



K. S. INSTITUTE OF TECHNOLOGY

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

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

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| 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 |
| <u>Aim/Objective of the Course:</u> This course enables students to: Apply the General principles of simulation which are used for model development in engineering applications. | | | |
| <u>Course Learning Outcomes:</u> 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: | | | |
| <u>Module 1</u> 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 | | | CO1 8 hrs PO1-3 PO2-1 |

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| / 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. | |

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| <p>Reference Books:</p> <ol style="list-style-type: none"> 1. Lawrence M. Leemis, Stephen K. Park: Discrete – Event Simulation: A First Course, Pearson Education, 2006. 2. Averill M. Law: Simulation Modeling and Analysis, 4 th Edition, Tata McGrawHill, 2007 | | | |
| <p>Useful Journals</p> <ol style="list-style-type: none"> 1. International Journal of System Modeling and Simulation Vol 4 No 1 (2019): Online ISSN: 2518-0959 <i>This is an open access issue under the CC BY-SA 4.0 license (https://creativecommons.org/licenses/by-sa/4.0/)</i> 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 <p>Useful Links https://nptel.ac.in/courses/112107220/</p> | | | |
| <p>Teaching and Learning Methods:</p> <ol style="list-style-type: none"> 1. Lecture class: 40 hrs. 2. Self-study: 5 hrs. 3. Field visits/Group Discussions/Seminars: 5hrs | | | |
| <p>Assessment: Type of test/examination: Written examination Continuous Internal Evaluation(CIE) : 40 marks (Average three tests will be considered)</p> <p>Semester End Exam(SEE) : 60 marks (students have to answer all main questions) Test duration: 1 :30 hr Examination duration: 3 hrs</p> | | | |
| <p><u>CO - PO MAPPING</u></p> <table border="1" data-bbox="217 1423 1300 1780"> <tr> <td data-bbox="217 1423 760 1780"> PO1: Science and engineering Knowledge PO2: Problem Analysis PO3: Design & Development PO4: Investigations of Complex Problems PO5: Modern Tool Usage PO6: Engineer & Society </td><td data-bbox="760 1423 1300 1780"> PO7:Environment and Society PO8:Ethics PO9:Individual & Team Work PO10: Communication PO11:Project Mngmt & Finance PO12:Life long Learning </td></tr> </table> <p>PSO1: Graduate should be able to understand the fundamentals in the field of Electronics & Communication and apply the same to various areas like Signal</p> | | 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 |
| 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 | | |

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 |

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| 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