

SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY:: PUTTUR (AUTONOMOUS) Siddharth Nagar, Narayanavanam Road – 517583 OUESTION BANK (DESCRIPTIVE)

Subject with Code: Operations Research(20MB9013)

Regulation: R20

Year & Sem: I-MBA & II-Sem

PART-A

UNIT –I

Introduction to operations Research

1	a)Define Operations Research.	[L1][CO1]	[5M]
	b)Discus the scope of Operations Research	[L2][CO1]	[5M]
2	Explain the terminologies of linear programming model	[L2][CO1]	[10M]
3	Define the following	[L1][CO1]	[10M]
	(i) Basic variable (ii) Artificial variable (iii) Slack variable (iv) Feasible solution		
	(v) Optimal solution		
4	A company manufactures two products P_1 and P_2 . Each product uses lathe and milling	[L6][CO1]	[10M]
	machine. The processing time per unit of P_1 on the lathe is 5 hours and on the milling		
	machine is 4 hours. The processing time per unit of P_2 on the lathe is 10 hours and on		
	the milling machine is 4 hours. The maximum number of hours available per week on		
	the lathe and the milling machine are 60 hours and 40 hours respectively. Also the		
	profit per unit of selling P_1 and P_2 are Rs.6.00 and Rs. 8.00 respectively. Formulate a		
	linear programming model to determine the production volume of each of the products		
	such that the total profit is maximized.		
5	Solve the following Liner Programming Problem (LPP) by using Graphical Method.	[L3][CO1]	[10M]
	$Minimize \ Z = 2X_1 + 3X_2$		
	Subject to constraints $X_1 + X_2 \ge 6, \ 7X_1 + X_2 \ge 14, X_1 \text{ and } X_2 \ge 0$		
6	Solve the following Liner Programming Problem (LPP) by using Graphical Method.	[L3][CO1]	[10M]
	$Maximize \ Z = 100X_1 + 80X_2$		
	Subject to constraints $5X_1 + 10X_2 \le 50$, $8X_1 + 2X_2 \ge 16$, $3X_1 - 2X_2 \ge 6$		
	$X_1 and X_2 \ge 0$		
-			[10] [1]
7	Explain the steps involving in solving Simplex Method	[L2][CO1]	[10M]
8	Solve the following LP problem using Simplex method	[L3][C01]	[10M]
	Maximize $Z = 6X_1 + 8X_2$		_
	Subject to constraints $5X_1 + 10X_2 \le 60$, $4X_1 + 4X_2 \le 40$, X_1 and $X_2 \ge 0$		
9	Solve the following LP problem using Simplex method	[L3][CO1]	[10M]
-	$Maximize \ Z = X_1 + X_2 + 3X_3$		
	Subject to constraints $3X_1 + 2X_2 + X_3 \le 3$, $2X_1 + X_2 + 2X_3 \le 2$, X_1 and $X_2 \ge 0$		
10	What are the major applications of Operations Research in business, commerce and	[L1][CO1]	[10M]
	industry		
10	What are the major applications of Operations Research in business, commerce and industry	[L1][CO1]	[10]



UNIT –II Transportation and Assignment Models

1	What are the types of Transportat	[L1][CO2]	[10M]					
2	a) Explain the steps involve in No						[L1][CO2]	[10M]
_	feasible solution for a transportat				meth	sa to find the initial basic		
3	Explain the steps involve in Leas	[L2][CO2]	[10M]					
	solution for a transportation prob	[[]][[]][]]	[_01,_]					
4	What are the steps involve in Vog		pprox	imation	meth	od to find the initial basic	[L1][CO2]	[10M]
	feasible solution for a transportat							
5	Determine an initial basic feasible				lowing	g transportation problem	[L3][CO2]	[10M]
	using Northwest corner cell meth	od						
		1	Destina	tion				
		1	2	3	4	Supply		
	1	3	1	7	4	300		
	Source 2	2	6	5	9	400		
	3	8	3	3	2	500		
						500		
	Demand 25	50 1	350	400	200			
6	Find an initial basic feasible solut	tion to	the fo	ollowing	g trans	portation problem using	[L3][CO2]	[10M]
	Least cost cell method							
			То					
		1	2	3	Sup	ply		
	1	2	7	4	5			
	From 2	3	3	1	8			
	3	5	4	. 7	7			
	5	5						
	4	1	6	2	14			
	Demand	2	9	18				
7	Determine an initial basic feasible		tion to	the fol	lowing	g transportation problem	[L3][CO2]	[10M]
	using Vogel's approximation met	thod						
		v	Vareho	uses				
					XX 7.4	Canacity		
	_ [W1	W2	W3	W4			
	F1	10	30	50	10	7		
	Factory F2	70	30	40	60	9		
		, ,	50		00			
	F3	40	8	70	20	18		
	Requirement							
	Kequitement							
8	Discuss the steps involve in U-V	[L2][CO2]	[10M]					
	basic feasible solution for a trans							
	cusie reasiere solution for a trans							
9	Discuss the steps of Hungarian m	nethod	to sol	ve the a	assign	ment problem	[L2][CO2]	[10M]
	÷	· •	-					

10	Solve the following assignm are processing times in hour	-	blem us	sing Hu	ngarian	method.	The matrix entries	[L3][CO2]	[10M]
			Ope	rator					
		1	2	3	4	5			
	1	10	12	15	12	8			
	Job 2	7	16	14	14	11			
	3	13	14	7	9	9			
	4	12	10	11	13	10			
	5	8	13	15	11	15]		

UNIT –III GAME THEORY

$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$		GAME THEORY	1	
point (Vi) Value of the game(Vii) Two-person zero-sum game (viii) Dominance propertyIL2][CO3][1000]2Discuss the steps involving in game with pure strategiesIL3][CO3][1000]3Find the optimum strategies of the players in the following gameIL3][CO3][1000]4Find the optimum strategies of the players in the following gameIL3][CO3][1000]4Find the optimum strategies of the players in the following gameIL3][CO3][1000]4Find the optimum strategies of the players in the following gameIL3][CO3][1000]4Find the optimum strategies of the players in the following gameIL3][CO3][1000]6S50403557Discuss the steps involving in game with mixed strategiesIL2][CO3][1000]6Consider the following payoff matrix with respect to player A and solve it optimallyIL2][CO3][1000]9Player A 128469244692446Players A and B play a game in which each player has three coins (20p,25p and 50p). Each of them selects a coin without the knowledge of the other person. If the sum of the values of the values of the coins in an even number, A wins B's coin. If that sum is an odd number, B wins A's coin. a) Develop a payoff matrix with respect to player AIf the sum of the values of the other payoff matrix with respect to player A	1	Define the following terminologies of game theory	[L1][CO3][[10M]
2Discuss the steps involving in game with pure strategies[L2][CO3][10]3Find the optimum strategies of the players in the following game[L3][CO3][10]4 $\begin{bmatrix} 1 & 2 & 3 \\ 3 & 20 & 40 \\ A & 2 \\ 3 & 60 & 30 & 40 \end{bmatrix}$ [L3][CO3][10]4Find the optimum strategies of the players in the following game[L3][CO3][10]4Find the optimum strategies of the players in the following game[L3][CO3][10]5550 & 60 $\frac{60}{60} = 30 - 40$ 3[10]5550 & 60 $\frac{10}{65} = 50 - 40$ 3[10]6Discuss the steps involving in game with mixed strategies[L2][CO3][10]6Consider the following payoff matrix with respect to player A and solve it optimally[L2][CO3][10]9Player A $\frac{1}{2}$ $\frac{2}{6}$ $\frac{9}{2}$ $\frac{1}{2}$ $\frac{2}{6}$ $\frac{9}{2}$ [L6][CO3][10]6Players A and B play a game in which each player has three coins (20p.25p and 50p). Each of them selects a coin without the knowledge of the other person. If the sum of the values of the values of the coins in an even number, A wins B's coin. If that sum is an odd number, B wins A's coin. a) Develop a payoff matrix with respect to player A[L6][CO3][10]		(i) Players (ii) Strategy(iii) Maximin principle (iv) Minimax principle(V) Saddle		
2Discuss the steps involving in game with pure strategies[L2][CO3][10N3Find the optimum strategies of the players in the following game[L3][CO3][10N4Find the optimum strategies of the players in the following game[L3][CO3][10N4Find the optimum strategies of the players in the following game[L3][CO3][10N4Find the optimum strategies of the players in the following game[L3][CO3][10N6Find the optimum strategies of the players in the following game[L3][CO3][10N6S5040355257A26550403552530[L2][CO3][10N6Consider the following payoff matrix with respect to player A and solve it optimally[L2][CO3][10N9Player A $\frac{1}{2}$ $\frac{2}{9}$ $\frac{1}{8}$ $\frac{2}{4}$ 6Players A and B play a game in which each player has three coins (20p,25p and 50p).[L6][CO3][10NEach of the m selects a coin without the knowledge of the other person. If the sum of the values of the coins in an even number, A wins B's coin. If that sum is an odd number, B wins A's coin.a) Develop a payoff matrix with respect to player A		point (Vi) Value of the game(Vii) Two-person zero-sum game (viii) Dominance		
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$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	4	Find the optimum strategies of the players in the following game	[L3][CO3]	[10M]
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5 Discuss the steps involving in game with mixed strategies [L2][CO3] [10] 6 Consider the following payoff matrix with respect to player A and solve it optimally [L2][CO3] [10] 9 Player B 1 2 1 2 9 Player A 6 9 9 2 8 4 9 1 2 8 4 1		A 2 65 50 40		
5 Discuss the steps involving in game with mixed strategies [L2][CO3] [10M] 6 Consider the following payoff matrix with respect to player A and solve it optimally [L2][CO3] [10M] 9 Player B 1 2 1 2 9 Player A 6 9 9 2 8 4 9 1 2 8 4 1		3 55 25 30		
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 6 Consider the following payoff matrix with respect to player A and solve it optimally Player B Player A 6 9 2 8 4 6 9 2 8 4 6 6 Players A and B play a game in which each player has three coins (20p,25p and 50p). Each of them selects a coin without the knowledge of the other person. If the sum of the values of the values of the coins in an even number, A wins B's coin. If that sum is an odd number, B wins A's coin. a) Develop a payoff matrix with respect to player A 	5	Discuss the steps involving in game with mixed strategies	[L2][CO3]	[10M]
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Image: 1 intermediate in the second secon				
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 Players A and B play a game in which each player has three coins (20p,25p and 50p). Each of them selects a coin without the knowledge of the other person. If the sum of the values of the values of the coins in an even number, A wins B's coin. If that sum is an odd number, B wins A's coin. a) Develop a payoff matrix with respect to player A 				
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an odd number, B wins A's coin. a) Develop a payoff matrix with respect to player A				
a) Develop a payoff matrix with respect to player A				
7Discuss the algorithm for for $2 \times n$ game in Graphical Method[L2][CO3][10]	7	Discuss the algorithm for for $2 \times n$ game in Graphical Method	[L2][CO3]	[10M]
	8			[10M]

9	Consider the following pay	[L2][CO3]	[10M]					
		1	2	3	4	5		
	Player A 1	3	0	6	-1	7		
	2	-1	5	-2	2	1		
10	Consider the following pay	[L3][CO3]	[10M]					
			D1	D				
			Play					
				2				
		Player	1 1	3				
			3 5	-1				
			4 6	-6				

UNIT –IV PROJECT MANAGEMENT

1	Define Project. What are the steps involved in CPM?													[L1][CO4]	[10M]		
2	v				•				•							[L1][CO4] [L3][CO4]	[10M]
	Find the Critica		-2	the fol	1-3	<u> </u>	blem	2-4	1		3-4			15			
	Activity Duration	6			1-5 2)		<u></u> 4	ł		<u>3-4</u>			<u>4-5</u> 4			
											3			4			
3	Find the Critic				tion of		projec								- -	[L3][CO4]	[10M]
	Activity Duration	1-2 6		1-3 2		<u>1-4</u>		$\frac{2-5}{3}$)	3-:	5	4-6)		5-6 6		
	Duration	0		Ζ		4		3		4		3			0		
4	What is a pro	oject?	P Exp	lain r	ules fo	or dra	awing	g a n	etwo	ſk						[L1][CO4]	[10M]
5	Draw the net	work	and	identi	ify the	e criti	ical p	ath	for the	e foll	owing	g activ	vitie	S		[L6][CO4]	[10M]
	Activity																
		1-2	1-3	2-3	- 5	3-4	3- 6	5	4-6	5-6	6-7						
					2-			4									
		15	15	3	5	8	12	1	14	3	14						
	Duration (Duration																
	(Days)																
6	Draw the net				ify the		ical p							1		[L6][CO4]	[10M]
	Activity	1-2	2	1-3		2-3		2-4		3-0	6	4-5	5		5-6		
-	Duration	7	• 1	7	1 .	8		6	1	9	. 1	3	C	.1	5		[10] []
7	Draw the net			ntify t	he cri	tical	path	and	total	proje	ect du	ration	for	the		[L6][CO4]	[10M]
	following act	tivitie	es										_				
	Activity			4	4		6					0	0				
		1-2	1-3	5-	3-	3-5	4	5-6	5-7	6-8	7-8	8-10	9-10				
	Time	4	1	1	1	6	5	4	8	1	2	5 7					
	(days)	-	1	1	1	0	5	4	0	1	2	5 1					
				<u> </u>													54.03.63
8	Write short n	otes	on a)	Proje	ect Cr	ashir	ig b) PE	RT							[L2][CO4]	[10M]
9	Determine th						on an	d co	st for	the f	ollow	ing da	ata i	f the		[L3][CO4]	[10M]
	indirect cost	per w	veek i	is 1	<u>Rs.16</u>	0											
	Activ	itv	Ν	lorma	1 1	Norn	nal	C	rosh	0	Crash	Cost					
	Activ	ny		time		Cos	st	Т	ìme		(Rs	5)					
				veeks	-	(Rs)		eeks)								
	1-2		13	8	70			9				00					
	1-3		5		4(4				-60					
	1-4		7		60			4				10					
	2-5		12	2	80			11		-		65					
	3-2		6		90			4				130	_				
	<u>3-4</u> 4-5		<u>5</u> 9			000		3				180					
10	4-5 Write short n	otos :			1.	500		6			1	800					[10]
10	write short h			tens ir		т										[L1][CO4]	
	a) Steps in PERTb) Cost slope																
						hing											
L	c) Project crashing										I						

UNIT –V

REPLACEMENT AND SEQUENCING MODELS

1	1 The cost of the machine is Rs 61000/- and its scrap value is Rs 1000 at the end of everyyear, The Maintenance cost found from experience are as follows:											[L1][CO5]	[10M]
	everyyea	r, The Mair	tenance	e cost f	ound fr	omex	perier	nce are	as follov	ws:			
		Year	1	2	3	4	5	6	7	8			
		Maintena	1	2	3	4	5	0	/	0			
		nce cost	0	0	0	0	0	8	00	00			
		in rupees	1000	2500	4000	6000	0006	12000	16000	20000			
	When should the machine be replaced?2 Define replacement models? Explain the replacement model types in detail												
2	-			-				• •				[L1][C05]	[10M]
		e steps invo							achines	A, B, C		[L2][CO5]	
4 5		b sequencii										[L1][CO5] [L1][CO5]	[10M] [10M]
		he steps in		-			÷		-				
6		5 jobs, eac					the tw	vo mach	nines A	and B i	n the	[L3][CO5]	[10M]
	order AB	. Processing	g time a	$\frac{re\ give}{2}$	n below	v. 3		4	5				
	Machine	-A 5		1		9		3	10				
	Machine			6		<u> </u>		8	4				
	Determin	e the seque	nce of 5	•	nat will	miniı	nizes	the tota	al elapse	ed time			
7	Find the s	sequence th	at minir	nizes tl	he total	elans	ed tim	e (in ho	ours)rea	uired to)	[L3][CO5]	[10M]
		the follow				-		(,			[10][000]	[101/1]
	Job	А	B	С	D	E	F	G	Н	Ι			
	Machine		5 8	4	9 4	6	8	7	5	4			
8	Machine There are	$\begin{array}{c c} -2 & 6 \\ \hline \text{five jobs (n)} \end{array}$	•		-	3		3	-	11 gh mael	hines A	II 21[CO5]	[10]/1
0		n the order									lines A,	[L2][CO5]	
	Jobs/Ma			2	0	3	,	4		5			
	Machine			7		6		9		5			
	Machine			1		4		5		3			
	Machine Find th	e-C 3 ne sequence	of that w	/ vill mini	mize th	5 e total	elanse	6 d time		/			
9		vner finds fi										[L1][CO5]	[10M]
	Rs 6000/-	and the run	$\frac{1}{2}$	st are g	$\frac{1}{4}$	1	t what 5	t age the	e replace	ement is	due;-		
	-	year 1 Mainte		5	4	•	5	0	/	0	-		
		nance	1200	1400	1800		2300	2800	3400	4000			
		COSt		1	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	Ĩ	5	5	3	4			
	Resale 0 0 2 2 0 <td></td> <td></td>												
		value	3(75	6	, ,	200	2(200	2(
10												[L4][CO5]	[10M]
		should manu							_				
	B) What is the importance of time value of money in replacement?												

PART-B

CASE STUDY-1

Solve the following Liner Programming Problem (LPP) by using Graphical Method.

 $Minimize \ Z = 2X_1 + 3X_2$

Subject to constraints $X_1 + X_2 \ge 6$, $7X_1 + X_2 \ge 14$, X_1 and $X_2 \ge 0$

CASE STUDY-2

Players A and B play a game in which each player has three coins (20p, 25p and 50p). Each of them selects a coin without the knowledge of the other person. If the sum of the values of the values of the coins in an even number, A wins B's coin. If that sum is an odd number, B wins A's coin.

a) Develop a payoff matrix with respect to player A

b) Find the optimal strategies for the players.

CASE STUDY-3

Determine the optimum project duration and cost for the following data if the indirect cost per week is Rs.160

Activity	Normal	Normal	Crash	Crash Cost
Activity	time	Cost	Time	(Rs)
	(weeks)	(Rs)	(weeks)	
1-2	13	700	9	900
1-3	5	400	4	460
1-4	7	600	4	810
2-5	12	800	11	865
3-2	6	900	4	1130
3-4	5	1000	3	1180
4-5	9	1500	6	1800

CASE STUDY-4

There are five jobs (namely 1,2,3,4 and 5), each of which must go through machines A, B and C in the order ABC. Processing Time (in hours) are given below:

Jobs/Machine	1	2	3	4	5
Machine-A	5	7	6	9	5
Machine-B	2	1	4	5	3
Machine-C	3	7	5	6	7

Find the sequence of that will minimize the total elapsed time.