CBCS SCHEME

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18IP62

Sixth Semester B.E. Degree Examination, July/August 2022
Operations Research

Time: 3 hrs. Max. Marks: 100

Note: ***1. Answer any FIVE full questions, choosing ONE full question from each module.***
2. Missing data, if any, may be suitably assumed.

Module-1

1 a. What is a model? What are the characteristics of a good model? **(05 Marks)**

b. List the various phases of OR implementation and explain any one phase briefly. **(05 Marks)**

c. A company owns two steel industries 'P' and 'Q', which have different production capacities for high, medium and low corbon steels. The company has a contract to supply steels to a firm every week with at least 120, 80 and 240 tonnes of high, medium and low corbon steel respectively. It costs company Rs. 24,000 and Rs.20,000 per day to run the industries 'P' and 'Q' respectively. During a day, industry 'P' produces 60, 20 and 40 tonnes of high, medium and low corbon steels respectively while the corresponding values of industry 'Q' are 20, 20, and 120 tonnes. How many days per week each industry be operated in order to meet the output most economically? Formulate this as a LPP and solve it graphically. **(10 Marks)**

OR

2 a. Express a LPP in the canonical form. What are its characteristics? **(05 Marks)**

b. Write the dual of the following primal LPP :

Maximize $Z = x_1 + 2x_2 + x_3$

Subject to $2x_1 + x_2 - x_3 \le 2$

$-2x_1 + x_2 - 5x_3 \ge -6$

$4x_1 + x_2 + x_3 \le 6$

$x_1, x_2, x_3 \ge 0.$ **(05 Marks)**

c. Solve the following LPP using Simplex method :

Maximize $Z = 3x_1 + 2x_2$

Subject to $4x_1 + 3x_2 \le 12$

$4x_1 + x_2 \le 8$

$4x_1 - x_2 \le 8$

$x_1, x_2 \ge 0.$ **(10 Marks)**

Module-2

3 a. Obtain an optimum transportation schedule and cost for the following transportation problem cell entries represent the unit transportation cost from source to destination.

		Destination				
		D_1	D_2	D_3	D_4	Supply
Source	S_1	6	1	9	3	70
	S_2	11	5	2	8	55
	S_3	10	12	4	7	70
Demand		85	35	50	45	

(10 Marks)

b. Solve the following travelling salesman problem :

$C_{12} = 7$; $C_{13} = 6$; $C_{14} = 8$; $C_{15} = 4$; $C_{23} = 8$;
$C_{24} = 5$; $C_{25} = 6$; $C_{34} = 9$; $C_{35} = 7$; $C_{45} = 8$;
$C_{ij} = C_{ji}$; $C_{ij} = \infty$ when i = j. **(10 Marks)**

OR

4 a. Assign the 5 jobs to 5 machines, given the following profit matrix :

		Machines				
		M_1	M_2	M_3	M_4	M_5
Jobs	J_1	32	38	40	28	40
	J_2	40	24	28	21	36
	J_3	41	27	33	30	37
	J_4	22	38	41	36	36
	J_5	29	33	40	35	39

(10 Marks)

b. A military equipment is to be transported from three origins to four destinations. The demand, supply, and time of shipment is given below. Obtain a transportation schedule to minimize the shipment time.

		Destination				
		1	2	3	4	Supply
Origin	1	10	0	20	11	15
	2	1	7	9	20	25
	3	12	14	16	18	05
Demand		12	8	15	10	

(10 Marks)

Module-3

5 a. Given the following details pertaining to a project :

i) Construct the networks

ii) Determine the critical path and its duration

iii)Compute the different types of (three types) floats for each activity.

Job →	1 – 2	1 – 3	1 – 4	2 – 3	2 – 6	3 – 5	4 – 5	4 – 6	5 – 6
Time (days) →	8	10	8	10	16	17	18	14	9

(12 Marks)

b. With neat sketches explain the following errors in project networks :

i) Looping ii) Dangling. **(05 Marks)**

c. Distinguish between direct and indirect costs in a project. **(03 Marks)**

OR

6 a. Explain the following time estimates as applied to PERT networks :

i) Optimistic time

ii) Pessimistic time

iii) Most likely time

iv) Expected time. **(06 Marks)**

b. The following data refers to a construction project.

i) Determine the normal project length and minimum project length

ii) Determine the minimum crashing cost of schedule, ranging from normal length down to and including the minimum length schedule

iii) What is optimum length?(over head cost = Rs. 60/day).

Activity (i – j)	Normal duration (days)	Crash duration (days)	Cost of crashing (Rs./day)
1 – 2	9	6	20
1 – 3	8	5	25
1– 4	15	10	30
2– 4	5	3	10
3 – 4	10	6	15
4 – 5	2	1	40

(14 Marks)

Module-4

7 a. With a neat block diagram, explain the major constituents of a queuing system. **(05 Marks)**

b. Reduce the following game using dominance rule and hence find its value. **(07 Marks)**

$$\text{Player 'A'} \begin{matrix} \\ 3 \\ 3 \\ 4 \\ 0 \end{matrix} \overset{\text{Player 'B'}}{\begin{pmatrix} 2 & 4 & 0 \\ 4 & 2 & 4 \\ 2 & 4 & 0 \\ 4 & 0 & 8 \end{pmatrix}}$$

c. Solve the following game graphically.

$$\begin{matrix} \\ A \end{matrix} \overset{B}{\begin{pmatrix} -3 & 5 & 6 & 1 & 2 & 0 \\ 1 & 3 & -1 & 4 & 2 & -5 \end{pmatrix}}$$

(08 Marks)

OR

8 a. Obtain the minimum cost service rate expression :

$$\mu = \lambda \pm \sqrt{\frac{C_w}{C_f} \cdot \lambda},$$

With usual notations. **(05 Marks)**

b. Solve the following game using method of subgames :

$$\begin{matrix} \\ A \end{matrix} \overset{B}{\begin{pmatrix} 1 & 3 & 11 \\ 8 & 5 & 2 \end{pmatrix}}$$

(07 Marks)

c. In a game of matching coins with two players, suppose 'A' wins one unit of value when there are two heads, wins nothing when there are two tails, and loses half unit of value when there are one head and one tail. Determine the pay off matrix, best strategies for each player and the value of the game to 'A'. **(08 Marks)**

Module-5

9 a. List the principal assumptions made during "sequencing" of jobs. **(05 Marks)**

b. Find the sequence that minimizes the total elapsed time required to complete the following tasks on two machines. Find the idle time on machines.

Task →	1	2	3	4	5
Machine 'A'	5	1	9	3	10
Machine 'B'	2	6	7	8	4

(07 Marks)

c. Five jobs are to be processed on three machines A, B and C in the order ABC. Determine the best sequence to minimize the total elapsed time. Compute the idle time on machines.

Job →	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

(08 Marks)

OR

10 a. Four jobs are to be machined on four machines. Given the machining times and sequencing of machines as M1 → M2 → M3 → M4, obtain the job sequence and total elapsed time, and idle time of machines :

Jobs ↓ Machines →	M_1	M_2	M_3	M_4
A	24	7	7	29
B	16	9	5	15
C	22	8	6	14
D	21	6	8	32

(10 Marks)

b. Use graphical method to minimize the total elapsed time to process two jobs on five machines as given below :

Job 1	Machine sequence →	A	B	C	D	E
	Time (Hrs) →	2	3	4	6	2
Job 2	Machine sequence →	C	A	D	E	B
	Time (Hrs) →	4	5	3	2	6

(10 Marks)

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