

Simulation and Modeling

B.E. Sem. VII [INFT]

EVALUATION SYSTEM

	Time	Marks
Theory Exam	3 Hrs.	100
Practical Exam	–	25
Oral Exam	–	–
Term Work	–	25

Prerequisite: Probability and Statistics.

Objective: The objective of this course is to teach students methods for modeling of systems using discrete event simulation. Emphasis of the course will be on modeling and on the use of simulation software. The students are expected to understand the importance of simulation in IT sector, manufacturing, telecommunication, and service industries etc. By the end of the course students will be able to formulate simulation model for a given problem, implement the model in software and perform simulation analysis of the system.

SYLLABUS

1. Introduction to Simulation and Modeling

Simulation – introduction, appropriate and not appropriate, advantages and disadvantage, application areas, history of simulation software, an evaluation and selection technique for simulation software, general – purpose simulation packages. System and system environment, components of system, type of systems, model of a system, types of models and steps in simulation study.

2. Manual Simulation of Systems

Simulation of Queuing Systems such as single channel and multi channel queue, lead time demand, inventory system, reliability problem, time-shared computer model, job-shop model.

3. Discrete Event Formalisms

Concepts of discrete event simulation, model components, a discrete event system simulation, simulation world views or formalisms, simulation of single channel queue, multi channel queue, inventory system and dump truck problem using event scheduling approach.

4. Statistical Models in Simulation

Overview of probability and statistics, useful statistical model, discrete distribution, continuous distribution, empirical distribution and Poisson process.

5. Queueing Models

Characteristics of queueing systems, queueing notations, long run measures of performance of queueing systems, Steady state behavior of Markovian models (M/G/1, M/M/1, M/M/c) overview of finite capacity and finite calling population models, Network of Queues.

6. Random Number Generation

Properties of random numbers, generation of true and pseudo random numbers, techniques for generating random numbers, hypothesis testing, various tests for uniformity (Kolmogorov-Smirnov and chi-Square) and independence (runs, autocorrelation, gap, poker).

7. Random Variate Generation

Introduction, different techniques to generate random variate:- inverse transform technique, direct transformation technique, convolution method and acceptance rejection techniques.

8. Input Modeling

Introduction, steps to build a useful model of input data, data collection, identifying the distribution with data, parameter estimation, suggested estimators, goodness of fit tests, selection input model without data, covariance and correlation, multivariate and time series input models.

9. Verification and Validation of Simulation Model

Introduction, model building, verification of simulation models, calibration and validation of models:- validation process, face validity, validation of model, validating input-output transformation, t-test, power of test, input output validation using historical data and Turing test.

10. Output Analysis

Types of simulations with respect to output analysis, stochastic nature of output data, measure of performance and their estimation, output analysis of terminating simulators, output analysis for steady state simulation.

11. Case Studies

Simulation of manufacturing systems, Simulation of Material Handling system, Simulation of computer systems, Simulation of super market, Cobweb model, and any service sectors.

Reference :

1. Discrete Event System Simulation (*Banks J., Carson J. S., Nelson B. L., and Nicol D. M.*) 3rd edition, Pearson Education, 2001.
2. System Simulation (*Gordon Geoffrey*) 2nd edition, PHI, 1978.
3. Simulation Modeling and Analysis (*Law A. M., and Kelton, W. D.*) 3rd edition, McGraw-Hill, 2000.
4. System Simulation with Digital Computer (*Narsing Deo*) PHI.
5. System Modeling and Simulation (*Frank L. Severance*)
6. Probability and Statistics with Reliability, Queueing, and Computer Science Applications (*Trivedi K. S.*) PHI, 1982.
7. Introduction to Probability and Random Variables (*Wadsworth G. P., and Bryan, J. G.*) McGraw-Hill, 1960.
8. System Analysis and Modeling (*Donald W. Body*) Academic Press Harcourt India.
9. Theory Of Modeling and Simulation (*Bernard*)
10. Statistics for Management (*Levin & Ruben*)
11. Business Statistics (*Aczel & Sounderpandian*)

