect to output analysis ,Stochastic nature of output data, Measures of performance and their estimation, Contd.. LO: At the end of this session the student will be able to, 1. Apply the tests for Goodness of Test and finding their appropriateness in different circumstances.	**CO4** **8 hrs** PO1-3 PO2-3 PO3-3 PO9-2
Module 5: Measures of performance and their estimation, Output analysis for terminating simulations Continued.., Output analysis for steady-state simulations. Verification, Calibration And Validation: Optimization: Model building, verification and validation, Verification of simulation models, Verification of simulation models, Calibration and validation of models, Optimization via Simulation. LO: At the end of this session the student will be able to, 1.Simulate the operation of a dynamic system and make improvement according to the simulation results after validation	**CO5** **8 hrs** PO1-3 PO2-1 PO3-1
Text Books: - Jerry Banks, John S. Carson II, Barry L. Nelson, David M. Nicol: Discrete-Event System Simulation, 5 th Edition, Pearson Education, 2010.	

Reference Books:

1.Lawrence M. Leemis, Stephen K. Park: Discrete – Eve nt Simulation: A First Course, Pearson Education, 2006.

2. Averill M. Law: Simulation Modeling and Analysis, 4 th Edition, Tata McGrawHill, 2007

Useful Journals

1. **International Journal of System Modeling and Simulation**
   Vol 4 No 1 (2019): Online ISSN: 2518-0959 ***This is an open access issue under the CC BY-SA 4.0 license (https://creativecommons.org/licenses/by-sa/4.0/)***
   Published: 2019-03-31

2. **International Journal of Engineering Systems Modelling and Simulation**
   Editors in Chief Prof. Xiaogang Yang, Dr. Zoubir Zouaoui
   ISSN online1755-9766 **ISSN print** 1755-9758

Useful Links

https://nptel.ac.in/courses/112107220/

Teaching and Learning Methods:

1. Lecture class: 40 hrs.
2. Self-study: 5 hrs.
3. Field visits/Group Discussions/Seminars: 5hrs

Assessment:

Type of test/examination: Written examination

Continuous Internal Evaluation(CIE) : 40 marks (Average three tests will be considered)

Semester End Exam(SEE) : 60 marks (students have to answer all main questions)

Test duration: 1 :30 hr

Examination duration: 3 hrs

CO - PO MAPPING

PO1: Science and engineering Knowledge **PO2:** Problem Analysis **PO3:** Design & Development **PO4:**Investigations of Complex Problems **PO5:** Modern Tool Usage **PO6:** Engineer & Society	**PO7:**Environment and Society **PO8:**Ethics **PO9:**Individual & Team Work **PO10:** Communication **PO11:**Project Mngmt & Finance **PO12:**Life long Learning

PSO1: Graduate should be able to understand the fundamentals in the field of Electronics & Communication and apply the same to various areas like Signal

processing, embedded systems, Communication & Semiconductor technology. **PSO2:** Graduate will demonstrate the ability to design, develop solutions for Problems in Electronics & Communication Engineering using hardware and software tools with social concerns.	

CO #	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
18CS645.1	3	2	1	-	-	-	-	-	-	-	-	-
18CS645.2	3	2	1	-	-	-	-	-	2	-	-	-
18CS645.3	3	1	2	-	-	-	-	-	2	-	-	-
18CS645.4	3	1	1	-	-	-	-	-	1	-	-	-
18CS645.5	3	1	1	-	-	-	-	-	1	-	-	-
18CS645	3	1.4	1.2	-	-	-	-	-	1.5	-	-	-

CO	PSO1	PSO2
18CS645.1	2	1
18CS645.2	2	1
18CS645.3	2	2
18CS645.4	2	2
18CS645.5	2	2
18CS645	2	1.6

3	Substantial (High) Correlation
2	Moderate (Medium) Correlation
1	Slight (Low) Correlation
-	No correlation.

Signature of Course in-Charge **Signature of Module Coordinator** **Signature of HOD**