RD – 08

B.C.A. (Semester – V) Examination, October 2016
NON-COMPUTER SCIENCE Elective – I
Operations Research

Duration : 2 Hours | Max. Marks : 50

Instructions : 1) ***All*** *questions are* ***compulsory,*** *however* ***internal choice*** *is provided from Q.* ***2*** *to Q.* ***5.***
2) *Use of Calculator is* ***permitted.***
3) *Graph paper will be provided if* ***needed.***
4) *Figures to the* ***right*** *indicate* ***full*** *marks.*

1. Answer the following : **(5×2=10)**
   a) Define Standard primal and dual problem.
   b) Briefly explain the service mechanism in queuing system.
   c) Explain Dominance rule in Game theory.
   d) Define the transportation problem. Write the necessary and sufficient condition for existence of feasible solution to it.
   e) Define Demand and Order cycle in Inventory Control theory.

2. A) Using Simplex method to Min $z = x_2 - 3x_3 + 2x_5$ subject to : **5**
   $3x_2 - x_3 + 2x_5 \leq 7, -2x_2 + 4x_3 \leq 12, -4x_2 + 3x_3 + 8x_5 \leq 10$ and $x_2, x_3, x_5 \geq 0$.

   B) Solve the following LPP using graphical method :
   Min $z = -x_1 + 2x_2$, subject to $-x_1 + 3x_2 \leq 10, x_1 + x_2 \leq 6, x_1 - x_2 \leq 2$, and $x_1, x_2 \geq 0$. **5**

   OR

   X) A farm is engaged in breeding pigs. The pigs are fed on various products grown on the farm. In view of the need to ensure certain nutrient constituents (X, Y and Z), it is necessary to buy two additional products, A and B. One unit of product A contains 36 units of X, 3 units of Y and 20 units of Z. One unit of product B contains 6 units of X, 12 units of Y and 10 units of Z. The minimum requirement of X, Y and Z is 108 units, 36 units and 100 units respectively. Product A costs Rs. 20 per unit and product B costs Rs. 40 per unit. Formulate the above as LPP to minimize the total cost. **5**

   Y) Using Big M (penalty) method to Maximize $z = 6x_1 + 4x_2$ subject to :
   $2x_1 + 3x_2 \leq 30, 3x_1 + 2x_2 \leq 24, x_1 + x_2 \geq 3, x_1, x_2 \geq 0$. **5**

P.T.O.

3. A) Obtain the optimal strategies for both-persons and the value of the game for zero-sum two-person game whose payoff matrix is as follows : 5

$$\begin{pmatrix} 1 & -3 \\ 3 & 5 \\ -1 & 6 \\ 4 & 1 \\ 2 & 2 \\ -5 & 0 \end{pmatrix}$$

B) A company operating 50 weeks in a year is concerned about its stocks of copper cable. This costs Rs. 240 a metre and there is a demand for 8000 metres a week. Each replenishment costs Rs. 1,050 for administration and Rs. 1,650 for delivery, while holding costs are estimated at 25 percent of value held a year. Assuming no shortages are allowed, what is the optimal inventory policy for the company ? 5

OR

X) Solve the following game : 5

		Player B			
		I	II	III	IV
Player A	I	3	2	4	0
	II	3	4	2	4
	III	4	2	4	0
	IV	0	4	0	8

Y) A manufacturing company needs 2500 units of a particular component every year. The company buys it at the rate of Rs. 30 per unit. The order processing cost for this part is estimated at Rs. 15 and the cost of carrying a part in stock comes to about Rs. 4 per year. The company can manufacture this part internally. In that case, it saves 20% of the price of the product. However it estimates a set-up cost of Rs. 250 per production run. The annual production rate would be 4800 units. However the inventory holding costs remain unchanged. Determine the EOQ and the optimal number of orders placed in a year. 5

4. A) Find the initial feasible solution to the following transportation problem using Vogel's Approximation Method given the cost matrix : 5

	D_1	D_2	D_3	D_4	Supply
S_1	20	25	28	31	200
S_2	32	28	32	41	180
S_3	18	35	24	32	110
Demand	150	40	180	170	

B) A person repairing radio finds that the time spent on the radio sets has exponential distribution with mean 20 minutes. If the radios are repaired in the order in which they come in and their arrival is approximately Poisson with an average rate of 15 for 8-hour day, what is the repairman's expected idle time each day ? How many jobs are ahead of the average set just brought in ? 5

OR

X) Solve the following transportation problem (cell entries represent unit costs). 5

							Available Units
	5	3	7	3	8	5	3
	5	6	12	5	7	11	4
	2	1	3	4	8	2	2
	9	6	10	5	10	9	2
Required Units	3	3	6	2	1	2	**17 (total)**

Y) Solve the following problem using Dynamic Programming : 5

Maximize $z = y_1^2 + y_2^2 + y_3^2$, subject to y_1, y_2, y_3 are positive integers.

5. A) Machine A costs Rs. 9,000. Annual operation costs are Rs. 200 for the first year, and then increase by Rs. 2,000 every year. Determine the best age at which to replace the machine. If the optimum replacement policy is followed, what will be the average yearly cost of owning and operating the machine ? **5**

B) A machine operator has to perform two operations, turning and threading, on a number of different jobs. The time required to perform these operations (in minutes) for each job is known. Determine the order in which the jobs should be processed in order to minimize the total time required to turn out all the jobs.

Job	Time for turning (minutes)	Time for threading (minutes)
1	3	8
2	12	10
3	5	9
4	2	6
5	9	3
6	11	1

Also find the total processing time and idle time for turning and threading operations. **5**

OR

X) A pipeline is due for repairs. It will cost Rs. 10,000 and last for 3 years. Alternatively, a new pipeline can be laid at a cost of Rs. 30,000 and lasts for 10 years. Assuming cost of capital to be 10% and ignoring salvage value, which alternative should be chosen ? **5**

Y) A machine operator has to perform three operations : turning, threading and knurling on a number of different jobs. The time required to perform these operation (in minutes) for each job is known. Determine the order in which the jobs should be processed in order to minimize the total time required to turn out all the jobs. Also find the idle times for the three operation. **5**

Job	Time for turning (minutes)	Time for threading (minutes)	Time for knurling (minutes)
1	3	8	13
2	12	6	14
3	5	4	9
4	2	6	12
5	9	3	8
6	11	1	13
