

IMT- 25

OPERATIONS RESEARCH

Notes:

- Write answers in your own words as far as possible and refrain from copying from the text books/handouts.
- Answers of Ist Set (Part-A), IInd Set (Part-B), IIIrd Set (Part – C) and Set-IVth (Case Study) must be sent together.
- Submit the assignments in IMT CDL H.O. along with the assignments Question Papers for evaluation .
- Only hand written assignments shall be accepted.

A. First Set of Assignments

5 Questions, each question carries 1.5 marks.

B. Second Set of Assignments

5 Questions, each question carries 1.5 marks.

C. Third Set of Assignments

5 Questions, each question carries 1.5 marks. Confine your answers to 150 to 200 Words.

D. Forth Set of Assignments

Two Case Studies : 7.5 Marks. Each case study carries 3.75 marks.

SECTION - A

1. What is the significance of operations research? What are the limitations of OR?

2. What are the basic concepts of linear programming?

3. Solve the following LPP using graphical method

$$\text{Minimize } Z = 20X_1 + 10X_2$$

$$\text{Subject to, } X_1 + 2X_2 \leq 40$$

$$3X_1 + X_2 \geq 30$$

$$4X_1 + 3X_2 \geq 60$$

$$X_1, X_2 \geq 0$$

4. Use simplex method to solve the following LP problem

$$\text{Maximize } Z = X_1 + 3 X_2$$

$$\text{Subject to } 4X_1 + 2 X_2 \leq 40$$

$$3X_1 + 5 X_2 \leq 60$$

$$10X_1 + 9 X_2 \leq 90$$

$$X_1, X_2 \geq 0$$

5. Write short notes on:

- Branch and bound method
- Mixed IPP
- Quadratic programming

SECTION - B

1. Explain the steps involved in solving a transportation problem.

2. Five men A, B, C, D, and E are available to do five jobs I, II, III, IV and V. The time that each man takes to do each job is given in the following matrix. Find the optimal assignment.

		JOBS				
		I	II	III	IV	V
MEN	A	2	9	2	7	1
	B	6	8	7	6	1
	C	4	6	5	3	1
	D	4	2	7	3	1
	E	5	3	9	5	1

3. Explain the elements of a queuing system.
4. At a gas station one car arrives every 7.5 minutes. It takes 6 minutes for every car to get service. Arrivals are Poisson distributed and Services are exponentially distributed. Calculate
 - a) Utilization factor
 - b) Average number of cars waiting for service
 - c) Average time a car must wait for service
 - d) Average time a car has to spend at the gas station
5. Write short notes on
 - a) Transshipment model
 - b) Johnson's rule for job sequencing

SECTION - C

1. a) Briefly describe Monte Carlo method of simulation
b) Differentiate between PERT and CPM
2. From the following matrix , the elements of which indicate the costs, obtain the decision using different principles of decision making:

	a1	a2	a3	a4	a5
S1	26	22	13	22	18
S2	26	22	34	30	20
S3	18	22	18	18	20
S4	22	22	18	18	18

3. A company manufactures around 150 mopeds. The daily production varies from 146 to 154 depending upon the variability of raw materials and other working conditions.

Production per day	Probability
146	0.04
147	0.09
148	0.12
149	0.14
150	0.11
151	0.10
152	0.20
153	0.12
154	0.08

The finished mopeds are transported in a specially arranged lorry accommodating only 150 mopeds. Using following random numbers 80,81,76,75,64,43,18,26,10,12,65,68,69,61,57 simulate the process to find out

- a) What will be the average number of mopeds waiting in the factory?
- b) What will be the average number of empty spaces on the lorry?

4. A small project consists of seven activities whose time estimates are given in the following table.

Activity	Preceding activity	Time in days
A	-	9
B	-	12
C	-	15
D	A	6
E	B	30
F	C	29
G	D, E	32

- a) Draw the network diagram
- b) Identify the critical path and critical path duration
- c) Calculate earliest start time, earliest finish time latest start time, latest finish time and float for each of the activities.

5. Write notes on

- a) Elements of a decision model
- b) Project crashing

CASE STUDY - 1

A firm is planning to develop and market a new drug. The cost of extensive research to develop the drug has been estimated at Rs 1,00,000. The manager of the research programme has found that there is a 60% chance that the drug will be developed successfully. The market potential has been assessed as follows:

Market conditions	Probability	Present value of profits
Large market potential	0.1	Rs 50,000
Moderate market potential	0.6	Rs 25,000
Low market potential	0.3	Rs 10,000

The present value figures do not include the cost of research. While the firm is considering this proposal, a second proposal, almost similar, comes up for consideration. The second one also requires an investment of Rs 1,00,000 but the present value of all profits is Rs 12,000. Of course the return on investment in the second proposal is certain.

- a) Draw a decision tree indicating all the events and choices of the firm.
- b) What decision the firm should take regarding the investment of Rs 1,00,000?

CASE STUDY - 2

A company has four factories manufacturing the same commodity, which are required to be transported to meet the demands of four warehouses. The supplies and demands as also the cost per transportation from factory to warehouse in rupees per unit of product are given below:

Factory	Warehouses				Supply (units)
	X	Y	Z	W	
A	25	55	40	60	60
B	35	30	50	40	140
C	36	45	26	66	150
D	35	30	41	50	50
Demand (units)	90	100	120	140	

- Derive and optimal strategy of transportation of goods from factories to warehouses and assess the optimal cost
- If a new transporter agrees to transport goods from factory C to warehouse W at a unit cost of Rs 50, analyze the impact of this on the current optimal solution.