PVP 20

Code: 20ME2701A

IV B.Tech - I Semester – Regular Examinations - DECEMBER 2023

OPERATIONS RESEARCH
(Common for ALL BRANCHES)

Duration: 3 hours Max. Marks: 70

Note: 1. This paper contains questions from 5 units of Syllabus. Each unit carries 14 marks and have an internal choice of Questions.
2. All parts of Question must be answered in one place.

BL – Blooms Level CO – Course Outcome

			BL	CO	Max. Marks
		UNIT-I			
1	a)	List any two types of models in operations research.	L2	CO1	2 M
	b)	A company manufactures three products namely *X*, *Y* and *Z*. Each of the products requires processing on three machines, Turning, Milling and Grinding. Product *X* requires 10 hours of turning, 5 hours of milling and 1 hour of grinding. Product *Y* requires 5 hours of turning, 10 hours of milling and 1 hour of grinding, and Product *Z* requires 2 hours of turning, 4 hours of milling and 2 hours of grinding. In the coming planning period, 2700 hours of turning, 2200 hours of milling and 500 hours of grinding are available. The profit contribution of *X*, *Y* and *Z* are Rs.10, Rs.15 and Rs.20 per unit respectively. Find the optimal product mix to maximize the profit.	L3	CO2	12 M
		OR			
2	a)	Define slack and surplus variables, and state it's use.	L2	CO1	2 M
	b)	Find the dual of the following LPP: Minimize $Z = 2x_2+5x_3$ Subjected to, $x_1 + x_2 \geq 2;\ 2x_1+x_2+6x_3 \leq 6;\ x_1 - x_2 +3x_3 = 4$, where, x_1, x_2 & $x_3 \geq 0$	L3	CO2	12 M

UNIT-II

3 a) List out conditions to perform the optimality test. L2 CO1 2 M

b) Find the basic feasible solution of the following transportation problem by applying i) North-west corner rule, ii) Least-cost method and iii) Vogel's approximation method(VAM). L3 CO2 12 M

		Factory			
		A	B	C	Supply
Warehouse	D	2	7	4	5
	E	3	3	1	8
	F	5	4	7	7
	G	1	6	2	14
Demand		7	9	18	34

OR

4 a) What is unbalanced Assignment problem? L2 CO1 2 M

b) A company is producing a single product and selling it through five agencies situated in the different cities. All of a sudden, there is a demand for the product in five more cities that do not have any agency of the company. The company is faced with the problem of deciding on how to assign the existing agencies to dispatch the product to the additional cities in such a way that the travelling distance is minimized. The distances (in km) between the surplus and the deficit cities are given in the following distance matrix: L3 CO2 12 M

		Deficit city				
		I	II	III	IV	V
Surplus city	A	160	130	175	190	200
	B	135	120	130	160	175
	C	140	110	155	170	185
	D	50	50	80	80	110
	E	55	35	70	80	105

Determine the optimum assignment schedule.

UNIT-III

5 a) Explain briefly fundamental structure of Queueing System. L3 CO1 4 M

b) Arrival of machinists at a tool crib are considered to be L3 CO3 10 M

		Poisson distributed at an average rate 6 per hour. The length of time the machinists must remain at the tool crib is exponentially with average time of 0.05 hours. i) What is the probability that a machinist arriving at the tool crib will have to wait? ii) What is the average number of machinists at the tool crib? iii) The company will install a second tool crib when convinced that a machinist would have to spend 6 minutes in waiting and being served at the tool crib. At what rate should the arrival of machinist to the tool crib increase to justify the addition of a second crib?			
		OR			
6	a)	List four common examples of queuing models.	L2	CO1	2 M
	b)	Determine the sequence that will minimize the elapsed time. Also find idle time of all machines.	L3	CO3	12 M

Job	1	2	3	4	5	6
Machine A	3	12	5	2	9	11
Machine B	8	6	4	6	3	1
Machine C	13	14	9	12	8	13

		UNIT-IV			
7	a)	Define mixed strategy in a game.	L2	CO1	2 M
	b)	Solve the following game.	L3	CO3	12 M

	Player-B		
Player-A	1	7	2
	6	2	7
	5	1	6

		OR			
8	a)	What is a replacement model?	L2	CO1	2 M
	b)	A machine costs Rs.15,000/-. The running costs for the different years are as follows:	L3	CO3	12 M

Year	1	2	3	4	5	6	7
Running	2500	3000	4000	5000	6500	8000	10000

Find the optimal replacement period if the capital is worth

<table>
<tr><td></td><td></td><td>10% per annum and has no salvage value.</td><td></td><td></td><td></td></tr>
<tr><td colspan="6">UNIT-V</td></tr>
<tr><td rowspan="2">9</td><td>a)</td><td>Define EOQ.</td><td>L2</td><td>CO1</td><td>2 M</td></tr>
<tr><td>b)</td><td>A manufacturing company purchases 9000 parts of a machine for its annual requirements, ordering one month usage at a time. Each part costs Rs.20. The ordering cost per order is Rs.15 and the carrying cost charges are 15% of the average inventory per year. You have been asked to suggest a more economical policy for the company. What advice would you offer and how much would it save the company per year?</td><td>L3</td><td>CO4</td><td>12 M</td></tr>
<tr><td colspan="6">OR</td></tr>
<tr><td rowspan="2">10</td><td>a)</td><td>List out the types of simulation models.</td><td>L2</td><td>CO1</td><td>2 M</td></tr>
<tr><td>b)</td><td>A tourist car operator finds that during the past few months, the car’s use has varied so much that the cost of maintaining the car varied considerably. During the past 200 days the demand for the car fluctuates as below.
<table>
<tr><th>Trips per week</th><th>Frequency</th></tr>
<tr><td>0</td><td>16</td></tr>
<tr><td>1</td><td>24</td></tr>
<tr><td>2</td><td>30</td></tr>
<tr><td>3</td><td>60</td></tr>
<tr><td>4</td><td>40</td></tr>
<tr><td>5</td><td>30</td></tr>
</table>
Simulate the demand for a 10-week period. Use random numbers: 82, 96, 18, 96, 20, 84, 56, 11, 52, 03.</td><td>L3</td><td>CO4</td><td>12 M</td></tr>
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