PAPER ID-310261

Subject Code: MTME101

Roll No: | | | | | | | | | | | | | |

MTECH
(SEM I) THEORY EXAMINATION 2025-26
SIMULATION, MODELLING & ANALYSIS

TIME: 3 HRS **M.MARKS: 70**

Note: Attempt all Sections. In case of any missing data; choose suitably.

SECTION A

1. Attempt *all* questions in brief. **02 x 7 = 14**

Q. No.	Question
a.	Differentiate between Discrete Systems and Continuous Systems with an example of each.
b.	State the major advantages and disadvantages of using simulation as a tool.
c.	List the basic properties that a good sequence of random numbers should possess.
d.	Briefly explain the components of a system in the context of simulation modelling.
e.	Define the Poisson Process. Where is it commonly used in simulation?
f.	What is the significance of the Server Utilization (ρ) in the long-run measures of performance for a queuing system?
g.	What is the primary difference between the Inverse Transform Technique and the Acceptance-Rejection Technique for random variate generation?

SECTION B

2. Attempt any *three* of the following: **07 x 3 = 21**

a.	Explain the concepts in discrete event simulation. Describe the working of the Time Advance Algorithm used in event-scheduling.
b.	Explain the Inverse Transform Technique for generating Random Variates. Derive the expression for the variate 'X' when the distribution is Exponential.
c.	Describe the characteristics of queuing systems. Detail the significance of the Calling Population, System Capacity, and Service Mechanism in a queuing model.
d.	Discuss the steps involved in Input Modelling for a simulation study, from data collection to distribution identification.
e.	Explain the role of Statistical Models in simulation. Briefly describe the application of Geometric Distribution and Weibull Distribution in reliability and maintainability studies.

SECTION C

3. Attempt any *one* part of the following: **07 x 1 = 07**

a.	With a detailed example, illustrate the technique of Manual Simulation using Event Scheduling. Clearly identify the events and the event list.
b.	Explain the methodology and procedure of Direct Transformation for generating random variates from the Normal and Lognormal distributions.

4. Attempt any *one* part of the following: **07 x 1 = 07**

a.	Explain the properties and techniques of generating Pseudo Random Numbers. Describe the Mid-Square or Linear Congruential Method for their generation.
b.	Discuss the various Tests of Random Numbers (e.g., Uniformity Test and Independence Test). Explain the use of the Chi-Square Goodness of Fit Test in this context.

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5. Attempt any *one* part of the following: 07 x 1 = 07

a.	Explain the importance of Verification and Validation of simulation models. Describe the steps involved in the Verification process.
b.	Detail the application of Goodness of Fit Tests (e.g., Kolmogorov-Smirnov test) for validating the selected input distribution in a simulation model.

6. Attempt any *one* part of the following: 07 x 1 = 07

a.	Explain the Larkovian Models of Queuing Systems. Discuss how the long-run measures of performance of queuing systems are derived.
b.	Discuss the concept of Costs in Queuing Problems. Explain the formulation of the total cost function and how it is minimized to find the optimal system configuration.

7. Attempt any *one* part of the following: 07 x 1 = 07

a.	Discuss the process of selecting input models without data. How are engineering judgment and expert opinion used to select appropriate distributions (e.g., Uniform, Triangular) in this scenario?
b.	Explain the Convolution Method for generating random variates. Illustrate its application for generating random variates from the Binomial Distribution.