B.E/B.Tech DEGREE END SEMESTER EXAMINATIONS, NOV/DEC 2012

Manufacturing Engineering

VII Semester

MF 9401 OPERATIONS RESEARCH

(REGULATIONS 2008)

Time : 3 hrs Max. Marks : 100

Use of Statistical Table is permitted

Answer ALL Questions

PART - A (10 x 2 = 20 Marks)

1. Define alternate optimal solution, unbounded solution and infeasible solution.
2. What is the difference between an artificial variable and a surplus variable?
3. Discuss the variable removal criterion and variable entry criterion of the dual simplex method.
4. Discuss the steps of Hungarian method.
5. How can degeneracy occur in Vogel's approximation method?
6. What is minimum spanning problem? What are all its practical applications?
7. What do we mean by "crashing" activities?
8. What modification is made in the total cost equation of the EOQ model with price discount?
9. Give the classification of queuing system based on Kendall notation.
10. Define economic life of an equipment.

PART – B (5 x 16 = 80 Marks)

11. A fleet owner finds from his past experience that the costs per year of maintaining a truck whose purchase price is Rs. 3,20,000 are given below:

Year	1	2	3	4	5	6	7	8
Maintenance cost in Rs.	16,000	18,000	21,000	26,000	30,000	40,000	50,000	60,000
Resale price in Rs.	2,90,000	2,64,000	2,44,000	2,28,000	2,18,000	1,80,000	1,40,000	1,00,000

i) At what average cost a replacement is due? (4)

ii) At present the truck owner has three trucks, two of which are 2 years old and third one is 1 year old. He is considering a new type of truck which is 50% more capacity than one of the old ones at unit price of Rs. 4,00,000. He estimates the maintenance costs and resale price for the new truck will be as follows:

Year	1	2	3	4	5	6	7	8
Maintenance cost in Rs.	20,000	24,000	28,000	33,000	38,000	50,000	60,000	80,000
Resale price in Rs.	3,20,000	2,90,000	2,66,000	2,48,000	2,39,000	2,24,000	1,80,000	1,20,000

Assuming that the loss of flexibility due to fewer truck is no importance, and that he will continue to have sufficient load for all the trucks, what should be his replacement policy? (12)

12. a) Write the dual of the following LP primal problem and solve using Simplex method.

Min $Z = 24x_1 + 30x_2$

Subject to
$2x_1 + 3x_2 >= 10$
$4x_1 + 9x_2 >= 15$
$6x_1 + 6x_2 >= 20$
x_1 and $x_2 >= 0$

OR

b i) The following LP problem, which is in primal form, has an unbounded solution. Show that the dual to this problem has no feasible solution using initial simples table.

Max $Z = -2x_1 + 3x_2$ (8)

Subject to
$1x_1 <= 5$
$2x_1 - 3x_2 <= 6$
x_1 and $x_2 >= 0$

ii) Solve the following LP problem graphically (8)

Min $Z = 200x_1 + 400x_2$

Subject to
$x_1 + x_2 >= 200$
$x_1 + 3x_2 >= 400$
$x_1 + 2x_2 <= 350$
x_1 and $x_2 >= 0$

13 a) Solve the following unbalanced transportation problem to minimize the total cost of transportation. The unit cost of transportation is given in the table. (16)

Market

Plant	1	2	3	4	5	Supply
A	10	2	16	14	10	300
B	6	18	12	13	16	500
C	8	4	14	12	10	825
D	14	22	20	8	18	375
Demand	350	400	250	150	400	

OR

b) Solve the following assignment problem using Hungarian method. The matrix entries are processing times in hours.

OPERATOR

JOB	1	2	3	4	5
A	20	22	35	22	18
B	4	26	24	24	7
C	23	14	17	19	19
D	17	15	16	18	15
E	16	19	21	19	25

14 a) A construction company is preparing a PERT network for a project. Given the following set of activities, their predecessor requirements and three time estimates of completion time :

Activity	Immediate Predecessor(s)	Duration in weeks		
		a	m	b
A	none	2	3	4
B	none	8	8	8
C	A	7	9	11
D	B	6	6	6
E	C	9	10	11
F	C	10	14	18
G	C,D	11	11	11
H	F,G	6	10	14
I	E	4	5	6
J	I	3	4	5
K	H	1	1	1

i) Construct the project network. (6)

ii) Find the slack for each activity and determine the critical path. (5)

iii) If the contract specifies a Rs. 5,000 per week penalty for each week the completion of the project extends beyond 37 weeks. What is the probability that this company will have to pay a maximum penalty of Rs. 15,000? (5)

OR

b i) Distinguish between P and Q systems of inventory.

ii) Annual demand for an item is 10,000 units. Ordering cost is Rs. 1,000 per order. Inventory carrying cost is 20% of the purchase price/unit/year. Find the optimal order size and total annual cost for the price breaks shown :

Order size	Price (Rs.)
$0 <= Q_1 < 1499$	100
$1500 <= Q_2 < 2499$	98
$2500 <= Q_3$	95

15 a i) What kinds of queue discipline would you encounter the most in real-world situations? (4)

ii) The arrival rate of customers in a banking counter follows Poisson distribution with mean of 45 per hour. The service rate of the counter clerk also follows Poisson distribution with a mean of 60 per hour. What are the probabilities of having 0 and 5 customers in the system? Find the average number of customers waiting in the system and in the queue. Find also the average waiting time of customers in the system and in the queue. (12)

OR

b) i) Solve the following 4x4 game using dominance rules. (10)

Player B

Player A	I	II	III	IV
I	12	4	8	16
II	4	-2	2	24
III	4	6	6	18
IV	10	4	12	20

ii) Formulate the following game into LP model with respect to player B (6)

3	1	1
1	1	5
1	4	1