C 1160 (Pages : 4) Name.....

Reg. No.....

SIXTH SEMESTER B.TECH. (ENGINEERING) [09 SCHEME] DEGREE EXAMINATION, APRIL 2016

ME/PTME 09 604—OPERATIONS RESEARCH

Time : Three Hours Maximum : 70 Marks

Part A

Answer **all** *questions.*

1. What are the advantages of solving an LPP by revised simplex methods ?
2. Give a general mathematical formulation of L.P. problem.
3. What is assignment problem ? Give two areas of its application.
4. What is symmetric game ? Show that the value of a symmetric game is zero.
5. Define the terms of return function in dynamic programming.

(5 × 2 = 10 marks)

Part B

Answer any **four** *questions.*

6. Describe three operations research models which have wide commercial applications.
7. Use two-phase simplex method to :

Maximize $Z = 5x_1 + 8x_2$

subject to $3x_1 + 2x_2 \geq 3$

$x_1 + 4x_2 \geq 4$

$x_1 + x_2 \leq 5$

$x_1, x_2 \geq 0.$

8. Four different jobs are to be done on four different on machine j in rupees machines. The setup and production times are prohibitively high for change over. The below tables indicates the cost of producing Job i on machine j in rupees.

Machines

Jobs	1	2	3	4
1	5	7	11	6
2	8	5	9	6
3	4	7	10	7
4	10	4	8	3

Assign jobs to different machines so that the total cost is minimized.

Turn over

9. Explain degeneracy in transportation model.

10. In a game of matching coins with two players A and B suppose A wins one unit of value when there are two heads, win nothing when there are two tails and loses 1/2 unit of value when there is one head and one tail. Determine the pay-off matrix, the optimal strategies for both the players. the pay-off matrix will be as follows :

		Player B	
		H	T
Player A	H	1	– 1/2
	T	– 1/2	0

11. The machines in a production shop breakdown at an average of 2 hours the breakdowns may be considered to be random. The non-productive time of any machine costs Rs.10 per hour.

    (i) If the repairman changes Rs. 15 per machine, what is the minimum cost service rate for the mechanic ?

    (ii) If service rate of or mechanic is 2.5 machines per hour find : (a) system cost per hour ; (b) probability that a machine will have to wait for more than half an hour before repair starts ; and (c) the probability that the number of machines in the system is 2.

(4 × 5 = 20 marks)

Part C

Answer **all** *questions.*

12. (a) A company manufactures two products A and B both products pass through three departments of the plant. The production rate per shift (8 hours) for each product and available hours per month of each department are given below :

Product	*Departments*		
	1	2	3
	Production rate per shift		
A	2	4/3	4
B	4/3	2	4
Available hours per month	1200	1800	800

The marketing department requires that at least 200 units of product A and 250 units of product B must be made available per month. The unit contributions of the two products are Rs.120 and Rs.140 respectively. Formulate the problem as a linear programming model.

Or

(b) A firm manufactures two products A and B, both of which have to be processed on two machines M_1 and M_2. Product A requires 4 hours each on both machines, while product B requires 6 hours on Machine M_1 and 2 hours on machine M_2. The available hours on machines M_1 and M_2 are 24 and 16 Respectively. The profit per unit is estimated at Rs. 100 for product A and Rs. 125 for product B.

What quantity of each product is produced to maximize profit ?

13. (a) Consider the L.P.P :

Maximize $Z = x_1 + 2x_2 - x_3$

subject to $3x_1 + x_2 - x_3 \leq 10$

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

$x_2 + x_3 \leq 4, \quad x_i \geq 0$ for $j = 1, 2, 3$.

Determine the range for discrete changes in the components b_2 and b_3 of the requirement vector so as to maintain the feasibility of the current optimum solution.

Or

(b) Solve the following simplex problem :

Maximize $Z = 2x_1 + x_2$

subject to $4x_1 + 3x_2 \leq 12$ ---------- (1)

$4x_1 + x_2 \leq 8$ ---------- (2)

$4x_1 - x_2 \leq 8$ ---------- (3)

x_1, x_2 both ≥ 0.

14. (a) A company has three plants with capacities of 60, 70 and 80 units respectively to meet the demands of Three warehouse with respective requirements of 50, 80 and 80 units. Given the following per unit cost of transportation, find the optimum plan.

Plants	*Warehouses*		
	A	B	C
x	8	7	3
y	3	8	9
z	11	3	5

Or

(b) There are 5 jobs and 5 machines. The associated cost of allocating a job to the machines is given in the table :

Jobs	*Machines*				
	M1	M2	M3	M4	M5
J1	11	17	8	16	20
J2	9	7	12	6	15
J3	13	16	15	12	16
J4	21	24	17	28	26
J5	14	10	12	11	15

It is required to assign one job to each of the 5 machines. Determine the optimal assignment of jobs so that the total cost of processing all the jobs is minimized.

15. (a) Worker come to tool store room to receive special tools (required by them) for accomplishing a Particular project assigned to them. The average time between two arrivals is 60 seconds and the Arrivals are assumed to be in Poisson distribution. The average service time is 40 seconds. Determine : (i) Average queue length ; (ii) average length of non-empty queues ; (iii) average number of workers in system including the worker being attended ; (iv) Mean waiting time of an arrival ; and (v) average waiting of an arrival (worker).

Or

(b) An auxiliary industry has to supply the following number of items at the end of each month to a large Scale industry.

November	*December*	*January*	*February*
20	30	45	35

It is given that :

(i) The manufacturing cost of each item is estimated as Rs.9,000.

(ii) Set up cost is Rs. 4,000 per production run.

(iii) Inventory carrying cost is estimated at Rs. 50 per unit per month.

(iv) Production during the month is available for supply at the end of the month or it may be kept in Stock for next month or later. However there should not be any stock at the end of February When the control terminates. In which month a batch should be made, and of what size, so that Total cost will be minimum.

(4 × 10 = 40 marks)