A		Reg. No. :							
		Question Pa	per Code: 96	5703					
	В	.E. / B.Tech. DEGREE EZ	XAMINATION,	NOV	2022				
		Sixth S	emester						
		Mechanical	Engineering						
		19UME603 - OPERA	TIONS RESEA	RCH					
		(Regulati	ons 2019)						
Dur	ation: Three hou	irs		Max	kimum	: 100) Ma	rks	
1.	Any feasible s objective funct	Answer AL PART A - (10 s solution which optimizes ion of the LPP is called its	L Questions x 1 = 10 Marks) (minimizes or	maxin	nizes)	the		CO	91- U
	(a) Optimal sol	ution	(b) Non basic	varia	ble				
	(c) Solution		(d) Basic feas	sible s	olutior	1			
2.	If a constraint v	with <= type, then	_variable should	d be ac	lded			CO	91- U
	(a) Slack	(b) Surplus	(c) Artificial		(d) D)ecis	ion		
3.	For solving an	assignment problem, whic	h method is used	1				CO	91- U
	(a) MODI	(b) Hungarian	(c) German		(d) An	neric	an	
4.	MODI method	also called as	_					CO	91- U
	(a) North West	Corner rule	(b) Least Co	ast me	ethod				
	(c) U-V method	ł	(d) Stepping	Stone	metho	od			
5.	In which mod distance?	lel, all the nodes must	be connected	with	minim	ium		CO	1- U
	(a) Shortest pat	h	(b) Maximal	flow					
	(c) Minimal spa	anning tree	(d) Critical pa	ath					
6.	Which method	is a probabilistic approach	n?					CO	91- U
	(a) CPM	(b) PERT	(c) PRIM'S		(d) DI	JKS	ΓRA	'S
7.	The inventory i	may be categorized as						CO	91- U
	(a) Raw materia	als inventory	(b) In-process inventory						
	(c) Finished go	ods inventory	(d) All the ab	ove					

8.	The inventory needs to be maintained to decrease the	CO1- U
	(a) Shortage costs (b) Setup costs (c) Loss of goodwill (d) All the abo	ove
9.	If a rectangular game has no saddle point, then the strategies of players are	CO1- U
	(a) Pure strategies (b) Mixed strategies	
	(c) Unique strategies (d) Specific strategies	
10.	One of the methods for simplifying m x n game with mixed strategy is	CO1- U
	(a) Dominance (b) Graphical (c) Saddle (d) Minima	ax
	PART - B (5 x 2= 10 Marks)	
11.	Explain the term operation research.	CO1- U
12.	Explain unbalanced transportation problem. How do you balance it?	CO1- U
13.	Explain network with an example.	CO1- U
14.	Explain individual replacement and group replacement with an example.	CO1- U
15.	Explain why we use graphical method.	CO1- U
	PART – C (5 x 16= 80 Marks)	
16.	(a) Solve the following LPP using graphical method CO2- Ap Maximize $Z = 2X_1 + 5X_2$ subject to $1X_1 + 4X_2 \le 24$ $3X_1 + 1X_2 \le 21$ $1X_1 + 1X_2 \le 9$ $X_1, X_2 \ge 0$ Or	ıp (16)
	(b) Use Simplex method to solve the following LP problem to Maximize $Z = 3X_1 + 2X_2 + 5X_3$ Subject to $1X_1 + 4X_2 \le 420$ $3X_1 + 2X_3 \le 460$ $1X_1 + 2X_2 + X_3 \le 430$	p (16)

$$X_1, X_2, X_3 \ge 0$$

17. (a) Solve the following TP problem using Least Cost method for CO2- App (16) initial feasible solution and MODI method for optimal solution.

		Supply			
	5	2	4	3	22
From	4	8	1	6	15
	4	6	7	5	8
Demand	7	12	17	9	-

Or

(b) Solve the following assignment problem.

CO ₂ - App (1	6)
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		Machines						
		Ι	II	III	IV	V		
	1	11	17	8	16	20		
Ioba	2	9	7	12	6	15		
JODS	3	13	16	15	12	16		
	4	21	24	17	28	26		
	5	14	10	12	11	15		

18. (a) Consider the details of a distance network as shown below.

CO2- App (16)

- (i) Construct a project network
- (ii) Determine the maximal flow from node 1 to 5

Arc (i i)	Flow				
Alt $(1-j)$	f_{ij}	\mathbf{f}_{ji}			
0-1	11				
0-2	12				
1-3	12				
2-1	1				
2-4	11				
3-4	7				
3-5	19				
4-5	4				
	Or				

(b) Find the critical path and calculate the earliest start, earliest CO2- App (16) finish, latest start, latest finish, total float, free float and independent float.



- 19. (a) A factory needs 36000 units annually of a component that cost CO3- App (16) Rs.2 per unit. Cost of each order placing is Rs. 25 and inventory carrying cost is Rs. 10 per year. Find
 (i) Economic order quantity
 - (ii) Number of orders per year
 - (iii) Time between the orders
 - (iv) Optimal total inventory cost

Or

(b) The cost of a bike is Rs. 3000. The salvage value (resale CO4- App (16) value) and the running cost are given as under. Find the most economical replacement age of the bike.

Year	1	2	3	4	5	6	7
Running Cost	600	700	800	900	1000	1200	1500
Resale Value	2000	1333	1000	750	500	300	300

- 20. (a) Consider a box office ticket window being manned by a single CO3- App (16) server. Customer arrives to purchase ticket according to Poisson input process with a mean rate of 30/hr. the time required to serve a customer has an ED with a mean of 90 seconds determine:
 - (a) Mean queue length.
 - (b) Mean waiting time in the system.
 - (c) The probability of the customer waiting in the queue for more than 10min.
 - (d) The fraction of the time for which the server is busy.

(b) Solve the following game.

Player B
I II III
Player II
$$6 2 7$$

A III $6 1 6$

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CO3- App (16)