

Second Semester M. E. (PTM) Examination
OPERATIONS RESEARCH TECHNIQUES

Paper - 2 SPTM 3

P. Pages : 4

Time : Three Hours]

[Max. Marks : 80

- Note :** (1) Separate answer book must be used for each Section in the subject Geology, Engineering material of civil branch and Separate answer – book must be used for Section A and B in Pharmacy and Cosmetic Tech.
- (2) Answer any **three** questions from Section A and any **three** questions from Section B.
- (3) Assume suitable data wherever necessary.
- (4) Use pen of Blue/Black ink/refill only for writing the answer book.

SECTION A

1. (a) Explain the advantages and limitations of linear programming. 6
- (b) A dairy farm has two milk plants with daily milk production of 6 million litres and 9 million litres respectively. Each day the farm must fulfil the needs of its three distribution centres which have milk requirement of 7, 5 and 3 million litres respectively. Cost of shipping one million litres of milk from each plant to each distribution centre is given, in hundreds of rupees below. Formulate the LP model to minimize the transportation cost.

		Distribution Centres			Supply
		1	2	3	
Plants	1	2	3	11	6
	2	1	9	6	9
Demand		7	5	3	8

2. (a) Solve the following LPP by simplex method :

$$\text{Maximize } Z = 4x_1 + 3x_2 + 6x_3$$

Subject to the constraints :

$$2x_1 + 3x_2 + 2x_3 \leq 440 ;$$

$$4x_1 + 3x_3 \leq 470 ;$$

$$2x_1 + 5x_2 \leq 430 ; \text{ and}$$

$$x_1, x_2, x_3 \geq 0$$

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(b) Write the dual of the following LPP. :—

$$\text{Minimize } Z = 100x_1 + 50x_2 + 30x_3$$

Subject to the constraints :

$$100x_1 + 50x_2 + 30x_3 \geq 200 ;$$

$$5x_1 - x_2 = 50 ;$$

$$x_2 - 2x_3 \leq 75 ; \text{ and}$$

$$x_1 \geq 0 ; x_2 \text{ and } x_3 \text{ unrestricted in sign.}$$

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3. Solve the following LPP by using simplex method :—

$$\text{Maximize } Z = 3x_1 + 6x_2$$

Subject to the constraints :

$$3x_1 + 4x_2 \geq 12 ;$$

$$-2x_1 + x_2 \leq 4 ; \text{ and}$$

$$x_1, x_2 \geq 0$$

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4. Solve the following LPP by using branch and bound method.

$$\text{Minimize } Z = 3x_1 + 5x_2$$

Subject to the constraints :

$$x_1 + 2x_2 \geq 20 ;$$

$$3x_1 + 2x_2 \geq 50 ; \text{ and}$$

$$x_1, x_2 \geq 0 \text{ and integers.}$$

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5. (a) What do you mean by two – person zero – sum game ? What are the assumptions of the game ?

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(b) Use the graphical method to solve the following game and find the value of the game.

		Player B		
		B ₁	B ₂	B ₃
Player A	A ₁	12	8	6
	A ₂	4	8	16

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SECTION B

6. (a) Explain the difference between expected opportunity loss and expected value of perfect information. 4
- (b) A glass factory specializing in crystal is developing a substantial backlog and the firm's management is considering three courses of action : Arrange for subcontracting, begin overtime production and construct new facilities. The correct choice depends largely upon future demand which may be low, medium or high. By consensus, the management ranks the respective probabilities as 0.15 , 0.45 and 0.40. A cost analysis reveals effect upon the profits (in ₹) that is shown below :

Demand	Probability	Courses of action		
		Subcontracting	Begin over time	Construct facilities
Low	0.15	10	- 20	- 150
Medium	0.45	50	60	20
High	0.40	50	100	200

Show the decision situation in the form of a decision tree and indicate the most preferred decision and corresponding expected value. 10

7. (a) What are the general steps of simulation process ? 4
- (b) A dentist schedules all her patients for 30 minutes appointments. Some of the patients take more or less than 30 minutes depending on the type of dental work to be done. The following summary shows the various categories of work, their probabilities and the time needed to complete the work.

Category	Time required (minutes)	Probability
Filling	45	0.50
Cleaning	20	0.10
Extraction	40	0.15
Check up	15	0.25

Simulate the dentist's clinic for four hours and determine the average waiting time for the patients as well as the idleness of the doctor. Assume that all patients show up at the clinic at exactly scheduled arrival times, starting at 6.00 PM. Use the following set of random numbers :—

40 , 82 , 11 , 34 , 25 , 66 , 17 and 79.

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8. (a) Explain the important characteristics of a queuing system. 4
- (b) A tax consulting firm has 3 counters in its office to receive people who have problems. On an average 48 persons arrive in an 8 – hour day. Each tax adviser spends 15 minutes on an average on an arrival. If arrivals are Poissonly distributed and service time are according to exponential distribution, find :—
- (a) Average number of customers in the system,
- (b) The probability that a customer has to wait before he gets service.

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9. An oil company has 8 units of money available for exploration of three sites. If oil is present at a site, the probability of finding it depends upon the amount allocated for exploiting the site, as given below

	Units of money allocated								
	0	1	2	3	4	5	6	7	8
Site 1	0.0	0.0	0.1	0.2	0.3	0.5	0.7	0.9	1.0
Site 2	0.0	0.1	0.2	0.3	0.4	0.6	0.7	0.8	1.0
Site 3	0.0	0.1	0.1	0.2	0.3	0.5	0.8	0.9	1.0

The probability that the oil exists at site 1, 2 and 3 is 0.4, 0.3 and 0.2 respectively. Find the optimal allocation of money. 13

10. Use revised simplex method to solve the following LPP

$$\text{Maximize } Z = 3x_1 + 5x_2$$

$$\text{Subject to } x_1 \leq 4$$

$$x_2 \geq 6$$

$$3x_1 + 2x_2 \leq 18$$

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

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