

GUJARAT TECHNOLOGICAL UNIVERSITY**M.E Sem-I Examination January 2010****Subject code:711901****Subject Name: Modeling, Analysis & Simulation****Date: 20 / 01 / 2010****Time: 12.00 – 2.30 pm****Total Marks: 60****Instructions:**

- 1. Attempt all questions.**
- 2. Make suitable assumptions wherever necessary.**
- 3. Figures to the right indicate full marks.**

- Q.1** (a) What is a mathematical model? Give the classification of mathematical models and how they differ in their predictions? **06**
- (b) Define 'entities' attributes and activities of a system. Name three principle entities, attributes and activities to be considered if you simulate the operation of **06**
- (i) a traffic system
 - (ii) a super market
 - (iii) a communication

- Q.2** (a) Vehicles arrive at a stop sign at an average rate of 300 per hour. Average waiting time at a stop sign is 10s per vehicle. If both the arrivals and the departures are exponentially distributed. What are the average queue length and the average delay per vehicle? **06**
- (b) It is known that the probability of an item produced by a certain machine will be defective is 0.05. If the produced items are sent to the market in packets of 20, find the number of packets containing at least exactly and almost 2 defective items in a consignment of 1000 packets using poisson approximation to binomial distribution. **06**

OR

- (b) If the density function of a continues random variable x is given by $f(x) = kxe^{-4x^2}, [-\infty, \infty]$ determine k . **06**

- Q.3** (a) Explain various steps used in a simulation study. **06**
- (b) Explain Monte Carlo method. Use it to find the area under the curve. **06**

OR

- Q.3** (a) How would you define a process of arrival of vehicles on a highway using discrete and continues distribution. **06**
- (b) Cars arrive at a petrol pump having one petrol unit, in poisson fashion with an average of ten cars per hour. The service time is distributed exponentially with a mean of three minutes. Find (i) average number of cars in the system (ii) average queue length (iii) the probability that the number of cars in the system is 2. **06**

- Q.4** (a) In a city, random samples of 500 people were taken and out of them 65 were vegetarians. Find the percentage of vegetarians in the city? **06**
- (b) A manufacturing firm claims that its brand 'A' product outsells its brand 'B' product by 8%. If it is found that 42 out of sample of 200 persons prefer brand 'A' and 18 out of another sample 100 of persons prefer brand 'B'. Test whether the 8% difference is a valid claim. **06**

OR

- Q.4** (a) The intelligence quotients (IQs) of 16 students from one area of a city showed a mean of 107 and an s.d of 10, while the IQs of 14 students from another area of the city showed a mean of 112 and an s.d of 8. Is there a significant difference between the IQs of the two groups at a significance level of (a) 0.01 and (b) 0.05? **06**
- (b) Ships arrive at a port at the rate of one in every 4 hours with exponential distribution of interval times. The time a ship occupies a berth for unloading has exponentially distribution with an average of 10 hours. If the average delay of ships waiting for berths is to be kept below 14 hours; how many berths should be provided at the port? **06**
- Q.5** (a) A biologist is researching a newly discovered species of bacteria At time $t = 0$ hours; he puts 100 bacteria in what he has determined to be favorable growth medium. Six hours later, he measures 450 bacteria. Assuming exponential growth, what is the growth constant 'K' for the bacteria correct to two decimal places. **06**
- (b) What is the "stochastic model" and how it is different from a probabilistic model? Which one is superior and how? Give examples to explain. **06**

OR

- Q.5** (a) What is a "Random number" and a "pseudo-random number" Explain. **06**
- (b) Customers arrive at a telephone booth with only one phone. According to the poisson distribution at the rate of 2 per every 5 minutes. Determine the following ; **06**
- (a) probability that the facility is idle
 - (b) the expected number of customers waiting to get the phone
 - (c) expected waiting time to get the phone
