PG (CBCS) ODD SEMESTER EXAMINATION, 2022

MATHEMATICS

3rd Semester

Course No. : MTMCC - 304

(Operations Research-II)

Full Marks : 70

Pass Marks : 28

Time : 3 hours

The figures in the margin indicate full marks for the questions

(Answer any five questions, taking one from each unit)

UNIT - I

1. (a) Find the mean and variance of Poisson-Distribution. 6

   (b) A box contain electric bulbs, proportion p of which are defective. A bulb is drawn at random. If x has value I when the bulb is defective and zero otherwise. Obtain the variance of x. 4

   (c) Write the propeties of Normal Distribution. 4

2. (a) If a random variable has a Poisson distribution such that P(1) = P(2). Find P(4) where $e^{-2} = 0.1353$. 5

(b) Discuss about Monte Carlo Simulation. A town contains six wards and they contain 170, 510, 640, 75, 250 and 960 houses respectively. Make a random selection of 8 houses using the random numbers 0136, 0163, 0472, 1155, 1089, 1221, 2579, 2570. 9

UNIT - II

3. (a) Discuss the Queuing Model M/M/I : (N/FCFS) 10

(b) Arrivals at a telephone both are considered to be poisson with an average time of 10 minutes between one arrival and the next. The length of a phone call assumed to be distributed exponentially with mean 3 minutes. What is the probability that a person arriving at the both will have to wait. 4

4. (a) Discuss about the power supply model to find the value of P_O. 10

(b) In a railway yard, goods trains arive at a rate of 30 trains per day. Assuming that the inter-arrival time follows an exponential distribution and the service time distribution is also exponential with an average 36 minutes. Calculate the mean queue-size. 4

UNIT - III

5. (a) Deduce the Inventory model with instantaneous demand without setpu cost in case of discrete random demand rate. 8

P_3 : Maximise profits limit upto Rs. 1200. Formulate the GPP and solve it graphically. 14

UNIT - V

9. (a) For the following function determine whether it is convex, concave or neither stating the respective conditions : 4

(i) $f(x) = x_1x_2 - x_1^2 - x_2^2$

(ii) $f(x) = 3x_1 + 2x_1^2 + 4x_2 + x_2^2 - 2x_1x_2$

(iii) $f(x) = x_1^2 + 3x_1x_2 + 2x_2^2$

(b) Solve the NLPP by using Lagrangian multipliers method : 10

Minimize

$Z = 2x_1^2 + x_2^2 + 3x_3^1 + 10x_1+8x_2+6x_3-100$

Subject to the constraint :

$x_1 + x_2 + x_3 = 20$, $x_1 + x_2$, $x_3 \geq 0$

10. (a) Obtain the set of necessary conditions for the NLPP

Minimize

$Z = 3x_1^2 + x_2^2 + 2x_1x_2 + 6x_1 + 2x_2$

Subject to the constraints

$2x_1 - x_2 = 4$, $x_1, x_2 > 0$ 4

(b) Solve the following NLPP by using Kubn-Tucker condtions conditions : 10

Maximize $Z = 2x_1^2 - 7x_2^2 + 12x_1x_2$

subject to constraint

$2x_1 + 5x_2 \leq 98$

$x_1, x_2 \geq 0$

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(b) A newspaper boy buys paper for Rs. 5 each and sells them for Rs. 6 each. He cannot seturn unsold news papers. Daily Demand R for news papers follows the distribution:

R :	10	11	12	13	14	15	16
P_R :	0.5	0.15	0.40	0.20	0.10	0.05	0.05

If each day's demand is independent of the previous day's how many papers should be order each day. 6

6. Explain the Probabilistic Invensotry Model with uniform demand no setup cost for a continuous random variable. 14

UNIT - IV

7. (a) Write the difference between LPP and GPP. 6

(b) An office equipment manufacturer produces two kinds of products fand and lamps. Production of a fan or a lamp requires 1 hour of production capacity in the plant. The plant has a maximum capacity of 10 hours per week. The gross margin from the sale of a fan is Rs. 80 and Rs. 40 for that of a lamp. Formulate the problem as a GPP with the following equally ranked goals .

(i) to earn a profit of Rs. 800 per week.

(ii) because of limited capacity, the maximum number of fans and lamps that can be sold are 6 and 8 per week respectively. 8

8. A Camera Company manufactures two types of 35mm cameras. To produce the standard camera requires 2 hours of production time in department 1 and 3 hours in department 2. To produce the detaxe model requires 4 hours of production time in department 1 and 3 hours in deparment 2. Currently 80 hours of labour are avaiable each week in each of the department. This labour time is some what restrictive factor. Since the company has a general policy of avoiding overtime, if possible. The manufacturer's profit on each standard camera is Rs. 30 while the profit on the detuxe model requires 4 hours of production time in department 1 and 3 hours in department 2. Currently 80 hours of labour are avilable each week in each of the department. This labour time is somewhat restrictive factor. Since the company has a general policy of avoiding overtime, if possible. The manufacturer's profit on each standard camera is Rs. 30 while the profit on the detuxe model is Rs. 40. Management has set the following goals :

P_1 : Avoid overtime operations in each department.

P_2 : Prior sale-records indicate that on average, a minimum of 10 standard and 10 detuxe caneras can be sold weekly. Management would like to meat these sale goasls.

Since production time may limit producing these numbers of each camera and since the deluxe camera has a higher profit margin, the sale goals should be weighted by the profit contribution for the respective cameras.