Total No. of Questions : 12]

SEAT No. :

P3989

[Total No. of Pages : 6

[5354]-540

B.E. (Mechanical) (Semester - I)

OPERATION RESEARCH

(2012 Pattern)

Time :2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8, Q.9 or Q.10, Q.11 or Q.12.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right side indicate full marks.***
4) ***Use of calculator is allowed.***
5) ***Assume Suitable data if necessary.***

Q1) Define Operations Research. Describe briefly its function. **[8]**

OR

Q2) a) Write dual of the following Problem : **[5]**

Minimize $z = 25 \times 1 + 10 \times 2$

Subjected to condition:

$x1 + x2 \geq 50$

$x1 \geq 20$

$x2 \leq 40$

$x1, x2 \geq 0$

b) Write short note on formulation of linear programming problem. **[3]**

Q3) Solve the following transportation problem and use stepping stone method to test optimality of solution. **[8]**

	D1	D2	D3	D4	Supply
Plant I	2	3	11	7	6
Plant II	1	0	6	1	1
Plant III	5	8	15	9	10
Requirement	7	5	3	2	

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OR

Q4) Five different machines can do any of five required components with different profit resulting from each assignment as shown in following table. Find out maximum profit possible through optimum assignment. **[8]**

		1	2	3	4	5
Component	A	30	37	40	28	40
	B	40	24	27	21	36
	C	40	32	33	30	35
	D	25	38	40	36	36
	E	29	62	41	34	39

Q5) In a game of matching coins with two players A and B, suppose A wins one unit of value when there are two heads, wins nothing when there are two tails and losses half unit of the value when there is one head and one tail. Determine the payoff matrix and value of the game to A. **[6]**

OR

Q6) Following figures are related to toy manufacturing company. **[6]**

Variable cost per unit = Rs 8/-

Selling price per unit = Rs. 14/-

Total units sold = Rs. 50,000/-

Fixed cost = Rs. 12,000/-

Calculate

a) P/v ratio,

b) BEP in units,

c) Margin of safety

Q7) a) The demand for an item in a company is 18000 units per year, and the company can produce the item at a rate of 3000 per month. The cost of one set up is Rs 500 and the holding cost of 1 unit per month. The shortage cost of one unit is Rs 240/ year. Determine optimum manufacturing quantity and number of shortage. Also determine the manufacturing time and time between set ups. **[8]**

b) Determine EOQ for a product whose average consumption rate is 50 units per day. The use of each unit is Rs 20 per year. The cost of planning and receiving an order is Rs 20. Assuming 300 total working days in a year, obtain the annual inventory capital if carrying cost is Rs 10 per order. **[8]**

OR

Q8) a) The annual demand for a product is 3600 units, with an average 12 units per ay. The lead time is 10 days. The order processing cost is Rs 200 per order and annual inventory cost is 20% of value of money in form of material. The unit price of product is Rs 250.

What will be EOQ? Find purchase cycle time and annual cost including material cost. **[8]**

b) The shop is about to order some heaters for the forecast spell of cold weather. The shop pays Rs 1000 for each heater, and during the cold spell they sell for Rs 2000 each. The demand for the heater declines after the cold spell is over, and any unsold units are sold at Rs 500. Previous experience suggests the likely demand for the heater is as follows: **[8]**

Demand	10	20	30	40	50
Probability	0.20	0.30	0.30	0.10	0.10

How many heaters should the shop buy?

Q9) a) The rate of arrival of customers at a public telephone follows poisson distribution, with an average time of ten minutes between one customer and the next. The duration of a phone call is assumed to follow exponential distribution with a mean time of three minutes. **[8]**

i) What is the probability that a person arriving at the booth will have to wait?

ii) What is average length of the queue?

iii) When another booth is to be installed when the customer has to wait for at least three minutes for their turn to make a call. How much should be the flow of customers in order to justify second booth?

b) There are five task jobs each of which must go through two machines A and B in the order AB. Processing times are given below. Determine the sequence for five jobs that will minimize the elapsed time and also calculate the total idle time. **[8]**

Job (task)	I	II	III	IV	V
Time for A (min)	5	1	9	3	10
Time for B (min)	2	6	7	8	4

OR

Q10)a) There is a congestion of the platform of a railway station. The trains arrive at the rate of 30 trains per day. The waiting time for any train to hump is exponentially distributed with an average of 36 minutes. **[8]**

Calculate:

i) The mean queue size

ii) The probability that the queue size exceeds 9.

b) There are five jobs each of which is to be processed through machines A,B and C in order ABC. The processing time (in hrs) are given below. **[8]**

Job (task)	1	2	3	4	5
Machine A	3	8	7	5	4
Machine B	4	5	1	2	3
Machine C	7	9	5	6	10

Q11)a) Write a short note on Goal Programming. **[4]**

b) A small project is composed of 7 activities whose time estimates are listed in the table below. Activities are identified by their beginning (i) and ending (j) node numbers. **[12]**

Activity	Estimated duration (weeks)		
(i-j)	Optimistic	Most likely	Pessimistic
1-2	1	1	7
1-3	1	4	7
1-4	2	2	8
2-5	1	1	1
3-5	2	5	14
4-6	2	5	8
5-6	3	6	15

i) Draw the network diagram of activities in the project.

ii) Find expected duration and variance for each activity. What is the expected project length.

OR

Q12)a) Write difference between PERT and CPM **[4]**

b) The following table lists the jobs of a network along with their time estimate **[12]**

i) Draw the project network

ii) Calculate the length and variance of the critical path.

iii) What is approximate probability that the job as per critical path will be completed in 24 hrs.

Activity	To	Tm	Tp
1-2	1	3	5
2-3	2	5	6
2-4	4	6	7
2-5	8	10	12
3-5	0	0	0
3-6	4	8	9
4-7	5	7	14
5-7	7	10	16
6-7	0	0	0
6-8	6	9	12
7-9	1	3	7
8-9	3	5	7

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