Roll No. .....

BCA–404(N)

B. C. A. (Fourth Semester)
EXAMINATION, May/June, 2015

(New Course)

Paper Fourth

OPTIMIZATION TECHNIQUES

Time : Three Hours] [*Maximum Marks : 75*

Note : Attempt questions from all Sections as directed.

Section—A

(Short Answer Type Questions)

Note : All question are compulsory. Each question is of 3 marks.

1. (A) State the characteristics of the standard form of an LPP.

   (B) What is the role of OR in decision-making ?

   (C) Solve graphically the following LPP :

$$z = 6x_1 - 2x_2$$

$$2x_1 - x_2 \leq 2$$

$$x_1 \leq 4$$

$$x_1, x_2 \geq 0$$

   (D) Construct the dual of the problem :

Minimize :

$$z = 3x_1 - 2x_2 + 4x_3$$

Subject to the constraints :

$$3x_1 + 5x_2 + 4x_3 \geq 7$$

$$6x_1 + x_2 + 3x_3 \geq 4$$

$$7x_1 - 2x_2 - x_3 \leq 10$$

$$x_1 - 2x_2 + 5x_3 \geq 3$$

$$4x_1 + 7x_2 - 2x_2 \geq 2$$

$$x_1, x_2, x_3 \geq 0$$

(E) There are seven jobs, each of which has to go through the machines A and B in the order AB. Processing time in hours are given as :

Job	Machine A	Machine B
1	3	8
2	8	10
3	15	10
4	6	6
5	10	12
6	11	1
7	9	3

Determine a sequence of these jobs that will minimize the total elapsed time T.

(F) A marketing company finds that the time spent their jobs has an exponential distribution with mean 20 minutes. The arrival of customers

follow the Poisson distribution with an average rate of 10 per 8 hour a day. Determine :

(i) The company expected idle time each day

(ii) How many jobs are ahead of the average set just brought in ?

(G) The cost of four operators to four machines are given in the following table :

Machines	Operators I	II	III	IV
A	10	5	13	15
B	3	9	18	3
C	10	7	3	2
D	5	11	9	7

(H) A firm manufactures three products A, B and C. The profit are ₹ 3, ₹ 2 and ₹ 4 respectively. The firm has two machines M_1 and M_2 and below is the required processing time in minutes for each machine on each product :

Machine	Product A	B	C
M_1	4	3	5
M_2	2	2	4

Machines M_1 and M_2 have 2000 and 2500 machine minutes respectively. The firm must manufacture 100 A's, 200 B's and 50 C's but not more then 150 A's.

Set up on LPP to maximize profit.

(I) Explain briefly the following :

(i) Set-up cost

(ii) Holding cost

Section—B

(Long Answer Type Questions)

Note : Attempt any *two* questions. Each question is of 12 marks.

2. Using Simplex method, solve the LPP :

Minimize :

$$z = 4x_1 + 8x_2 + 3x_3$$

Subject to :

$$x_1 + x_2 \geq 2$$

$$2x_1 + x_3 \geq 5$$

$$x_1, x_2, x_3 \geq 0$$

3. The following table gives the cost of transporting material from supply points A, B, C and D to demand points E, F, G, H and J :

To / From	E	F	G	H	I
A	8	10	12	17	15
B	15	13	18	11	9
C	14	20	6	10	3
D	13	19	7	6	12

The present allocation is as follows :

A to E 90, A to F 10, B to F 150, C to F 10,

C to G 50, C to J 120, D to H 210, D to J 70

(a) Check if this allocation is optimum. If not find an optimum schedule.

4. Find the optimum solution to the following T. P. in which cells contain the transport cost in rupees :

	W_1	W_2	W_3	W_4	W_5	Available
F_1	7	6	4	5	9	40
F_2	8	5	6	7	8	30
F_3	6	8	9	6	5	20
F_4	5	7	7	8	6	10
Required	30	30	15	20	5	

5. A self-service store employs one cashier at its counter. Nine customers arrive on an average every 5 minutes while the cashier can serve 10 customers in 5 minutes. Assuming Poisson distribution for arrival rate and exponential distribution for service rate. Find :

(i) Average number of customers in the system.

(ii) Average number of customer in queue or average queue length.

(iii) Average time a customer spends in the system.

(iv) Average time a customer waits before being served.

Section—C

(Long Answer Type Questions)

Note : Attempt any *two* questions. Each question is of 12 marks.

6. A particular has a demand of 9000 units –1 year. The cost of one procurement is ₹ 100 and the holding cost

per unit is ₹ 2.40 per year. The replacement is instantaneous and no shortage are allowed. Determine :

(i) economic lot size.

(ii) no-of order per year.

(iii) time between orders.

(iv) total cost per year is the cost of one unit is ₹ 1.

7. Give Johnson's procedure for determining an optimal sequence for processing *m* jobs on two machines.

8. The maintenance cost and resale value per year of a machine whose purchase price is ₹ 7,000 is given :

Year	Maintenance Cost (₹)	Resale value (₹)
1	900	4,000
2	1,200	2,000
3	1,600	1,200
4	2,100	600
5	2,800	500
6	3,700	400
7	4,700	400
8	5,900	400

When should the machine be replaced ?

9. The following mortality rates have been observed for a certain types of light bulbs :

End of week	Probability of Failure to Data
1	0.09
2	0.25
3	0.49
4	0.85
5	0.97
6	1.00

If a bulb fails in service, it cost ₹ 3 to replace but if all bulbs are replaced in the same operation, it can be done for only a ₹ .70 a bulb. It is proposed to replace all bulbs at fixed interval, whether or not they have burnt out, continue replacing burnt out bulbs as they fail :

(a) What is the best interval between group replacement ?

(b) At what group replacement per bulb, would a policy of strictly individual replacement become preferable of the adopted policy ?