C 80809 (Pages : 4) Name.....

Reg. No.....

SIXTH SEMESTER B.TECH. (ENGINEERING) [09 SCHEME] DEGREE EXAMINATION, APRIL 2015

ME/PTME 09 604—OPERATIONS RESEARCH

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*

1. What is Operations Research Model ? State the various classification schemes of models.
2. What is the function of stack, surplus and artificial variables in simplex procedure ?
3. How the problem of degeneracy arises in a transportation problem ?
4. What is the difference between transportation and assignment model ?
5. Define the decision variable in dynamic programming.

(5 × 2 = 10 marks)

Part B

Answer any **four** *questions.*

6. Briefly describe the scope of Operation Research.
7. Use two-phase simplex method to :

Maximize $Z = 12x_1 + 15x_2 + 9x_3$

subject to $8x_1 + 16x_2 + 12x_3 \leq 250$

$4x_1 + 8x_2 + 10x_3 \geq 80$

$7x_1 + 9x_2 + 8x_3 = 105$

$x_1, x_2, x_3 \geq 0.$

8. Discuss assignment model. Indicate a method of solving an assignment problem.
9. Determine an initial basic feasible solution to the following Transportation problem using NWC method.

Warehouse

	W_1	W_2	W_3	W_4	*Supply*
F_1	14	25	45	5	6
F_2	65	25	35	55	8
F_3	35	3	65	15	16
Factory	4	7	6	13	30
					(Total)

Turn over

10. Consider a modified form of "matching coins" game. The matching player is paid Rs. 8.00 of two coins are both heads and Rs. 1.00 if both are tails. The Non-matching player is paid Rs. 3.00 when the coins do not match. Given the choice of being the matching or non-matching player both, which would you choose and what would be your strategy ?

11. The machines in production shop breakdown at an average of 2 per hour. The non-productive time of any machine cost Rs. 30 per hour. If the cost of repairman is Rs. 50 per hour and the repair rate is 3 per hour.

    Calculate :

    (a) Number of machines not working at any point of time.

    (b) Average time that a machine is waiting for the repairman.

    (c) Cost of non-productive time of the machine operator.

(4 × 5 = 20 marks)

Part C

Answer **all** *questions.*

12. (a) ABC Foods company is developing a low calorie high protein diet supplementary called Hi-pro. the specifications for Hi-pro. have been established by a panel of medical experts. These specifications along with the calorie, protein and vitamin content of three basic foods, are given in the following table :

Nutritional elements	*Units of Nutritional elements* (per 100 gm. *serving of basic foods*			*Basic foods Hi-Pro Specifications*
	1	2	3	
Calories	350	250	200	300
Proteins	250	300	150	200
Vitamin A	100	150	75	100
Vitamin C	75	125	150	100
Cost per serving	1.50	2.00	1.20	

What quantities of food 1, 2 and 3 should be used ? Formulate this problem as a linear programming model to minimize cost of serving.

Or

(b) A manufacturing company produces two products A and B. each product undergoes two operations on machines M_1 and M_2. The time required to perform these operations with the available capacity of machines M_1 and M_2 in a given quarter are as given below. The market survey has predicted that not more than 450 units of product A and not more than 250 of product B can be sold in the given quarter. The company wants to determine the product mix to maximize profit. The unit profits for products A and B are Rs. 20 and Rs. 40, respectively.

Formulate the problem and solve graphically.

Machine	*Product time required per unit*		*Available Capacity (Hrs.)*
	A	B	
M_1	1.5 hrs	1 hr.	750
M_2	1 hr.	3 hrs.	900
Profit	Rs. 20	Rs. 40	

13. (a) Solve the following simplex problem.

Maximize $Z = 2x_1 + x_2$

subjected to : $4x_1 + 3x_2 \leq 12$.....(1)

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

$4x_1 - x_2 \leq 8$.....(3) $x_1, x_2 \geq 0$.

Or

(b) Show that is an unbounded solution to the following L.P. problem :

Maximize $Z = 4x_1 + x_2 + 3x_3 + 5x_4$.

subject to the constraints $4x_1 - 6x_2 - 5x_3 - 4x_4 \geq -20$

$-3x_1 - 2x_2 + 4x_3 + x_4 \leq 20$

$-8x_1 - 3x_2 + 3x_3 + 2x_4 \leq 20$

$x_1, x_2 \; x_3, x_4 \geq 0$.

14. (a) A production control superintendent finds the following information on his desk. In departments A, B and C, the number of surplus pallets is 18, 27 and 21 respectively. In departments G, H, I and J, the number of pallets required is 14, 12, 23 and 17 respectively. The time in minutes to move a pallet from one department to another is given below :—

From				
A	13	25	12	21
B	18	23	14	9
C	23	15	12	16

What is the optimal distribution plan to minimize the moving time ?

Or

(b) A company has one surplus truck in each of the cities A, B, C, D and E and one deficit truck in each of the cities 1, 2, 3, 4, 5 and 6. The distance between the cities in KM is shown in the matrix below. Find the assignment of truck from cities in surplus two cities in deficit so that the total distance covered by the vehicle is minimum.

	1	2	3	4	5	6
A	12	10	15	22	18	8
B	10	18	25	15	16	12
C	11	10	3	8	5	9
D	6	14	10	13	13	12
E	8	12	11	7	13	10

15. (a) Arrival rate of telephone calls at the telephone booth are according to Poisson distribution, with the average time of 9 min. between two consecutive arrivals. The length of telephone calls is assume to be exponentially distributed, with mean 3 min.

(i) Determine the probability that a person arriving at the booth will have to wait.

(ii) Find the average queue length that is formed from time to time.

(iii) The telephone company will install a second booth when convinced that an arrival would expect to have to wait at least 4 min for the phone. Find the increase in flow of arrival which will justify the second booth.

(iv) What is the probability that an arrival will have to wait for more than 10 min before the phone is free.

Or

(b) Determine the value of u_1, u_2 and u_3 so as to Determine :

Maximize $Z = u_1 \cdot u_2 \cdot u_3$

subject to constraints $u_1 + u_2 + u_3 = 10$

$u_1, u_2, u_3 \geq 0$.

(4 × 10 = 40 marks)