GUJARAT TECHNOLOGICAL UNIVERSITY

Master of Engineering
Subject Code: 3725010
Semester – II
Subject Name: Simulation Modeling of Manufacturing System

Type of course: Core III

Prerequisite: Nil

Rationale:
This course is designed to provide an insight into how simulation modeling can aid in effective decision-making. Simulation model building aspects of discrete systems (such as Queuing, Inventory and manufacturing) are covered in detail. It is also demonstrated how computer simulation can be used to successfully model, analyze and improve systems under study. It also looks into the statistical analysis of simulation model output.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
03	0	02	04	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	**Introduction to Simulation** When Simulation Is the Appropriate Tool, When Simulation 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, Steps in a Simulation Study	**08**
2	**Simulation Software** Introduction, Comparison of Simulation Packages with Programming Languages, Classification of Simulation Software, Desirable Software Features, And General Purpose Simulation Packages.	**08**
3	**Basic Probability and Statistics** Introduction, Random Variables and Their Properties, Simulation Output Data and Stochastic Processes, Estimation of Means, Variances, and Correlations, Confidence Intervals and Hypothesis Tests for the Mean, The Strong Law of Large Numbers , The Danger of Replacing a Probability Distribution by its Mean	**08**
4	**Random Variate Generation** Inverse-Transform Technique: Exponential Distribution, Uniform Distribution, Weibull Distribution, Triangular Distribution, Empirical Continuous Distributions, Discrete Distributions, Acceptance—Rejection Technique: Poisson Distribution, Nonstationary Poisson Process,	**08**

	Gamma Distribution	
5	**Verification and Validation of Simulation models** Model-Building, Verification, and Validation, Verification of Simulation Models, Calibration and Validation of Models: Face Validity, Validation of Model Assumptions**,** Validating Input-Output Transformations, Input-Output Validation	**06**
6	**Output data analysis** Types of Simulation w.r.t output data analysis, Warmup period, Welch algorithm, Approaches for Steady State Analysis, Replication & Batch means methods.	**04**
7	**Application of Simulation** Simulation of queuing system, Simulation of Inventory system, Simulation of manufacturing and material handling system	**03**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	**20**	**25**	**25**	**10**	**10**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. Simulation Modelling and Analysis / Law, A.M.& Kelton / McGraw Hill, Edition, New York,1991.
2. Discrete Event System Simulation / Banks J. & Carson J.S., PH/Englewood Cliffs, NJ, 1984.
3. Simulation of Manufacturing Systems/Carrie A. /Wiley, NY, 1990.
4. A Course in Simulation /Ross, S.M., McMillan, NY, 1990.
5. Simulation Modelling and SlMNET/TahaHA./PH,Englewood Cliffs, NJ, 1987

Course Outcomes:

Sr. No.	CO statement	Marks % weightage
CO-1	The students learn the basic concepts of simulation and how to model and to analyze complex systems using standard simulation software.	50
CO-2	The students can able to validate simulation model and analyze for different industry problem. software.	50

Term Work:
The term work shall be based on the topics mentioned above.

List of Experiments:

1. Simulation of Single Server Queuing System,
2. Simulation of manufacturing shop ,
3. Simulation of supply chain Inventory System,
4. Simulation of Multiple Servers Queuing System,
5. Simulation of batch shop manufacturing process,
6. Simulation of multi machine assignment system,
7. Simulation of Manufacturing and material handling systems,
8. Simulation of supply chain inventory system,
9. Simulation of Job shop System,
10. Simulation of queuing System.

Major Equipment:

Simulation Software

List of Open Source Software/learning website:

NPTEL