Program:	**T.Y.B.M.S.**	**Semester:**	**VI**	**Program Code:**	**2M00156**
Course:	**Operation Research**			**Course Code:**	**86001**
Duration:	**2 ½ Hours**	**Examination Pattern:**	**REV- 16- Autonomous- External**	**Max. Marks:**	**75**

Instructions:

1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Draw neat diagrams wherever necessary.

Examination:
REGULAR

Q. 1 A) Fill in the blanks with an appropriate answer from the alternatives given.(Any 08) **[08]**

i) _____are the entities whose values are to be determined from the solution of the LLP.

a) Decision Variable b) Objective Function

c) Mixed Variable d) Constraints

ii) Objective function is expressed in terms of the _____

a) Decision Variable b) Mixed Variable

c) Objective Function d) Mixed Constraints

iii) When the feasible region is such that the value of objective function can extend to infinity , it is called a case of _____

a) Constraints b) Bounded Solution

c) Neutral d) Unbounded Solution

iv) When a maximization assignment problem is converted in minimization problem , the resulting matrix is called _____

a) Real Matrix b) Regret Matrix

c) Min Row d) Max Column

v) The participants in a game are called _____

a) Zero sum game b) n-Player

c) Player d) Value of Game

vi) The time between the starting of the first job and completion of the last job in sequencing problems is called _____

a) Idle Time b) Elapsed Time

c) Total Time d) Difference

vii) In transportation problem , the method of penalties is called _____method

a) Vogel Approximation b) N-W Method

c) Least cost Method d) Modi-Method

viii) The longest path in the network diagram is called _____path

a) Critical Path b) Largest Value

c) Small path d) Short term

ix) The shortest possible completion time of an activity in PERT is called _____time

a) Optimistic b) Pessimistic

c) Most likely d) None

x) In project crashing , rent and overheads are treated as _____costs.

a) Indirect b) Direct

c) Most likely d) Optimistic

B) State whether the following statements are true or false. (Any 07) **[07]**

i) The models of OR need lot of computation and therefore , the use of computers become necessary.

ii) The main advantage of linear programming is its simplicity and easy way of understanding.

iii) When an assignment problem has more than one optimal solution, it is known as multiple or alternative optimum solution.

iv) Transportation problems whose main objective is to minimize the cost of shipping goods are called minimizing.

v) An event which represents completion of multiple activities is know as a merge event.

vi) It is assumed that the indirect cost increases linearly with the time.

vii) Optimistic time is the longest possible time required for the completion of the activity.

viii) The processing times on different machines are dependent of the order of the job in which they are to be processed.

ix) A payoff matrix shows the outcomes or payoff that results from each combination of strategies adopted by the two participants in the game.

x) A game with only players (for example Player A and Player B) is known as a mixed Game.

Q.2 **Answer the following.**

a) Use Graphical Method to solve the following problems: **[08]**

Min Z=5X1+6X2

Subject to constraints

$2X1+5X2 \geq 1500$

$3X1+X2 \geq 1200$

$X1,X2 \geq 0$

b) In order to avoid the fractional values of annual sales of each salesman in each territory The problem is to determine the assignment which make the total sales maximum and effectiveness matrix is given by. **[07]**

Territories

Salesman	I	II	III	IV
A	42	35	28	21
B	30	25	20	15
C	30	25	20	15
D	24	20	16	12

OR

c) Find initial Feasible solution by Vogel's Approximation Method. **[08]**

	1	2	3	4	Available
A	6	1	9	3	70
B	11	5	2	8	55
C	10	12	4	7	90
Required	85	35	50	45	215

d) Use Simplex Method to solve the following problems: **[07]**

Max Z=6X1+8X2

Subject to constraints

$5X1+10X2 \leq 60$

$4X1+4X2 \leq 40$

$X1,X2 \geq 0$

Q.3 **Answer the following.**

a) A small project consists of following activities construct a network diagram for the project and identify critical path and project completion time. **[08]**

Find i) Draw network diagram and find critical path and project completion time.

ii) Find EST,EFT,LST and LFT for all the activities

Activity	A	B	C	D	E	F	G	H
Node	1-2	1-3	1-5	2-3	2-4	4-6	3-6	5-6
Duration (Days)	4	6	13	5	20	10	6	16

b) For the following problems, identify the optimal strategies for players and the value of the game. **[07]**

Player N

Player M	I	II	III
I	260	200	210
II	-100	-40	240
III	400	160	-20

OR

c) For the following project ,draw PERT network and find expected project completion time. **[08]**

Activity	Optimistic time (a) in days	Most likely time (m) in days	Pessimistic Time (b) in days
1-2	5	5	5
1-3	1	3	5
2-3	0	0	0
2-4	1	2	9
2-5	1	2	3
3-5	3	6	9
4-6	1	1.5	5
5-6	1	3	5
6-7	1	2	3

Answer the following questions.

i) Find probability of project completion in 18 days

ii) Find probability of project completion in 15 days

iii) Find project completion time for 90% confidence level.

d) Five jobs I,II,III,IV are to be processed on two machines A and B in the order **[07]**

Processing Time (Min.)

Jobs	Machine A	Machine B
I	28	49
II	21	47
III	50	21
IV	18	36

Find i) Total minimum Elapsed time ii) idle time for each machine

Q.4 **Answer the following.**

a) The following table gives the activities in a construction project and other relevant information **[08]**

Activity	Normal time (Week)	Crash Time (months)	Normal cost(Rs 000)	Crash cost (Rs 000)
1-2	8	6	1500	2000
1-4	10	7	2000	3000
2-4	5	4	800	1400
2-3	6	4	1100	1500
2-5	8	5	900	1500
3-4	0	0	0	0
4-6	12	8	300	400
5-6	5	4	500	800

i) Construct a network diagram.
ii) Identify the critical path, normal duration and corresponding total cost of the project?

b) Five jobs I,II,III,IV,V are to be processed on two machines A,B and C in the order ABC **[07]**

Processing Time (Hrs.)

Jobs	Machine A	Machine B	Machine C
I	12	11	13
II	15	12	14
III	13	9	12
IV	12	10	15
V	14	9	10

Find i) Total minimum Elapsed time ii) idle time for each machine A,B,C

OR

c) A Company produces two Products A and B. 1 unit of product A requires 10 units of machine 1 and 6 units of machine 2. 1 unit of product B requires 4 units of machine 1 and 8 units of machine 2. Capacities of M1 and M2 are 40 units and 48 units respectively. Profit per unit of A and B is Rs.10 and Rs. 20 respectively. Obtain i) formulation of LPP ii) Solve by Graphical Method. **[08]**

d) The table given below has been taken from the solution procedure of a transportation problem, involving minimization of cost (in Rs.) **[07]**

Factories	Stockists			Monthly Capacity (units)
	P	Q	R	
A	4 (30)	8 (25)	8	55
B	18 (44)	24	18 (44)	88
C	12	16 (77)	24	77
Monthly Demand (Units)	74	102	44	220

Find Optimal solution by MODI Method

Q.5 A) Answer the following.

i) Define Operation Research. Discuss Advantages and Limitation of O.R **[08]**

ii) What do you mean by Alternate Solution in Assignment Problem? How do you identify alternate solution in Assignment Problem? Further What is Procedure to find alternate Solution ? **[07]**

OR

B) Short Note: (Any3) (5 marks each) **[15]**

i) Assumption in LPP

ii) Principle of Dominance

iii) Assumption of Job Sequencing

iv) Dummy activity and its use in Network analysis

v) Three time Estimates in Network analysis

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