

Total No. of Questions : 6]

SEAT No. :

P1180

[Total No. of Pages : 7

[4659] - 151

B.E. (Production Sandwich) (Semester - I)
OPERATIONS RESEARCH AND MANAGEMENT
(2008 Pattern)

Time : 3 Hours]

[Max. Marks : 100

Instructions to the candidates:

- 1) *Answers to the two sections should be written in separate books.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 5) *Assume suitable data, if necessary & state it clearly.*
- 6) *All questions are compulsory.*

SECTION - I

Q1) a) Explain in brief phases in O.R. **[4]**

b) Solve the following L.P.P. by Simplex Method. **[12]**

$$\text{To Max. } Z = 10x_1 + 20x_2$$

$$\text{S.t. } 5x_1 + 3x_2 \leq 30$$

$$3x_1 + 6x_2 \leq 36$$

$$2x_1 + 5x_2 \leq 20 \text{ \& } x_1, x_2 \geq 0$$

c) Write the dual of above problem & write the values of dual decision variables from primal simplex table. **[2]**

P.T.O.

OR

- a) A pharmaceutical company has 100 kgs of A, 180 kgs of B & 120 kgs of C available per month. The company use these to make 3 drugs namely 5-10-5, 5-5-10 & 20-5-10, where the numbers in case represents the % by weight of A, B & C respectively. The cost of the raw materials are given below :

Ingradiant	-	A	B	C	Inert
Cost / kg (Rs.)	-	80/-	20/-	50/-	20/-

The selling prices of 3 drugs are Rs. 40.5, Rs. 43 & Rs. 45 respectively. Construct the mathematical model to maximise the profit. Do not solve further. [8]

- b) Sketch special cases in graphical solution of L.P.P. [4]
- c) Define following terms in LPP : [6]
- i) Basic solution
 - ii) Basic variables
 - iii) Non basic variable
 - iv) Feasible solution
 - v) Degenerate solution
 - vi) Redundant constraint

- Q2) a) Solve the following T.P. : [10]

		To			
		2	7	4	5
From		3	3	1	8
		5	4	7	7
		1	6	2	14
		7	9	18	

- b) Write LP form for an assignment problem. [3]
- c) What is travelling salesman problem with sub-optimal solution? [3]

OR

- a) Discuss the degeneracy in transportation problem. [4]
- b) The captain of cricket team has to allot five middle batting positions to five batsman. The average runs scored in past by each batsman at these positions are as follows :

		Batting Positions				
		III	IV	V	VI	VII
Batsman	A	40	40	35	25	50
	B	42	30	16	25	27
	C	50	48	40	60	50
	D	20	19	20	18	25
	E	58	60	59	55	53

- i) Find the assignment of batsman to positions which would give maximum number of runs. [6]
- ii) If E batsman is fixed for III position, how the decision get altered?[6]

Q3) a) Derive basic EOQ formula. [5]

b) A firm uses every year 12000 units of raw material costing Rs. 1.25 per unit. Ordering cost is Rs. 15 per order & the carrying cost is 5% per year of unit cost.

- i) Determine EOQ & the corresponding cost. [4]
- ii) If firm operates for 300 days per year & if lead time is 14 days with safety stock of 400 units, determine reorder point, maximum inventory level and average inventory level. [4]

c) Mention any three optimality criteria in sequencing problems. [3]

OR

- a) Find the optimal order quantity with following price-breaks : [7]

Q	Unit cost (Rs.)
$0 < Q < 500$	Rs. 10/-
$500 \leq Q < 750$	Rs. 9.25/-
$750 \leq Q$	Rs. 8.75/-

Monthly demand for product is 200 units, ordering cost Rs. 100/- & Storage cost is 2% of unit cost.

- b) Find the sequence that minimise the total time required in performance of the following jobs on 3 machines in order ABC. Processing time in minutes are given below : [9]

Jobs →	I	II	III	IV	V
M/c A	8	10	6	7	11
M/c B	5	6	2	3	4
M/c C	4	9	8	6	5

SECTION - II

- Q4)** a) What are the advantages & limitations of simulation? [4]

- b) Maintenance work in a factory can be carried by a one-man crew or by two-men crew. One man crew is expected to take 2, 3, 3.5 or 4 hours with probabilities of 0.2, 0.3, 0.4, 0.1 respectively. Two men crew may take 1.25, 1.5, 2, 3 hours with probabilities 0.2, 0.4, 0.25, 0.15 respectively. The labour cost is Rs. 15/hr while machine idle cost is Rs. 40/hr. Using Monte Carlo simulation, decide whether one man a two men crew should be selected. Use following Random numbers (for both crews) – 39, 82, 06, 43, 29, 62, 31, 36, 23, 54. [12]

OR

- a) Two functionally identical machines P & Q are available in market with no scrap value. P costs Rs. 12000 & its annual cost is Rs. 400 in first year, progressively increases by Rs. 100/- in next 2 years, then by 200 in next years & finally by Rs. 300, 400, 600, 800 in subsequent years. Machine Q costs Rs. 13000/- & annual cost is Rs. 200, 350, 550, 750, 1000, 1300, 1800, 2400 & 3000 from year to year. If time value of money is 10%, which is better choice, P or Q? And in that case what would be the replacement policy? [12]
- b) Discuss the replacement policy for the items that fail suddenly. [4]

- Q5)** a) Goods trucks arrive randomly at a stockyard with a mean of 8 trucks/hr. A crew of 4 operatives can unload a truck in 6 minutes. Trucks waiting in queue to be unloaded are paid a waiting charge at a rate of Rs. 60/hr. Operatives are paid a wage rate of Rs. 20/hr. It is possible to increase the numbers of crews to 2 or 3 (of four operatives per crew), then the unloading time will be 4 minutes or 3 minutes respectively per truck. Find the optimal crew size. [10]
- b) Define : [6]
- i) Maxmini & Mini Max principle.
 - ii) Column & Row Dominance.

OR

- a) Show MCSR in queuing graphically. [3]
- b) Transform the following game in LPP form from A's angle. [5]

		B		
		5	3	7
A		7	9	1
		10	6	2

- c) Solve the following game by graphical method. [8]

$$\begin{vmatrix} -5 & 5 & 0 & -1 & 8 \\ 8 & -4 & -1 & 6 & -5 \end{vmatrix}$$

- Q6)** a) A project has following data :

Activity →	1-2	1-3	1-4	2-5	3-5	4-6	5-6
Optimistic time -	1	1	2	1	2	2	3
Most likely time -	1	4	2	1	5	5	6
Pessimistic time -	7	7	8	1	14	8	15

- i) Draw the network & show critical path. [3]
- ii) Find expected duration & variance for each activity. [4]
- iii) What is the probability of project completion in 19 days? [2]

Given $Z = -0.67$, $P = 0.25$

- b) A small project has following data :

Activity	1-2	1-3	1-4	2-4	2-5	3-6	4-6	5-6
Normal time -	6	8	5	3	5	12	8	6
Crash time -	4	4	3	3	3	8	5	6
Cost slope/week (Rs./week)	2400	2700	1500	-	1200	6000	1500	-

The cost of completing all activities in normal time is Rs. 2,00,000/-.
Indirect cost is Rs. 4,900/- per week.

- i) Find out normal duration & normal cost of project. [4]
- ii) Find out optimum duration & corresponding cost for project. [3]
- iii) Calculate Total Float for activity 2-5. [2]

OR

a) A project data is given below :

Activity	1-2	1-3	1-4	2-5	2-6	3-7	4-8	5-9	6-9	7-8	8-9
duration -	2	2	0	2	5	4	5	6	3	4	6
Labour requirement	5	4	0	2	3	6	2	8	7	4	3

There are 11 persons employed on this project. Carry out approximate man-power levelling so that the fluctuations of work force requirement from day to day is as small as possible. **[14]**

b) Discuss fulkerson's rules for numbering the events. **[4]**

