The demand is assumed to be instantaneous. The unit carrying cost of the item in inventory is Rs. 0.50 per day and unit shortage cost is Rs. 4.50 per day. If Rs. 0.50 is the purchase cost per unit, determine the optimal order level of the inventory. 8

5. a) Investigate the effect of probabilistic demand on the cost of order level inventory system. 8

   b) A company uses iron ore in its manufacturing process at the rate of 1000 ton per month. It costs Rs. 200 to place an order for a new shipment. The holding cost per ton per month is Rs. 30 and shortage cost per ton is Rs. 120. Historical data show that the demand during the lead time is uniform over the range (0, 500) tons. Determine the optimal ordering policy for the company. 8

6. What do you mean by overage and underage costs. 2

M. Sc. Mathematics Examination, 2023

(2nd Year, 2nd Semester)

Production and Inventory Control II

Paper – 4.5 (B 2.33)

Time : Two hours Full Marks : 50

The figures in the margin indicate full marks.

(Notations/Symbols have their usual meanings)

Answer **Q. No. 6** and ***any three*** questions from the rest.

1. a) Show that, for a stochastic inventory model with instantaneous demand and no set up cost, the optimum stock level S^* in discrete units can be obtained by satisfying the following inequality:

$$\sum_{x=0}^{s-1} p(x) < \frac{c_2}{c_1+c_2} < \sum_{x=0}^{s} p(x)$$ 8

   b) A baking company sells cake by kg. weight. It makes a profit of Rs. 5 per kg. on each kg. sold on the day it is baked. It disposes all the cakes not sold on the day it is baked at a loss of Rs. 1.2 per kg. If the demand is known to be rectangular between 2000 and 3000 kg., formulate a mathematical model and determine the optimal amount baked. 8

2. a) Show that the expected average total cost of the probabilistic order level inventory system with uniform demand is

[Turn over

$$C(S)=c_1\int_0^S\left(S-\frac{x}{2}\right)f(x)\,dx+c_1\int_S^\infty\frac{S^2}{2x}f(x)\,dx+c_2\int_S^\infty\frac{(x-S)^2}{2x}f(x)\,dx$$

8

b) A television dealer finds that the cost of holding a television in stock for a week is Rs. 20. The customer who cannot obtain new television immediately tends to go to other dealers and he estimates that he loses on an average Rs. 200. The probability distribution of demand of a particular model of television is as follows:

Demand :	0	1	2	3	4	5
Probability :	0.05	0.10	0.20	0.30	0.20	0.15

How many televisions should the dealer order in every week? 8

3. a) Show that the probabilistic order level system with uniform demand and probabilistic order level system with instantaneous demand are equivalent.

In a probabilistic order level system with uniform pattern of demand, the density of demand is as follows:

$$f(x)=\frac{1}{b^2}xe^{-x/b},\ x\geq 0.$$

Find the optimal order level of the above system considering the equivalent system of instantaneous demand. 8+2

b) The probability distribution of monthly sales of a certain item is as follows:

Monthly sales :	0	1	2	3	4	5	6
Probability :	0.02	0.05	0.30	0.27	0.20	0.10	0.06

The cost of carrying inventory is Rs. 10/unit/month. The current policy is to maintain a stock of three items at the beginning of each month. Assuming that the cost of shortage is proportional to both time and quantity short, obtain the shortage cost of one item for one unit of time. 6

4. a) Formulate and solve the following inventory problem:

"Stock is reviewed continuously and an order of size y is placed every time the stock level reaches a certain reorder point R. The p.d.f. of demand during lead time is $f(x)$. p and h denote respectively the penalty cost per unit and holding cost per unit per unit time. K is the set up cost per order". 8

b) Let the probability of demand of certain item during a day be

$$f(x)=\begin{cases}0.1, & 0\leq x\leq 10\\ 0, & x>10\end{cases}$$