CBCS SCHEME

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15MA71

Seventh Semester B.E. Degree Examination, Dec.2018/Jan.2019
Operations Research

Time: 3 hrs. Max. Marks: 80

Note: *1.* **Answer any FIVE full questions, choosing ONE full question from each module.**
2. Use of normal distribution table permitted.
3. Missing data, if any, may be suitably assumed and stated.

Module-1

1 a. List and briefly explain the major phases in OR study. **(06 Marks)**

b. A manufacturer has 5 lathes and 3 milling machines in his workshop and produces an assembly that consists of 2 units of part 'A' and 3 units of part 'B'. The processing time for each part on the two types of machines is given below.

Part	Processing time in minutes on	
	Lathe	Milling machine
A	10	18
B	25	12

In order to maintain a uniform work load on the two types of machine, the manufacturer has formed a policy that no type of machine should run more than 40 minutes per day longer than the other machine. Formulate this as a linear programming problem, if the objective is to produce the maximum number of assemblies in an 8 hour working day. **(10 Marks)**

OR

2 a. What is a 'model'? List the characteristics of a good model. **(06 Marks)**

b. A publisher of a text books is in the process of presenting a new book to the market. The book may be bound either by cloth or hard paper. Each of the cloth and paper bound books earns a profit of Rs.30 and Rs.25 respectively. It takes 8 minutes to bind a cloth cover and 6 minutes to bind a paperback. The total available binding time is 800 hours. It is estimated that the cloth cover book sales will be at least 2000 copies and paperback book sales will be at the most 5000 copies. Formulate this as a linear programming problem and solve it graphically. **(10 Marks)**

Module-2

3 a. Represents a LPP in canonical form. State its characteristics. **(04 Marks)**

b. Using simplex method solve the following LPP :

Max $z = 3x_1 + 2x_2$

Subject to $x_1 + x_2 \leq 4$

$x_1 - x_2 \leq 2$

$x_1, x_2 \geq 0$. **(12 Marks)**

OR

4 a. Write the Dual of the following primal LPP.

Max $Z = x_1 + 2x_2 + x_3$

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

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

$4x_1 + x_2 + x_3 \le 6$

$x_1, x_2, x_3 \ge 0.$ **(04 Marks)**

b. Use the principle of duality to solve the following LPP :

Max $z = 6x + 8y$

Subjected to $5x + 2y \le 20$

$x + 2y \le 10$

$x, y \ge 0.$ **(12 Marks)**

Module-3

5 a. Represent a 'Transportation Problem' mathematically. **(04 Marks)**

b. Find the optimum transportation schedule for the following transportation matrix. The cell entries represent the unit transportation costs.

	D_1	D_2	D_3	D_4	Supply
S_1	8	10	7	6	50
S_2	12	9	4	7	40
S_3	9	11	10	8	30
Demand	25	32	40	23	120

(12 Marks)

OR

6 a. 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 $i = j$; C_{ij} = cost of travelling from city 'i' to city 'j'. **(08 Marks)**

b. Five jobs are to be assigned to five machines given the profit matrix of assignment below.

		Machines				
		M_1	M_2	M_3	M_4	M_5
Jobs		28	30	40	25	45
	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

(08 Marks)

Module-4

7 a. With neat sketches, explain :
i) Looping
ii) Dangling, as applied to project networks. **(04 Marks)**

b. Based on the following data, construct a project network and determine the 'critical path' and its duration. Estimate the probability of completing the project within 20 days.

Activity	t_0	t_m	t_p
1 – 2	2	2	8
2 – 3	1	1.5	11
2 – 4	0.06	1	8.5
3 – 4	0	0	0
3 – 5	1	2.5	7
3 – 6	1	2	3
4 – 5	6	7	8
4 – 6	3	4	11
5 – 6	4	6	8

(12 Marks)

OR

8 a. List and briefly explain the various elements of a queuing system. **(08 Marks)**

b. An automobile mechanic finds the time spent on the jobs has an exponential distribution with a mean of 30 minutes. He repairs the automobiles in the order in which they come in. If the arrival rate is approximately Poisson with an average of 10 per eight hour day, what is the mechanics expected idle time each day? How many jobs are ahead of the average automobile just brought in? **(08 Marks)**

Module-5

9 a. Solve the following game using "Rule of dominance".

$$\begin{array}{c} \\ A \end{array}\begin{array}{c} \begin{array}{cccc} B & & & \end{array} \\ \begin{bmatrix} 3 & 2 & 4 & 0 \\ 3 & 4 & 2 & 4 \\ 4 & 2 & 4 & 0 \\ 0 & 4 & 0 & 8 \end{bmatrix} \end{array}.$$

(08 Marks)

b. Solve the following game graphically.

$$\begin{array}{c} \\ A \end{array}\begin{array}{c} \begin{array}{cccc} B & & & \end{array} \\ \begin{bmatrix} 3 & 3 & 4 & 0 \\ 5 & 4 & 3 & 7 \end{bmatrix} \end{array}.$$

(08 Marks)

OR

10 a. A company has six jobs and all of them have to go through two machines M_1 and M_2. The time required for processing the jobs on each machine (in hours) is given below. Find the optimum sequence, total minimum elapsed time, and idle time on machines.

Job→	A	B	C	D	E	F
Machine M_1→	1	4	6	3	5	2
Machine M_2→	3	6	8	8	1	5

(06 Marks)

b. Two jobs are to be processed on four machines with processing times as given below. Ordering of machining for the two jobs are J1 : ABCD and J2 : DBAC. Determine the total elapsed time and idle time of machines. (Processing time hours).

Jobs ↓ Machines →	A	B	C	D
J1→	2	4	5	1
J2→	2	4	3	6

(10 Marks)

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