U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

September / October 2023 Supplementary Examinations

Programme: B.E. **Semester: VIII**
Branch: Institutional Electives **Duration: 3 hrs.**
Course Code: 19MD8OE3OR **Max Marks: 100**
Course: Operations Research

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

		UNIT - I	CO	PO	Marks
1	a)	Define: i) Feasible solution ii) Slack variable iii) Unbounded solution	*CO1*	*PO1*	**06**
	b)	A company manufactures two types of printed circuits. The requirements of transistors, resistors and capacitors for each type of printed circuits along with other data are given in the below table: Circuit: A, B; Stock Available Transistor: 15, 10, 180 Resistors: 10, 20, 200 Capacitor: 15, 20, 210 Profit: Rs.5, Rs.8 How many circuits of each type should the company produce from the stock to earn maximum profit.	*CO1*	*PO2*	**06**
	c)	Use simplex method to solve the LPP: Minimize : $Z = x_1 - 3x_2 + 2x_3$ subject to $3x_1 - x_2 + 2x_3 \le 7$ $-2x_1 + 4x_2 \le 12$ $-4x_1 + 3x_2 + 8x_3 \le 10$ $x_1,\ x_2,\ x_3 \ge 0$	*CO1*	*PO2*	**08**
		OR			

	2	a)	Using Big M method solve the given LPP : Minimize: $z = 4x_1 + x_2$ subject to $3x_1 + x_2 = 3$ $4x_1 + 3x_2 \geq 6$ $x_1 + 2x_2 \leq 4$ $x_1, x_2 \geq 0$	*CO1*	*PO2*	**10**
		b)	Use simplex method to solve the LPP: Maximize: $Z = x_1 + 2x_2 + x_3$ subject to $2x_1 + x_2 - x_3 \leq 2$ $x_1 - x_2 + 5x_3 \leq 6$ $4x_1 + x_2 + x_3 \leq 6$ $x_1, x_2, x_3 \geq 0$	*CO1*	*PO2*	**10**
			UNIT - II			
	3	a)	Find the optimal solution for the given transportation problem. (Use Vogel's approximation method to obtain the initial basic feasible solution)	*CO2*	*PO2*	**10**
		b)	Solve the transportation problem to maximize the optimum profit	*CO2*	*PO2*	**10**

		TO					
		A	B	C	D	E	SUPPLY
FROM	1	**4**	**2**	**3**	**2**	**6**	8
	2	**5**	**4**	**5**	**2**	**1**	12
	3	**6**	**5**	**4**	**7**	**3**	14
DEMAND		4	4	6	8	8	

	A	B	C	D	SUPPLY
P	**15**	**51**	**42**	**33**	23
Q	**80**	**42**	**26**	**81**	44
R	**90**	**40**	**66**	**60**	33
DEMAND	23	31	16	30	

			UNIT - III			
	4	a)	A company has 5 jobs to be done. The following matrix shows the return in rupees on assigning ith (i = 1,2,3,4,5) machine to the jth job (j = A,B,C,D,E). Assign the five jobs to the five machines so as to maximize the total expected profit.	*CO3*	*PO2*	**10**

	A	**B**	**C**	**D**	**E**
1	5	11	10	12	4
2	2	4	6	3	5
3	3	12	5	14	6
4	6	14	4	11	7
5	7	9	8	12	5

		b)	Solve the following travelling salesman problem	*CO3*	*PO2*	**10**

	A	**B**	**C**	**D**	**E**
A	∞	7	6	8	4
B	7	∞	8	5	6
C	6	8	∞	9	7
D	8	5	9	∞	8
E	4	6	7	8	∞

			UNIT - IV			
	5	a)	A project has the following time schedule.	*CO4*	*PO2*	**10**

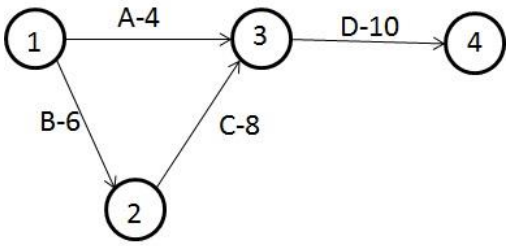
Activity	Time in Weeks	Activity	Time in Weeks
(1-2)	2	4-6	3
(1-3)	2	5-8	1
(1-4)	1	6-9	5
(2-5)	4	7-8	4
(3-6)	8	8-9	3
(3-7)	5		

Construct CPM network and compute

i) Total float for each activity

ii) Critical path and its duration.

		b)	Consider the project network below with activity times given in days	*CO4*	*PO2*	**10**



The normal and crash data for this project are as follows

Activity	Normal time (Days)	Crash time (Days)	Normal cost ($)	Crash cost ($)
A	4	3	80	105
B	6	4	180	250
C	8	5	200	320
D	10	6	350	530

i) Find the Critical path
ii) Find the project completion time and the corresponding cost.
iii) If we want to complete the project in 19 days, then find the best crash time and cost.

OR

6 a) Fusion Engineering Inc. is designing a new product for welding two different alloys. The company has limited time and resources to complete the project. The following activity information is available. *CO4* *PO2* **10**

Activity	Immediate Predecessors	Normal Time (Days)	Normal Cost($)	Crash Cost/ Day($)	Crash Time (Days)
A	-	4	400	125	3
B	A	5	800	200	4
C	A	4	520	150	2
D	B	3	600	225	2
E	C	3	255	100	2
F	B,E	4	600	175	2

(i)Draw the project network and find the critical path.
(ii)Find the project completing time and corresponding cost.
(iii)What is the total cost, if the project deadline is 12 days.

b) The following table lists the data for a PERT network with their time estimates *CO4* *PO2* **10**

Activity [i-j]	Duration (Weeks)		
	Optimistic	Most likely	Pessimistic
1-2	5	8	10
1-3	18	20	22
1-4	26	33	40
2-5	16	18	20
2-6	15	20	25
3-6	6	9	12
4-7	7	10	12
5-7	7	8	9
6-7	3	4	5

i) Draw the project network.
ii) Calculate the mean and variance of the critical path.
iii) What is the probability that the project will be completed in 41.5 weeks? [Given : $P(0< z < 0.52) =0.30$]

UNIT - V

7 a) Define: 1) saddle point 2) Pay off matrix
3) Zero sum Two person game *CO5* *PO1* **06**

	b)	Solve the following 3 x 5 game using dominance rule Use dominance principle to find the optimal strategies.	*CO5*	*PO2*	**07**
	c)	Solve the game graphically whose payoff matrix for the players A is given in as follows:	*CO5*	*PO2*	**07**

		COMPANY B				
		B_1	**B_2**	**B_3**	**B_4**	**B_5**
COMPANY A	**A_1**	2	5	10	7	2
	A_2	3	3	6	6	4
	A_3	4	4	8	12	1

Player B

Player A		B_1	B_2	B_3	**B_4**
	A_1	2	1	0	-2
	A_2	1	0	3	2

******