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INSTITUTE OF TECHNOLOGY AND MANAGEMENT

(AN AUTONOMOUS INSTITUTION)

(Approved by AICTE, New Delhi & Affiliated to JNTUH, Hyderabad)

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III B.Tech I Sem Supply End Examination, July 2022

Operations Research

(MECH)

Time: 3 Hours.

Max. Marks: 70

Note: 1. Question paper consists: Part-A and Part-B.

2. In Part - A, answer all questions which carries 20 marks.

3. In Part - B, answer any one question from each unit.

Each question carries 10 marks and may have a, b as sub questions.

PART- A

(10*2 Marks = 20 Marks)

- | | | | | |
|-------|---|----|-----|-----|
| 1. a) | Give the merits and demerits of solving LPP by graphical solutions in operations research | 2M | CO1 | BL2 |
| b) | What is degeneracy in simplex problem? How do you resolve? | 2M | CO1 | BL1 |
| c) | Define transportation problem. | 2M | CO2 | BL1 |
| d) | What is meant by restricted (or prohibited) assignment? | 2M | CO2 | BL1 |
| e) | What is 'No-Passing Rule' in sequencing? | 2M | CO3 | BL2 |
| f) | Differentiate between individual replacement policy and group replacement policy. | 2M | CO3 | BL4 |
| g) | When is the game said to be determinable? | 2M | CO4 | BL2 |
| h) | What are the functions of inventories? | 2M | CO4 | BL1 |
| i) | What are waiting line costs? | 2M | CO5 | BL1 |
| j) | What do you mean by forward and backward recursion in dynamic programming? | 2M | CO5 | BL1 |

PART- B

(10*5 Marks = 50 Marks)

- | | | | | |
|------|---|----|-----|-----|
| 2 a) | With an example discuss the degeneracy in simplex. | 5M | CO1 | BL2 |
| b) | A teacher gives his students three long lists of problems with the instructions to submit not more than 100 of them correctly solve, for credit. The problems in the First list are of 5 points each, in second 4 points each and in third 6 points each. On an average 3 minutes are required to solve a problems from first list, 2 min. for a problem from second & 4 min. for a problem from third. The students are not allowed to devote more than 2½ hours of numerical hours. How many problems from each list, a student should solve so as to get the maximum credit. Formulate the problems as LPP | 5M | CO1 | BL4 |

OR

3 Solve the following LPP using Simplex method.

10M CO1 BL4

$$\begin{aligned} \text{Maximize } & Z = 10x_1 + 8x_2 \\ \text{Subject to } & x_1 + 2x_2 \leq 1000 \\ & x_1 \leq 300 \\ & x_2 \leq 500; \\ \text{and } & x_1, x_2 \geq 0 \end{aligned}$$

4 Find the optimal solution to the following transportation problem using VAM-MODI method each cell value being the unit cost.

10M CO2 BL4

	D ₁	D ₂	D ₃	D ₄	D ₅	Supply
C ₁	35	41	28	16	20	285
C ₂	14	21	28	30	15	145
C ₃	45	18	17	29	26	165
Demand	125	125	100	100	175	

OR

5 A company has four territories and four salesmen for assignment. The territories are not equally rich in their sales potential. It is estimated that a typical salesman operating in each territory would bring the following annual sales.

10M CO2 BL4

Territory	I	II	III	IV
Annual sales(rs)	6000	5000	4000	3000
	0	0	0	0

The four salesmen are also considered to differ in ability, it is estimated that working under same condition their yearly sales could be proportionately as follows

Sales man	A	B	C	D
proportion	0.7	0.5	0.5	0.4

If criterion is to maximize expected sales, the intuitive answer is to assign the best salesman to the richest territory and next best to second richest and so on. Verify this answer by assignment technique.

6 a) Explain the necessity and significance of replacement.

5M CO3 BL2

b) A factory has a large number of bulbs all of which must be in working condition. The mortality of bulbs is given in the following table :

5M CO3 BL4

Week	Proportion of Bulbs Failing During the
1	0.1
2	0.15
3	0.25
4	0.35
5	0.12
6	0.03

If a bulb fails in service, it costs 3.50 to replace but if all bulbs are replaced at a time it costs Rs. 1.20 each. Find the optimum group replacement policy. (Assume 1000 bulbs as available in the beginning).

OR

- 7 Find the minimum elapsed time sequence of 2 works and 5 machines when we are given the following information. 10M C03 BL4

Work 1	Sequence	A	B	C	D	E
	Time(Hours)	2	3	4	6	2
Work 2	Sequence	C	A	D	E	B
	Time(Hours)	4	5	3	2	6

- 8 Two children Divya and Savya play the following game, named "scissors, paper, stone". Both players simultaneously call one of the three "scissors, paper and stone" scissors beat paper (as paper can be cut by scissors), paper beats stone (as stone can be wrapped in paper) and stone beats scissors. If the two players name the same item, then there is a tie. If there is one point for win, zero for tie and -1 for loss, form the pay off matrix of the game and solve it. 10M C04 BL4

OR

- 9 Solve the following game whose pay-off matrix is given by 10M C04 BL4

		B			
		I	II	III	VI
A	I	3	2	4	0
	II	3	4	2	4
	III	4	2	4	0
	IV	0	4	0	8

- 10 a) Discuss the arrival and service patterns used in Q-models. 5M C05 BL2
 b) In a railway marshalling yard, goods trains arrive at a rate of 30 trains per day. Assuming that the inter-arrival time follows an exponential distribution and the service time (the time taken to dump a train) distribution is also exponential with an average of 36 minutes; calculate i) expected queue size (line length) ii) probability that the queue size exceeds 10. If the input of trains increases to an average of 33 per day, what will be the change in (i) and (ii) 5M C05 BL4

OR

- 11 Ten people have to be divided into three groups and to be sent on three projects, given that the cost of the project is numerically equal to the square the size of th3e group. Solve by DPP approach. 10M C05 BL4

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