

## MANAGEMENT PROGRAMME

### MBA 301: Applied Operation Research

Time : 3 hours

Maximum Marks : 60

*Note : There are three sections : Section A, Section B and Section C in this paper.*

#### SECTION A (4x5=20)

I. *Attempt any four questions from Section A.*

- Explain meaning, scope importance and limitations of Operation Research in decision making.
- Express the linear Programming Problem in its general form with Matrix Notation.
- Explain when and where sensitivity analysis is used.
- What is duality testing?
- What do you mean by Mixed Strategy Game, explain its uses?
- Explain Queuing theory and its basic concept?

#### SECTION B (4x8=32)

**Attempt one question from each UNIT.**

#### UNIT I

- II. For the following data, draw the network diagram, and then crash the activities to find the time-cost trade-off points that the company should want to consider. Start with the plan that has the longest duration.

Activity	Preceding Activity	Time(weeks)		Cost (\$000s)	
		Normal Program	Crash Program	Normal Program	Crash Program
A	-	2	2	5	5
B	A	5	3	11	21
C	A	2	1	7	16
D	B, C	4	2	8	22
E	B	3	2	9	18
F	D, E	3	3	9	9

- III. Write short notes on the following: a) CPM vs PERT technique b) Total slack c) advantages of Matrix organization d) Commission of projects

## UNIT II

- IV. Solve the following LP - problem by SIMPLEX Method.

Minimize  $z = x_1 - 3x_2 + 2x_3$

subject to,

$$3x_1 - x_2 + 3x_3 \leq 7$$

$$-2x_1 + 4x_2 \leq 12$$

$$-4x_1 + 3x_2 + 5x_3 \leq 10$$

$$x_1, x_2, \text{ and } x_3 \geq 0$$

- V. A company manufactures a product from its two plants  $P_1$  and  $P_2$  with a capacity of 200 units and 100 units per month. It supplies the product to four shops at  $S_1$ ,  $S_2$ ,  $S_3$ , and  $S_4$  having a demand of 75, 100, 100 and 30 units respectively per month. The profit per unit differs with shops as given below in Rs.

	$S_1$	$S_2$	$S_3$	$S_4$
$P_1$	90	90	100	110
$P_2$	50	70	130	85

Plan the production programme for maximising profit.

## UNIT III

- VI. Find the saddle point in the following case and also the game value.

	B	
	4	2
A	-2	-3
	-4	-5

- VII. In a game of matching coins with two players, suppose A wins one unit of value when there are two heads, wins nothing when there are two tails and loses 1/2 unit of value when there is one head and one tail. Determine PAY - OFF matrix, the best strategy for each player and the value of the game to A.

## UNIT IV

- VIII. Belt snapping for conveyors in an open cast mine occurs at the rate of 2 per shift. There is only one hot plate available for vulcanising, and it can vulcanise on an average 5 belt-snaps per shift.

- (a) What is the probability that when a belt snaps, the hot plate is readily available?
- (b) What is the average number of belts in the system?
- (c) What is the average waiting time of an arrival?
- (d) What is the average waiting time plus vulcanising time?

- IX. In a railway marshalling yard, goods trains arrive at a rate of 30 trains / day. Assuming that inter - arrival time follows exponential distribution and the service time distribution is also exponential with average 36 minutes, calculate the following :

- (i) Average number of trains in the yard.
- (ii) Probability of queue exceeding 10.
- (iii) Utilization rate of the yard.

### SECTION C (8 marks)

- X. The activities, duration and direct activity costs are given below. The indirect cost is Rs. 3000 per week. Starting from the normal duration obtain the crash cost and duration of the project.

Activity	Time in Weeks		Cost		Cost to Expedite per week (Cost slope)
	Normal	Crash	Normal	Crash	
1 - 2	2	2	3000	3000	---
2 - 3	4	3	4000	5000	1000
2 - 6	8	8	6000	6000	----
3 - 4	3	2	2000	3500	1500
3 - 5	2	2	2000	2000	----
4 - 6	4	3	4000	5000	1000
5 - 6	3	3	4000	4000	----
6 - 7	8	5	8000	12000	1333