IV Semester B.C.A. Examination, September/October 2022
(CBCS) (F + R)
MATHEMATICS
Paper – IV : Operation Research

Time : 3 Hours

Max. Marks : 100

Instruction : *Answer **all** the Sections.*

SECTION – A

I. Answer **any ten** of the following. (10×2=20)

1) Define Operation Research.
2) Define slack and surplus variable.
3) Define artificial variables with examples.
4) Define basic feasible solution and optimum solution in transportation problem.
5) What are the different methods in solving assignment problems ?
6) How to calculate critical path ?
7) Define expected time in PERT. Write its mathematical formula.
8) Explain Fulkerson's rule of numbering events.
9) Write the steps for backward pass computation.
10) Define independent float and free float of an activity.
11) Define :
   i) Total elapsed time
   ii) Idle time.
12) What is pay-off matrix ? Give an example.

SECTION – B

II. Answer **any four** of the following. (4×10=40)

13) a) Explain the phases of operation research. 4
   b) A production manager wants to determine the quantity to be produced per month of Products A and B manufactured by his firm. The data on resources required and availability of resources are given below :

Resources	Requirements		Available per month
	Product A	Product B	
Raw material (kg)	60	120	12000
Machine hours (pieces)	8	5	600
Assembly man (Hour)	3	4	500
Scale price/piece	Rs. 30	Rs. 40	

Formulate the above problem as a standard linear programming problem. 6

P.T.O.

14) a) Explain the general LPP in standard form. 4

b) Solve the following LPP by graphical method : 6

Maximize z = 2x + 3y

Subjected to the constraints

x + 2y ≤ 10

x + y ≤ 6

x ≤ 4

x, y ≥ 0

15) a) Use Vogel's approximation method to obtain an initial basic feasible 6
solution of the given transportation problem :

	D	E	F	G	Available
A	11	13	17	14	250
B	16	18	14	10	300
C	21	24	13	10	400
Demand	200	225	275	250	

b) Determine an initial basic feasible solution to the following transportation
problem using North-West corner rule : 4

		Destination					Supply
		1	2	3	4	5	
Source	A	2	11	10	3	7	4
	B	1	4	7	2	1	8
	C	3	9	4	8	12	9
Demand		3	3	4	5	6	

16) a) Explain Hungarian method for solving assignment problem. 5

b) The assignment cost of assigning any one operator to any one machine 5
is given in the following table :

		Operator			
		I	II	III	IV
Machine	A	10	5	13	15
	B	3	9	18	3
	C	10	7	3	2
	D	5	11	9	7

Find the optimal assignment schedule.

17) A small project consists of seven activities for which the relevant data are given below :

Activity	Preceding Activities	Activity Duration
A	–	4
B	–	7
C	–	6
D	A, B	5
E	A, B	7
F	C, D, E	6
G	C, D, E	5

    i) Draw the network and find the project completion time.   **5**

    ii) Calculate the total float for each of the activities.   **5**

18) Write short notes on :
    a) Strategies used in game theory.   **5**
    b) Maximin-Minimax principle.   **5**

SECTION – C

III. Answer **any four** of the following.   **(4×10=40)**

19) a) Compare between assignment problem and transportation problem.   **4**

    b) Solve the following linear programming problem by simplex method :

    Maximize $z = 5x + 3y$

    Subject to the constraints

    $x + y \leq 2$

    $5x + 2y \leq 10$

    $3x + 8y \leq 12$

    $x, y \geq 0$ **6**

20) a) Solve the following transportation problem by MODI Method :   **6**

	1	2	3	4	Supply
I	21	16	25	13	11
II	17	18	14	23	13
III	32	27	18	41	19
Demand	6	10	12	15	

    b) Write the steps to find initial basic feasible solution by matrix minima method.   **4**

21) a) Explain the North-West corner method of solving transportation problem. **4**

b) Solve by matrix minima method and North-West corner method to obtain an initial basic feasible solution for the transportation problem : **6**

From	To				Supply
	1	2	1	4	30
	3	3	2	1	50
	4	2	5	9	20
Demand	20	40	30	10	

22) a) Mention the types of assignment problem. Describe the methods of an assignment problem. **5**

b) Solve the assignment problem given below : **5**

	A	B	C	D
I	1	4	6	3
II	9	7	10	9
III	4	5	11	7
IV	8	7	8	5

23) Solve the following game, use dominance method to reduce the matrix. Write the strategies adopted by each player and value of game. **10**

		Y_1	Y_2	Y_3	Y_4	Y_5
		B_1	B_2	B_3	B_4	B_5
X_1	A_1	4	4	2	−4	−6
X_2	A_2	8	6	8	−4	0
X_3	A_3	10	2	4	10	12

24) a) Differentiate between PERT and CPM. **4**

b) Calculate the earliest start, earliest finish, least start, least finish of each activity of the project given below : **6**

Activity	1 − 2	1 − 3	2 − 4	2 − 5	3 − 4	4 − 5
Duration (in days)	8	4	10	2	5	3