

(3 hours)

(Marks: 80)

Note:

- N. B.: (1) Question number 1 is **compulsory**
 (2) Attempt any **Three** out of remaining **Five** questions
 (3) Assume any **necessary data** but justify the same
 (4) Illustrate **answers with sketches** wherever necessary.
 (5) Use of **Scientific calculator** is allowed

Q1

- a) Discuss simulation application in any one of the following system
 i) Cash counter Analysis in bank
 ii) Customer flow analysis in a hotel
 iii) Check out counter at airport (10)
- b) Use inverse transformation method to generate random variates for exponential distribution with mean 1. Use the random numbers:0.30, 0.48, 0.36, 0.01, 0.54, 0.34. (10)

Q2

- a) A NGO collected the records of monthly number of job related accidental injuries at an underground coal mine for study. The records for the past 100 months are as given below. Use the chi square test to test the hypothesis that the underlying distribution is Poisson and value of $\chi^2_{0.05, 2}$ is 5.99) (10)

Monthly Injuries	0	1	2	3	4	5	6
Frequency of occurrence	35	40	13	6	4	1	1

- b) What do you understand by model verification and validation? How would you validate input-output transformation of a model? (10)

Q3

- a) What is modeling and simulation? Explain different types of simulation models with example. (10)
- b) Use mixed congruential method to generate a sequence of three two digit random numbers with $X_0=37, a=7, c=29$ and $m=100$. (10)

Q4

- a) The time required for a professor to travel from his house to college is uniformly distributed over the interval 30 to 35 minutes. Generate two random travel times from this distribution. Use $R_1=0.5023, R_2= 0.2916$ (10)

b) Write a short note on:-

- (i) Selecting input models without data
- (ii) Types of simulation with respect to output analysis (10)

Q5

- a) Suppose five numbers generated are 0.44, 0.81, 0.14, 0.05, 0.93. Perform Kolmogorov-Smirnov test with level of significance $\alpha = 0.05$, to determine if the hypothesis that the numbers are uniformly distributed on the interval[0.1] can be rejected, Given critical value $D\alpha = 0.565$. (10)
- b) Perform the simulation of the following inventory system, given daily demand is represented by the random numbers 0.4, 0.1, 0.8, 0.5 and 0.2. The demand probability is given as below

Demand	0	1	2
probability	0.2	0.5	0.3

If the initial inventory is 4 units, determine on which day the shortage condition occurs. The review period is of 5 days. (10)

Q6

- a) Consider a single server system. Arrival is uniformly distributed between 1 and 8 minutes. Service distribution and random digits for inter arrival and service time are as follows

Service time	1	2	3	4	5	6
Probability	0.17	0.15	0.32	0.20	0.06	0.10

Develop a simulation table and analyze the system by simulating the arrival and service of 10

Customer No	1	2	3	4	5	6	7	8	9	10
RD for inter arrival time	---	751	303	106	94	606	747	339	877	454
R D for Service Time	74	52	16	82	94	61	87	35	29	99

customers. The first customer arrives to the system at 0th time. Calculate the average waiting time, service time and average time spend by the customer in the system. (10)

- b) Write short notes on
 - i) Properties of Random numbers
 - ii) Steps of Simulation study (10)
