QP CODE : 27884

(3 Hours) **[Total Marks: 80]**

N.B.: (1) Question **No.1** is **Compulsory**.
(2) Attempt **any three** questions from **remaining** questions.
(3) Assume **suitable** data wherever required but **justify** the same.
(3) **Figures** to the **right** indicate **full marks**.
(4) Use of **Statistical Table** is allowed.

1. (a) Define model. Explain different models with suitable example. **(10)**
(b) Explain Naylor Finger approach for validation of simulation model. **(10)**

2. (a) Consider a single server system. Let the arrival distribution be uniformly distributed between 1 and 10 minutes and the service time distribution is as follows: **(10)**

Service Time (Min)	1	2	3	4	5	6
Probability	0.04	0.20	0.10	0.26	0.35	0.05

Develop the simulation table and analyze the system by simulating the arrival and service of 10 customers. Random digits for inter-arrival time and service times are as follows:

Customer	1	2	3	4	5	6	7	8	9	10
R.D. for Inter-arrival Time	--	853	340	205	99	669	742	301	888	444
R.D. for Service Time	71	59	12	88	97	66	81	35	29	91

(b) Explain the following terms: Event Scheduling, Process Interaction, Activity Scanning, Bootstrapping, and Terminating Event. **(10)**

3. (a) Suppose that the life of an industrial lamp, in thousands of hours, is exponentially distributed with failure rate $\lambda=1/3$ (one failure every 3000 hours, on average). **(10)**
i) Determine the probability that lamp will last longer than its mean life of 3000 hours.
ii) Determine the probability that the lamp will last between 2000 and 3000 hours.
iii) Find the probability that the lamp will last for another 1000 hours, given that it is operating after 2500 hours.

(b) Explain Direct Transformation method for random variate generation using Normal and Lognormal distribution. **(10)**

4. (a) Test the following random numbers for independence by Poker test. **(10)**
{0.594, 0.928, 0.515, 0.055, 0.507, 0.351, 0.262, 0.797, 0.788, 0.442, 0.097, 0.798, 0.227, 0.127, 0.474, 0.825, 0.007, 0.182, 0.929, 0.852}
Use $\alpha = 0.05$, $\chi^2_{0.05,1} = 3.84$

(b) Explain Inventory system. Discuss the cost involved in inventory systems. **(10)**

5. (a) Give the equations for steady state parameters for M/G/1 queue and derive M/M/1 from M/G/1. **(10)**

(b) A federal agency studied the records pertaining to the number of job-related injuries at an underground coal mine. The values for the past 100 months were as follows: **(10)**

Injuries per Month	0	1	2	3	4	5	6
Frequency of Occurrence	35	40	13	6	4	1	1

i. Apply the Chi-Square test to these data to test the hypothesis that the underlying distribution is Poisson.
ii. Apply the Chi-Square test to these data to test the hypothesis that the underlying distribution is Poisson with mean 1.0.

Use level of significance $\alpha = 0.05$ and $\chi^2_{0.05,2} = 5.99$, $\chi^2_{0.05,3} = 7.81$

6. Write short notes on (**any two**): **(20)**
(a) Poisson Process and its properties.
(b) Manufacturing and Material Handling Systems.
(c) Initialization bias in steady state simulation.
(d) Steps in simulation study.
