Day : Tuesday

Date : 14-06-2022   **S-11060-2022**

Time : 02:00 PM-05:00 PM

Max. Marks : **100**

N.B.:

1) Attempt **ANY FOUR** questions from Section – I and attempt **ANY TWO** questions from Section – II.
2) Answers to both the sections should be written in **SAME** answer books.
3) Use of non-programmable **CALCULATOR** is allowed.
4) Graph papers and statistical table will be permitted if necessary.
5) Figures to the right indicate **FULL** marks.

SECTION – I

Q.1 A company manufactures two types of gift items: ordinary O and deluxe D. **[15]** Each gift of type D takes twice as long to produce as that of type O, and the company would have time to make a maximum of 2000 gifts per day, if it produces only the ordinary items. The supply of the plastic is sufficient to produce 1500 gift items per day (both O and D). The deluxe gift item requires a fancy sheet, of which there are only 600 pieces available per day. If the company makes a profit of Rs. 3 and Rs. 5 per gift item respectively on items O and D, how many of each should be produced per day to maximize the profit?

Q.2 Solve the following transportation problem using the MODI method: **[15]**

	To			Available
	2	7	4	5
From	3	3	1	8
	5	4	7	7
	1	6	2	14
Required	7	9	18	

Q.3 Solve the following assignment problem. **[15]**

		Persons				
		1	2	3	4	5
	I	12	8	7	15	4
jobs	II	7	9	17	14	10
	III	9	6	12	6	7
	IV	7	6	14	6	10
	V	9	6	12	10	6

Q.4 Consider the following project: **[15]**

Activity	0 – 1	1 – 2	1 – 3	2 – 4	2 – 5	3 – 4	3 – 6	4 – 7	5 – 7	6 – 7
Duration (in days)	2	8	10	6	3	3	7	5	2	8

a) Draw the network diagram.
b) Find the critical path and the project duration.
c) Determine the total, free and independent floats.

P.T.O.

Q.5 A tube and tyre manufacturing company is planning to increase its existing **[15]** capacity. Among various available alternatives, its management ultimately approves two plans:

a) Modernization at a cost of Rs. 50 lakhs

b) Expansion at a cost of Rs. 80 lakhs.

Both these plans would require the same time for implementation. The management believes that over the required payback period, the demand will either be high or moderate. Since high demand is considered less likely, the probability of its occurrence is set at 0.35. If the demand is high, modernization would gross an estimated additional Rs. 60 lakhs, whereas expansion would gross an additional Rs. 120 lakhs. On the other hand, if the demand is moderate, the corresponding figures would be Rs. 50 lakhs for modernization and Rs. 70 lakhs for expansion.

i) Identify the states of nature and courses of action.

ii) Calculate the expected profit values for the courses of action.

iii) Calculate EVPI.

Q.6 A firm has several machines and wants to install its own service facility for **[15]** the repair of its machines. The average breakdown rate of the machines is three per day. Assume that the inter-arrival times are independent exponential variables and the repair time has exponential distribution. The loss incurred due to the lost time caused by the breakdown of an inoperative machine is Rs. 40 per day. The firm has two repair facilities – A and B. While facility A requires an installation cost of Rs. 20,000, facility B costs Rs. 40,000. The total labour cost per year is Rs. 5000 and Rs. 8000 per year for A and B respectively. While A can repair 4.5 machines per day, B can repair five machines per day. Both these facilities have a life of four years. Which facility should be installed?

Q.7 Write short notes on **ANY TWO** of the following: **[15]**

a) Operation Research Models

b) Limitations of Operations Research

c) Decision environments

d) Floats

SECTION – II

Q.8 Solve the following LPP using the simplex method: **[20]**

$$\text{Max } Z = -x_1 + 4x_2$$

Subject to $x_1 - x_2 \leq 1$

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

and $x_1, x_2 \geq 0$

Q.9 Determine an initial BFS of the following transportation table using NWCM, **[20]** LCM and VAM.

	Warehouse				Capacity
	W_1	W_2	W_3	W_4	
F_1	19	30	50	10	7
F_2	70	30	40	60	9
F_3	40	8	70	20	18
Requirement	5	8	7	14	34

Q.10 a) Discuss the applications of Assignment Problems. **[10]**

b) Explain the characteristics of M/M/I Queue model. **[10]**

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