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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belagavi)

Eighth Semester, B.E. - Mechanical Engineering

Semester End Examination; July / August - 2022

Operations Research

Time: 3 hrs *Max. Marks: 100*

Course Outcomes

The Students will be able to:

CO1: Identify and develop operation research models from the verbal description of real life.

CO2: Analyse the problem using mathematical tools and simple queue system.

CO3: Describe the model and the solving technique to analyse the results and propose recommendation.

CO4: Solve Transportation and Assignment problem using different methods.

CO5: Explain the game theory with their characteristics and Solve problems.

***Note**: I) **PART - A** is compulsory. **Two** marks for each question.*

*II) **PART - B**: Answer any **Two** sub questions (from a, b, c) for a Maximum of **18 marks** from each unit.*

Q. No.		Questions	Marks	BLs	COs	POs
		I : PART - A	**10**			
I	a.	List any two applications of Operations Research.	2	L2	CO1	PO1
	b.	With example explain slack variable.	2	L2	CO2	PO1
	c.	List the different steps in Hungarian method.	2	L1	CO3	PO1
	d.	Mention basic steps in PERT / CPM.	2	L2	CO4	PO1
	e.	What is two person zero sum game?	2	L2	CO5	PO1
		II : PART - B	**90**			
		UNIT - I	**18**			
1	a.	Explain the characteristics of operations research.	9	L2	CO1	PO2
	b.	ABC company owns a paint factory that produces both exterior and interior paints for wholesale distribution. The basic raw material A and B are used for manufacturing. Maximum availability of A is 6 ton/day and then B is 8 ton/day. Requirement of raw materials/ton of the interior exterior paints are given below,	9	L2	CO1	PO2

Raw material	Exterior paint	Interior Paint
A	1	2
B	2	1

Market survey has established that, the daily demand for interior paint cannot exceed that of the exterior paint by more than one ton. The maximum demand for interior paint limited to 2 tons/day, the whole sale price / ton is Rs3000 of exterior and Rs. 2000 for interior paint. How much interior and exterior paint the company should produce to maximize the gross income, formulate the LPP.

Contd… 2

c. Solve the following LPP by Graphical method $Z_{Max} = 40X_1+30X_2$

Subjected to ,

$2X_1+X_2 \leq 1000,$

$X_1+X_2 \leq 800,$

$X_1 \leq 400,$

$X_2 \leq 700$

$X_1 \& X_2 \geq 0$

9 L2 CO1 PO2

UNIT - II **18**

2 a. Solve the following LPP by using simplex method $Z_{Max} = 3X_1+2X_2$

Subjected to ,

$X_1+X_2 \leq 40,$

$X_1-X_2 \leq 20,$

$X_1, X_2 \geq 0$

14 L3 CO2 PO2

b. Solve the following LPP by Big-M method $Z_{Min} = 3X_1 +2X_2+ 4X_3$

subjected to,

$2X_1 +X_2+ 3X_3 = 60$

$3X_1 +3X_2+ 5X_3 \geq 120,$

$X_1, X_2 \geq 0$

14 L3 CO2 PO3

c. Explain procedure to resolve Degeneracy. 4 L2 CO2 PO3

UNIT - III **18**

3 a. A company has 5 tasks and 5 persons to same. The matrix showed the profit in hundreds of rupees. For assigning jobs to persons. Assign 5 tasks to 5 persons to maximize the profit.

		Persons				
		P1	P2	P3	P4	P5
Task	J1	5	11	10	12	4
	J2	2	4	6	3	5
	J3	3	12	5	14	6
	J4	6	14	4	11	7
	J5	7	9	8	12	5

14 L2 CO3 PO2

b. Solve the travelling salesman problem given by the following data:

$C_{12} = 20$, $C_{13} = 4$, $C_{14} = 10$, $C_{23} = 5$, $C_{34} = 6$, $C_{25} = 10$, $C_{35} = 6$, $C_{45} = 20$, where $C_{ij} = C_{ji}$, there is no route between i and j if the value for C_{ij} is not shown.

14 L2 CO3 PO2

c. List the differences between transportation problem and assignment problem. 4 L2 CO1 PO1

Contd… 3

UNIT - IV **18**

4 a. A project consists of series of tasks labeled A, B…H, I with the following constraints / precedence relationship.

A < D, E: B, D < F : C < G ; B < H; F, G < I, W < *x*, *y* means *x* and *y* cannot start until W is completed. Construct a network using this notation, also find the minimum time required for the completion of the project when the time required for the project when the time required for the completion of each task is given below, 12 L2 CO4 PO2

Task	A	B	C	D	E	F	G	H	I
Time	23	8	20	16	24	18	19	4	10

b. Mention technique used for planning, controlling and scheduling of a project AND Explain network terminologies. 12 L2 CO4 PO2

c. List the difference between PERT and CPM. 6 L3 CO4 PO2

UNIT - V **18**

5 a. In a game of matching coins, player *A* wins Rs 8, if both coins show head and Rs 1 if both are tails, player *B* wins Rs 3 when coins do not match. Given the choice of being player *A* and player *B* which would you choose and what would be your strategy. 12 L3 CO5 PO2

b. Using dominance concept, obtain the optimal strategies for both players and determine the value of game, the payoff matrix player 'A' is given; 12 L2 CO5 PO2

		B				
		I	II	III	IV	V
A	I	2	4	3	8	4
	II	5	6	3	7	8
	III	6	7	9	8	7
	IV	4	2	8	4	3

c. Briefly explain Queuing system and its characteristics. 6 L2 CO5 PO2

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