Seat No. : _______________

MD-107

March-2019

B.B.A., Sem.-V

CC-304 : Operations Research & Quantitative Techniques

Time : 2:30 Hours] **[Max. Marks : 70**

Instructions : (1) Graph paper will be supplied on request.
(2) Use of simple calculator is allowed.

1. (a) (i) What is Linear Programming ? Give tis mathematical formulation. **7**

(ii) Use the graphical method to solve the following linear programming problem. **7**

Maximize $Z = 15x + 10y$

Subject to the constraints

$$4x + 6y \leq 360$$

$$3x + 0y \leq 180$$

$$0x + 5y \leq 200$$

$$x, y \geq 0$$

OR

(i) Define O.R. Give applications of O.R. in various fields.

(ii) A manufacturer produces two different models : X and Y of the same product. Model X makes a contribution of ₹ 50 per unit and model Y, ₹ 30 per unit towards total profit. Raw materials r_1 and r_2 are required for production. At least 18 kg of r_1 and 12 kg of r_2 must be used daily. Also at most 34 hours of labour are to be utilized. A quantity of 2 kg of r_1 is needed for model X and 1 kg of r_1 for model Y. For each of X and Y, 1 kg of r_2 is required. It takes 3 hours to manufacture model X and 2 hours to manufacture model Y. How many units of each model should be produced to maximize the profit ?

Solve by graphical method

(b) Answer the following : (any **four**) **4**

(i) Define Feasible solution.

(ii) Linear programming is a branch of mathematical programming. (True/False)

(iii) The graphical method can be used only when there are only __________ variables in a L.P.P.

(iv) A basic feasible solution is said to be __________ if values of all basic variables are non-zero and positive.

(v) What do you mean by unbounded solution ?

(vi) Obtain dual of

Maximize $Z = 2x + 5y$

Subject to $-x_1 - x_2 \leq 5$

$x_1 - 5x_2 \leq 4$

$x_1, x_2 \geq 0$

2. (A) (i) Explain transportation problem and describe the North-West corner rule to obtain its initial basic feasible solution. **7**

(ii) Solve the following transportation problem by Vogel's method and obtain optimal solution : **7**

		Consumer			Available
		A	**B**	**C**	
Supplier	I	6	8	4	14
	II	4	9	8	12
	III	1	2	6	5
	Required	6	10	15	32

OR

(i) Explain :

(a) Unbalanced transportation problem

(b) Degeneracy in transportation problem.

(ii) The cost matrix of a transportation problem is given below. Solve it by North-West Corner rule and Least cost method.

	P	Q	R	S	**Supply**
A	5	6	2	1	20
B	2	3	5	8	20
C	2	6	7	4	20
Demand	15	15	15	15	

(B) Answer the following : (any **four**) **4**

(i) What do you mean by balanced transportation problem ?

(ii) If total supply _________ total demand then dummy column is added to make it balance.

(iii) $\Delta_{ij} = C_{ij} -$ _________

(iv) How many methods are used to solve transportation problem ?

(v) Full form of V.A.M. is _________.

(vi) If all values of $\Delta_{ij} > 0$, the solution is _________ and _________.

3. (A) (i) Give difference between PERT and CPM. **7**

(ii) Find EST, LST, EFT, LFT and total float for each activity. **7**

Activity	1-2	1-3	2-4	3-4	3-5	4-5	4-6	5-6
Time	6	5	10	3	4	6	2	9

OR

(i) Give the advantages and limitations of PERT.

(ii) Time estimates and predecessor of each activity in a project are given below. Find Free Float for each activity.

Activity	A	B	C	D	E	F	G	H
Immediate Predecessor	–	–	–	C	A, B	E, D	D	F, G
Time (in days)	4	6	8	4	8	4	3	3

(B) Answer the following : (any **three**) **3**

(i) Define Pessimistic Time.

(ii) CPM was developed by _________.

(iii) Define EST.

(iv) The optimistic time is denoted by _________.

(v) Prepare a PERT chart for the following project :

Activity	1-2	2-3	2-4	3-4	3-5	4-5
Time	2	3	1	2	3	5

4. (A) (i) What is Game Problem ? What are the assumptions made in Game theory ? **7**

(ii) A company has 4 machines on which to do 3 jobs. Each job can be assigned to one and only one machine. The cost of each job on each machine is given in the following table. What are the job assignments for minimum cost ? **7**

		Machine			
		W	X	Y	Z
Job	A	17	23	27	31
	B	7	12	16	18
	C	9	14	1	21

OR

(i) Solve the following game :

$$\begin{array}{cc} & y \\ x & \begin{bmatrix} 4 & 1 \\ 2 & 3 \end{bmatrix} \end{array}$$

(ii) Solve the following assignment problem for minimum cost :

	A	**B**	**C**	**D**
I	1	4	6	3
II	9	7	10	9
III	4	5	11	7
IV	8	7	8	5

(B) Answer the following : (any **three**) **3**

(i) The method used for solving an assignment problem is called _________.

(ii) The competitor are called _________.

(iii) What is saddle point ?

(iv) What do you mean by unbalance assignment problem ?

(v) The objective of assignment problem is to assign number of origins to equal number of destinations at a maximum cost or at a minimum profit.

(True/False)