U.S.N.										

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

Autonomous Institute Affiliated to VTU

August 2024 Supplementary Examinations

Programme: B.E. **Semester: V**
Branch: Chemical Engineering **Duration: 3 hrs.**
Course Code: 19CH5DELB1 **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

1 a) A manufacturer produces two types of models M1 and M2. Each model of the type M1 requires 4 hours of grinding and 2 hours of polishing; whereas each model of the type M2 requires 2 hours of grinding and 5 hours of polishing. The manufacturers have 2 grinders and 3 polishers. Each grinder works 40 hours a week and each polisher work for 60 hours a week. The profit on M1 model is Rs.3.00 and on model M2 is Rs.4.00. Whatever is produced in a week is sold in the market. How should the manufacturer allocate his production capacity to the two types of models, so that he may make the maximum profit in a week? **08**

b) Solve the following LPP by graphical method. **12**

Max (Z) = $- x_1 + 2 x_2$

Constraints:

$$-x_1 + 3x_2 \leq 10;$$
$$x_1 + x_2 \leq 6;$$
$$x_1 - x_2 \leq 2;$$
$$x_1, x_2 \geq 0$$

UNIT - II

2 a) A car company has one car at each of five depots A B C D and E. A customer requires a car in each town T1, T2, T3, T4 and T5. Distance in kms between the depots (origin) and town (destinations) are given in the following matrix. **10**

	A	B	C	D	E
T1	160	130	175	190	200
T2	135	120	130	160	175
T3	140	110	155	170	185
T4	50	50	80	80	110
T5	55	35	70	80	105

How should cars be assigned to customers so as to minimize the distance travelled?

b) Solve the following travelling salesman problem and find the least cost route. Values are in kilometers. **10**

From City	A	B	C	D	E
A	∞	4	10	14	2
B	12	∞	6	10	4
C	16	14	∞	8	14
D	24	8	12	∞	10
E	2	6	4	16	∞

UNIT - III

3 a) Solve by North West Corner rule and obtain the transportation cost. Also find whether the solution is degenerative or non-degenerative. **10**

	Destination				
Origin	**D1**	**D2**	**D3**	**D4**	**Supply**
O1	11	13	17	14	250
O2	16	18	14	10	300
O3	21	24	13	10	400
Demand	200	225	275	250	

b) Solve the following transportation problem using the Vogel's approximation method and obtain a feasible solution. **10**

	Destination			
Origin	**P**	**Q**	**R**	**Supply**
A	5	7	8	70
B	4	4	6	30
C	6	7	7	50
Demand	65	42	43	150

OR

4 a) Determine the initial basic feasible solution for the following transportation problem using MODI method. **12**

Destination					
Sources		**1**	**2**	**3**	**Supply**
	1	2	2	3	10
	2	4	1	2	15
	3	1	3	1	40
	Demand	20	15	30	65

b) Determine the initial basic feasible solution for the following transportation problem using Vogel's approximate method. **08**

Company	**Retail**				**Supply**
	D1	**D2**	**D3**	**D4**	
O1	6	1	9	3	70
O2	11	5	2	8	55
O3	10	12	4	7	70
Demand	85	35	50	45	

UNIT - IV

5 a) Find an optimal sequence for the following sequencing problem of four jobs and five machines when passing is not allowed, of which processing time (in hours) is given below. Also find the total elapsed time. **10**

Job	**Machine**				
	A	**B**	**C**	**D**	**E**
O1	7	5	2	3	9
O2	6	6	4	5	10
O3	5	4	5	6	8
O4	8	3	3	2	6

b) Determine the optimal sequence of jobs that minimizes the total elapsed time based on the following information processing time on machines is given in hours and passing is not allowed. Each job has to be processed in the order $M_3M_1M_2$. **10**

Job	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**I**
Machine M1	4	6	7	4	5	3	6	2
Machine M2	8	10	7	8	11	8	9	13
Machine M3	5	6	2	3	4	9	15	11

UNIT - V

6 a) An assembly is to be made from two parts X and Y. Both parts must be turned on a lathe Y must be polished whereas X need not to be polished. The sequence of activities and their predecessors, is given below. **08**

Activity	Description	Predecessor activity
A	Open work order	-
B	Get material for X	A
C	Get material for Y	A
D	Turn X on lathe	B
E	Turn Y on lathe	B, C
F	Polish Y	E
G	Assemble X and Y	D, F
H	Pack	G

Draw a network diagram of activities for the project.

b) Explain the terms total float, tree float and independent float. **06**

c) Construct a network of the project having activities and precedence relationship as given below: **06**

A, B, and C can start simultaneously, A<D, I; B<G, F; D<G, F; C<E; E<H, K; F<H, K; G, H<J.

OR

7 a) Define the following terms used in network analysis. **06**

(a) Dangling error (b) Looping error (c) Reductancy error

b) Draw the network diagram for the following project and find the critical path and maximum time for completion of the project. **14**

Activity	A	B	C	D	E	F	G	H	I	J	K	L
Preceded by	-	A	A	B	B	C	C	F	D	G, H	E	I
Duration (weeks)	10	9	7	6	12	6	8	8	4	11	5	7

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