PART A

Birla Institute of Technology and Science, Pilani 333031
Second Semester 2016-17

Course No: MATH F242, Course Name :Operations Research
Class Test II : Closed Book

09/10.

Max. Marks: 10	Time: 25 mins	Date: 23/02/2017
Name		ID No.

Q1. In an $(M \mid M \mid 1):(FCFS \mid \infty \mid \infty)$ queueing model, customers arrive at the mean rate of 10 per hour. Calculate the mean service rate μ in order that the probability that a new arrival will not have to wait ≥ 0.5. **[4]**

Q2. The demand for an item in a company is 1800 units per year. The company can produce the items at a rate 300 per month. If the cost of one setup is Rs. 500, holding cost of one unit per month is Rs. 5 and the shortage cost of one unit is Rs. 10 per month, then find the optimum manufacturing quantity (Q^*) per month. If shortages are not allowed then what will be the Q^*. **[6]**

Q1 $\lambda = 10$

P[new arrival does not have to wait] = P_0

because ~~if~~ there ~~are~~ must be no customers in the system i.e, server has to be free

03

$$P_0 = \left[\sum_0^{\infty} C_n\right]^{-1} = \left(\sum_{i=0}^{\infty} \frac{\lambda^i}{\mu^{i+1}}\right)^{-1} = \left(1 + \frac{10}{\mu} + \left(\frac{10}{\mu}\right)^2 \cdots\right)^{-1}$$

$$= \left(\frac{1}{1-\frac{10}{\mu}}\right)^{-1} \geq 0.5 \qquad 1 - \frac{10}{\mu} \geq 0.5$$

$$\Rightarrow \frac{10}{\mu} \Rightarrow \frac{10}{\mu} \leq \frac{1}{2} \qquad \mu = 20 \text{ per hour}$$

Q2. $D = 1800$ /year = 150/month $\qquad K = Rs\ 500$

$A = 300$/month

$C_1 = 5$/month/unit

$C_2 = 10$/month/unit

$\frac{1-P}{A} = 0.5$

$$Q^* = \sqrt{\frac{2KD(C_1+C_2)}{C_1C_2(1-P/A)}} = \sqrt{900.00} = 300 \text{ units}$$