Duration: 2 hrs. 30 min **Marks: 60**

N.B.: 1) All questions are compulsory and carry equal marks.
2) Figures to the right indicate marks for each question.
3) Use of calculators is allowed.

Q.1 (a) Explain Big M method of solving linear programming problem. (08)

OR

Q.1 (a) Explain Graphical method of solving Linear Programming Problem. Explain the type of solutions. (08)

Q.1 (b) Define following terms in Linear Programming Problem. (08)
1) Basic solution
2) Feasible Solution
3) Basic feasible solution
4) Non-degenerate basic feasible solution
5) Degenerate basic feasible solution

OR

Q.1 (b) Prove that Dual of Dual is Primal. (08)

Q.2 (c) What is a transportation problem? Represent transportation problem as LPP. (08)

OR

Q.2 (c) Explain MODI method to obtain optimum solution of Transportation problem. (08)

Q.2 (d) Consider the following unbalanced transportation problem. (08)
Since there is not enough supply, some of the demand at these destinations may not be satisfied. Suppose there are penalty cost for every unsatisfied demand as 5,3,2 respectively for destinations 1,2 and 3. Obtain optimum transportation schedule.

FROM	TO			
	1	2	3	Supply
1	5	1	7	10
2	1	4	6	80
3	7	2	5	15
Demand	75	20	50	

OR

Q.2 (d) How will you resolve following difficulties in Transportation problem, i) problem is of maximization ii) problem is unbalanced. (08)

Q.3 (e) What is an Assignment problem? Represent it as LPP. (08)

OR

Q.3 (e) Explain Hungarian method of solving an Assignment problem. (08)

Q.3 (f) What is sequencing problem? State 4 basic assumptions & explain the method of solving Three machines, n jobs sequencing problem. (08)

OR

Q.3 (f) A Company needs to assign four jobs to receives four workers following table summarizes cost data of assignment. (08)

		Jobs			
		I	II	III	IV
Workers	1	50	50	--	20
	2	70	40	20	30
	3	90	30	50	--
	4	70	20	60	70

i) The data indicates that worker I can't work on job III and worker III can't work on job IV determine the optimum assigning.

ii) Suppose that additional workers become available for performing respective cost of 60,45,30,80. Is it economical to replace one of the four current workers with the new workers.

Q.4 (A) **State True or False and correct if necessary (Attempt any Three)** (06)

1. A basic feasible solution is said to be degenerate if one or more non-basic variables are zero.
2. Simplex method can be applied even if one or more variables are unrestricted.
3. Transportation problem have unique solution always.
4. To solve assignment problem, complete enumeration method is most suitable method.
5. If there are n jobs to be, processed on m machines then the number of possible sequences are $(m!)^n$.
6. In Big M method for minimization, if all $Z_j - C_j \leq 0$, it implies that problem has finite optimum solution.

(B) **Answer the following (Attempt any Three)** (06)

1. Define Slack and Surplus variable.
2. How to resolve the situation of unbalanced assignment problem?
3. Explain dummy origin/destination. When these are essential?
4. What is no passing rule in a sequencing problem?
5. What is Infeasible solution in graphical method?
6. How assignment problem is related to Transportation problem?

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