Course Name:
Simulation

Course Number:
20564

Credit:
3

Course Content (outline):

1. Introduction to Simulation and its applications for planning, systems; models and simulations, different simulation systems, discrete-event dynamic Systems.
2. Simulation of a single server queueing system.
3. An overview of probability and statistics, random variables, probability/density and distribution functions of discrete and continuous random variables, expected value, conditional probability, an overview of the distribution of important random variables (Bernoulli, discrete uniform, binomial, geometric, negative binomial, poisson, uniform, exponential, m-erlang, gamma, Weibull, normal, lognormal, beta, pearson type v, pearson type vi, log-logistic, johnson, triangular, and empirical distributions), central limit theorem, strong law of large numbers, stochastic process, Poisson process, nonstationary poisson processes, confident intervals and hypothesis tests.
4. Basic Queueing & Inventory Theory.
5. Random number generators, different kinds of random number generators, linear congruential generators, Testing random number generators.
6. Random Variate Generation, Random variates generator techniques, invers transform, composition, convolution, acceptance-rejection, special properties, generating important continuous random variates, generating discrete random variates.
7. Input modelling, Data collection, Selecting Input Distributions, Estimation of parameters, maximum likelihood estimators, Goodness of fit tests, regression analysis.
8. Simulation software, Simulation with programming languages, Object oriented simulation, General purpose simulation packages, Application oriented simulation packages, simulation software ARENA.
9. Model Verification and Validation.
10. Output Analysis, Output data analysis for a single system, Comparing Alternatives.
11. A review of some advanced techniques in simulating systems, Modeling complex systems, Variance Reduction Techniques.
12. Monte Carlo simulation.
13. Optimization via simulation, Simulation-based optimization, meta-models, heuristic algorithms for solving optimization problems.
14. Some examples of simulation of systems, agent-based simulation.

References:
1. Discrete-Event System Simulation,4th Edition, Banks, Carson, Nelson & Nicol, Prentice Hall, 2005.
2. Simulation Modelling & Analysis, 4th Edition, Averill, M. Law, McGrew-Hill Series in Industrial Engineering & Management Science, 2007.
3. Simulation with ARENA, 4th Edition, Kelton, Sadowski & Sturrock, McGrew-Hill Series in Industrial Engineering & Management Science, 2007.

4. Simulation Modeling Hand Book: A Practical Approach, Christopher A. Chung, CRC Press, 2004.
5. Lecture notes, PowerPoint and articles presented or distributed in the classroom.