

Time :3 hours

Total Marks: 100

Instruction: 1) There are Five compulsory questions in this Q. papers.

2) Graph papers will be provided on request.

- Q-1** (a) What are various phases of the OR problem? Explain them briefly. 8  
(b) Write applications of Operation Research. 6  
(c) Define following terms: 6  
(i) Constraints (ii) Objective function (iii) Artificial variable

**OR**

- Q-1** (a) What are the situations where Operation Research technique will be applicable. 6  
(b) What is importance of slack, surplus and artificial variables in L.P.P. 8  
What values are taken by these variables in objective function.  
(c) Define following terms: 6  
(i) Feasible solution (ii) Basic Solution (iii) Optimal solution
- Q-2** (a) Write down the assumptions made in Linear Programming Problem. 6  
(b) A company sells two different products A and B, making a profit of Rs. 40 and Rs. 30 per unit on them, respectively. They are produced in a common production process and are sold in two different markets. The production process has a total capacity of 30,000 men – hours. It takes three hours to produce a unit of A and one hour to produce a unit of B. The market has been surveyed and company officials feel that the maximum number of units of A that can be sold is 8,000 units and that of B is 12000 units. Subject to these limitations, products can be sold in any combination. Formulate this problem as an LP model to maximize profit. 6  
(c) Describe briefly Simplex Method of solving Linear Programming Problem. 8

**OR**

- Q-2** (a) Solve the following problem using Simplex method 8  
Maximize  $Z = 3X_1 + 5X_2$   
subject to  $X_1 + X_2 \leq 4$   
 $3X_1 + 2X_2 \leq 18$ ,  $X_1, X_2 \geq 0$   
(b) Give general Mathematical Model of Linear Programming Problem. Why it is called L.P.P.? 8  
(c) Prove that, 'set of feasible solution is a convex set'. 4
- Q-3** (a) What is Transportation problem? Give its mathematical formulation. Show that it is a special case of L. P. P. 8

(b) Find an Optimum Solution for the following Transportation problem.

8

Plant	Warehouse				Availability
	W <sub>1</sub>	W <sub>2</sub>	W <sub>3</sub>	W <sub>4</sub>	
P1	190	300	500	100	70
P2	700	300	400	600	90
P3	400	100	600	200	180
Requirement	50	80	70	140	

(c) Write note on 'Degeneracy in transportation problem'.

4

OR

Q-3 (a) Explain Hungarian method of solving assignment problem.

8

(b) Solve the following assignment problems to obtain assignment by using Hungarian Method, hence calculate optimal assignment.

8

Tasks	Job				
	1	2	3	4	5
1	6	2	5	3	6
2	2	5	8	7	7
3	7	8	6	9	8
4	6	2	3	4	5
5	9	3	8	9	7
6	4	7	4	6	8

(c) Show that assignment problem is a special case of transportation problem.

4

Q-4 (a) Distinguish between CPM and PERT.

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(b) Listed in the table are the activities and sequencing requirements necessary for the Completion of a research report.

9

Activit	Description	Precedence	Duration(weeks)
A	Literature search	—	6
B	Formulation of hypothesis	—	5
C	Preliminary feasibility	B	2
D	Formal proposal	C	2
E	Field analysis	A, D	2
F	Progress report	D	1
G	Formal research	A, D	6
H	Data collection	E	5
I	Data analysis	G, H	6
J	Conclusions	I	2
K	Rough draft	G	4
L	Final copy	J, K	3
M	Preparation of oral	L	1

(a) Draw a network diagram for this project.

(b) Find the critical path. What is its length?

(c) Find the total float and the free float for each non – critical activity.

(c) Write down the advantages and disadvantages of PERT.

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OR

- Q-4 (a) Explain the following terms corresponding to PERT /CPM 6  
 (i) Earliest time (ii) Latest time (iii) Total activity time  
 (b) What do you mean by “dummy activity” and “successor activity”. 4  
 (c) For a small project of 12 activities, the details are given below. Draw the network and find earliest occurrence time, latest occurrence time, critical activities and project completion time: 10

Activity	A	B	C	D	E	F	G	H	I	J	K	L
Dependence	---	---	---	B, C	A	C	E	E	D,F,H	E	I, J	G
Duration(days)	9	4	7	8	7	5	10	8	6	9	10	2

- Q-5 (a) Explain Johnson algorithm for processing n jobs 3 machine problem. 8  
 (b) The data collected in running a machine, the cost of which is Rs. 60,000 12  
 are given below:

Year	1	2	3	4	5
Resale value(Rs.)	42,000	30,000	20,400	14,400	9,650
Cost of spares(Rs.)	4,000	4,270	4,880	5,700	6,800
Cost of labour (Rs.)	14,000	16,000	18,000	21,000	25,000

Determine the optimum period for replacement of the machine.

OR

- Q-5 (a) What do you mean by replacement? State some important replacement 6  
 situations.  
 (b) Find the sequence that minimizes the total elapsed time required to 8  
 complete the following tasks. Each job is processed in the order ABC.

Job	1	2	3	4	5	6	7
Machine A	12	6	5	11	5	7	6
Machine B	7	8	9	4	7	8	3
Machine C	3	4	1	5	2	3	4

- (c) What is sequencing problem? State various underlying assumption of 6  
 sequencing problem