M.G. Science Institute (Autonomous) B.Sc. (Hons.) Mathematics

MASEC 356: Mathematical Modelling and Simulation-I

Semester: V	Course Title: Mathematical Modelling and Simulation -I	Credit: 2 (1T+1P)
Course No.: 356 T	SEC (T+P)	Hours: 3/week

COs with cognitive Abilities:

COs	COGNITIVE ABILITIES	COURSE OUTCOMES
CO1	REMEMBERING	Recall fundamental concepts of simulation, system modeling, probability distributions, and queuing theory.
CO2	UNDERSTANDING	Explain principles, mechanisms, and applications of simulation techniques and operations research models.
CO3	APPLYING	Apply simulation techniques to solve problems in single-server, multi-server, and parallel queuing systems, and Monte Carlo methods.
CO4	ANALYSING	Analyse simulation outputs to evaluate system behaviour, performance measures, and bottlenecks.
CO5	EVALUATING	Assess the validity, accuracy, and efficiency of simulation models for decision-making.
CO6	CREATING	Design and develop new simulation models for complex systems using discrete-event and continuous-event approaches.

Unit	Detailed Syllabus	No. of Hours of Teaching
I	Concept of Simulation, System, and Model, When simulation is appropriate and not appropriate, Applications of simulation in science, business, and industry, Random number generation and properties, Coin flipping experiment simulation, Monte Carlo simulation to estimate area of a circle, Basics of queuing theory (arrival, service, performance measures), Single server queue model simulation, Multi-server and parallel server queuing systems, Inline (series) server models, Verification and validation of simulation models, Applications in operations research, management, and manufacturing	15

LIST OF PRACTICALS

Unit	Detailed Syllabus	No. of Hours of Teaching
1	Simulation of Random Experiments	5
2	Monte Carlo Method	5
3	Simulation of Single Server Queue	5
4	Simulation of in line two-Server Queue	5
5	Parallel Server Queue Simulation	5
6	Three server queue simulation.	5

Suggested Reference Books:

1. **Operations Research: An Introduction (8th ed.)** – Hamdy A. Taha, Pearson Education India, 2013.
2. **Operations Research: Applications and Algorithms (3rd ed.)** – Wayne L. Winston & Jeffrey B. Goldberg, Thomson/Brooks/Cole, 2004.
3. **Introduction to Operations Research (5th ed.)** – Frederick S. Hillier & Gerald J. Lieberman, McGraw-Hill, 1990.
4. **Discrete-Event System Simulation** – Jerry Banks, John S. Carson, Barry L. Nelson & David M. Nicol, Pearson Education India, 2005.
5. **Simulation Modeling and Analysis (3rd ed.)** – Averill M. Law & W. David Kelton, McGraw-Hill, 2000.
6. **System Simulation with Digital Computer** – Narsingh Deo, Prentice Hall of India.
7. **Simulation** – Sheldon M. Ross, Academic Press.