

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -2 EXAMINATIONS- 2026

B.Tech-IV Semester (CSE/IT)

COURSE CODE (CREDITS):18B11CI413 (3)

MAX MARKS: 25

COURSE NAME: Modeling and Simulation Techniques

COURSE INSTRUCTOR: Dr. Emjee Puthooran

MAX. TIME: 1 Hour 30 Min

Note: (a) All questions are compulsory.

(b) The candidate is allowed to make Suitable numeric assumptions wherever required for solving problems

(c) Use of calculator is allowed

Q.No	Question	CO	Marks																		
Q1	Define Discrete Event Simulation (DES) and list its key characteristics	CO-3	2																		
Q2	Explain the components of a queuing system with neat representation.	CO-3	3																		
Q3	A single-server queuing system has the following characteristics: Arrival rate ( $\lambda$ ) = 4 customers/hour Service rate ( $\mu$ ) = 6 customers/hour Assuming an M/M/1 queue, calculate: a) Average number of customers in the system (L) (2) b) Average time spent in the system (W) (2) c) Utilization factor ( $\rho$ ) (1)	CO-3	5																		
Q4	Using Monte Carlo Simulation, estimate the value of $\pi$ using the following random points inside a unit square:  <table border="0" style="width: 100%;"> <tr> <td style="width: 15%;"><b>Point</b></td> <td style="width: 35%;"><b>(x, y)</b></td> <td style="width: 50%;"></td> </tr> <tr> <td>1</td> <td>(0.2, 0.3)</td> <td>a) Determine how many points fall inside the quarter circle and estimate <math>\pi</math>. (3)</td> </tr> <tr> <td>2</td> <td>(0.7, 0.8)</td> <td></td> </tr> <tr> <td>3</td> <td>(0.5, 0.4)</td> <td>b) Interpret the result and comment on accuracy. (2)</td> </tr> <tr> <td>4</td> <td>(0.9, 0.1)</td> <td></td> </tr> <tr> <td>5</td> <td>(0.6, 0.6)</td> <td></td> </tr> </table>	<b>Point</b>	<b>(x, y)</b>		1	(0.2, 0.3)	a) Determine how many points fall inside the quarter circle and estimate $\pi$ . (3)	2	(0.7, 0.8)		3	(0.5, 0.4)	b) Interpret the result and comment on accuracy. (2)	4	(0.9, 0.1)		5	(0.6, 0.6)		CO-3	5
<b>Point</b>	<b>(x, y)</b>																				
1	(0.2, 0.3)	a) Determine how many points fall inside the quarter circle and estimate $\pi$ . (3)																			
2	(0.7, 0.8)																				
3	(0.5, 0.4)	b) Interpret the result and comment on accuracy. (2)																			
4	(0.9, 0.1)																				
5	(0.6, 0.6)																				
Q5	a) Explain the steps in simulation methodology. (2) b) A Linear Congruential Generator (LCG) is defined as: $X_{n+1} = (aX_n + c) \text{ mod } m$ Given: a=5, c=3, m=16, $X_0=7$ Generate the next four random numbers. (3)	CO-3	5																		
Q6	a) Compare deterministic vs stochastic models with examples. (2) b) A simulation study shows that increasing service rate reduces waiting time but increases cost. Perform a sensitivity analysis discussion and suggest an optimal strategy. (3)	CO-3	5																		