CBCS SCHEME

USN | | | | | | | | | | |

BME755C

Seventh Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026
Operation Research

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

Module – 1

			M	L	C
Q.1	a.	Define Operation Research. Explain the phases of Operation Research.	10	L1	CO1
	b.	A firm manufactures two types of products A and B and sells them at a profit of Rs.2 on type A and Rs.3 on type B. Each product is processes on the machines G and H. Type A requires one minute of processing time on G and two minutes on H, type B requires one minute on G and one minute on H. the machine G is available for not more than 6 hours 40 minutes while machic H is available for 10 hours during any working day. Formulate the given problem as linear programming problem.	10	L3	CO1

OR

			M	L	C
Q.2	a.	Solve the LPP by the simplex method, Maximize. $3x_1 + 2x_2$ Subject to, $x_1 + x_2 \le 4$ $x_1 - x_2 \le 2$ $x_1, x_2 \ge 0$	10	L3	CO1
	b.	Solve the LPP Graphically, Maximize, $z = 3x_1 + 5x_2$ Subject to, $x_1 + 2x_2 \le 2000$ $x_1 + x_2 \le 1500$ $x_2 \le 600$ and $x_1, x_2 \ge 0$	10	L3	CO1

Module – 2

			M	L	C
Q.3	a.	Obtain the mathematical formulation of transportation problem.	7	L2	CO2
	b.	Obtain the initial basic feasible solution by, (i) Vogel's approximation method. (ii) North-West corner rule method.	13	L3	CO2

Warehouse → Factories ↓	W_1	W_2	W_3	W_4	W_5	Available
1	7	6	4	5	9	40
2	8	5	6	7	8	30
3	6	8	9	6	5	20
4	5	7	7	8	6	10
Required	30	30	15	20	5	

Differentiate between Assignment problem and Transportation problem.

		OR			
Q.4	a.	A company has one surplus truck in each of the cities A, B, C, D and E and one deficit truck in each of the cities 1, 2, 3, 4, 5 and 6. The distance between the cities in kilometers is shown in the matrix below. Find the assignment of trucks from cities in surplus to cities in deficit so that the total distance covered by vehicle is minimum.	10	L3	CO2
	b.	Four new machines M_1, M_2, M_3 and M_4 are to be installed in a machine shop. There an five vacant places A, B, C, D and E available. Because of limited space, Machine M_2 cannot be placed at C and M_3 cannot be placed at A, Cij, the assignment cost of machine i to place j in rupees is shown below.	10	L3	CO2

Table for Q.4 a:

	1	2	3	4	5	6
A	12	10	15	22	18	8
B	10	18	25	15	16	12
C	11	10	3	8	5	9
D	6	14	10	13	13	12
E	8	12	11	7	13	10

Table for Q.4 b:

	A	B	C	D	E
M_1	4	6	10	5	6
M_2	7	4	-	5	4
M_3	-	6	9	6	2
M_4	9	3	7	2	3

Module – 3

Q.5	a.	Explain the basic steps involved in PERT/CPM. Explain the Fulkerson's rule for numbering the events.	10	L1	CO3
	b.	An organization has large number of activities but it is interested in controlling a part of these activities to 7 in number. The following data is available for these activities.	10	L3	CO3

Activity	Precedence	Time (days)		
		t_o	t_m	t_p
A	-	4	6	8
B	A	6	10	14
C	A	8	15	22
D	B	9	9	9
E	C	10	14	18
F	A	5	5	5
G	D, E, F	8	10	12

(i) Draw a PERT network for the activities

(ii) Identify the critical path and its duration.

(iii) If the organization puts 47 days as dead line to complete, what is the probability of completion in 47 days.

OR

Q.6 a. Consider the network shown in Fig. Q6 (a). The three time estimates are given along the arrows. Determine the critical path. What is the probability that the project will be completed in 20 days? **10 | L3 | CO4**

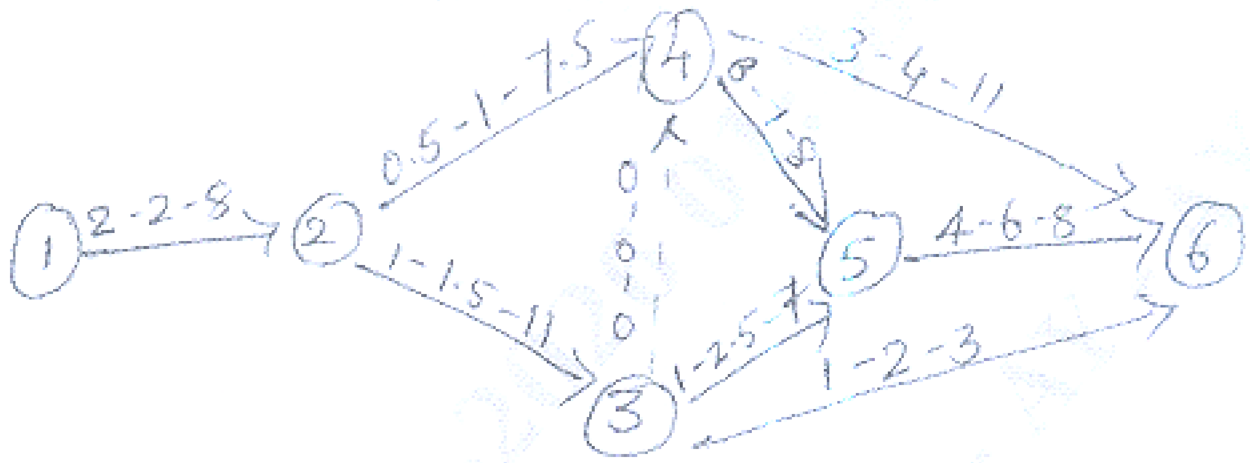

Fig. Q6 (a)

b. For the network shown below, find the critical path and validate. **10 | L3 | CO4**

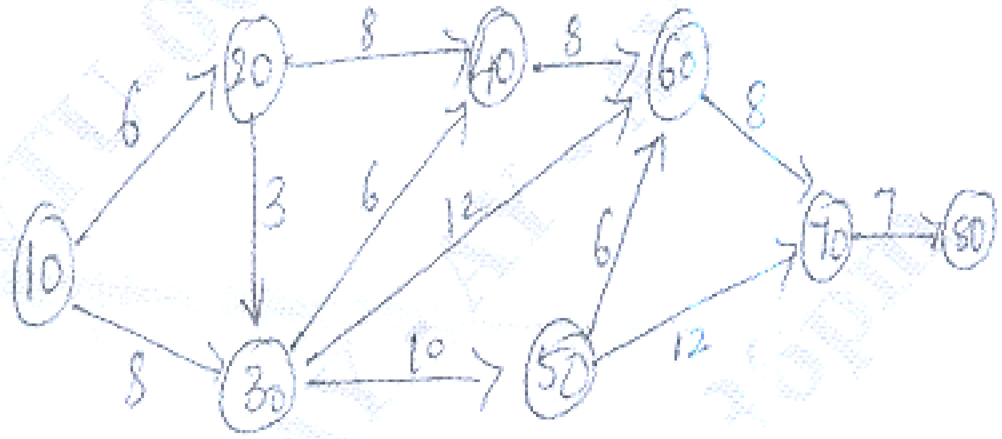

Fig. Q6 (b)

Module – 4

Q.7 a. Use the dominance rule and solve the following game whose payoff matrix for Player A is, **10 | L2 | CO4**

$$
\begin{array}{cc}
 & \text{B} \\
 & \begin{array}{ccc} B_1 & B_2 & B_3 \end{array} \\
\text{A} \begin{array}{c} A_1 \\ A_2 \\ A_3 \end{array} & \begin{pmatrix} -4 & 6 & 3 \\ -3 & -3 & 4 \\ 2 & -3 & 4 \end{pmatrix}
\end{array}
$$

b. Solve the game by graphical method, **10 | L3 | CO4**

B

A	B_1	B_2	B_3	B_4	B_5
A_1	-5	5	0	-1	8
A_2	8	-4	-1	6	-5

OR

Q.8 a. Define the term queue. State and explain the characteristics of queuing system. **10 | L1 | CO4**

	b.	Patrons arrive at 9 reception counter at an average inter arrival time of 2 minutes. The receptionist on duty lates an average of one minute per person. (Arrivals are as per exponential and services are as per Poisson distribution). (i) What is the probability that 9 person will straight away meet the receptionist? (ii) For what portion of the time the receptionist is busy? (iii) What is the average length of queue? (iv) What is the average number of patrons in the system? (v) What is the average waiting time of a person? (vi) What is the average time a patron spends in the system?	10	L3	CO4

Module – 5

Q.9	a.	Consider the processing time (in minutes) of 5 jobs each of which must undergo through 2 machines M_1 and M_2 in the order M_1M_2.	10	L3	CO5

	Job	J_1	J_2	J_3	J_4	J_5
Machine	M_1	5	1	9	3	10
	M_2	2	6	7	8	4

Obtain the sequence for the jobs that minimizes the total elapsed time and also find the idle time of both the machines.

	b.	There are five jobs, each of which must go through the two machines A and B in the order AB processing time are given below :	10	L3	CO5

Job	1	2	3	4	5
Machine A	5	1	9	3	10
Machine B	2	6	7	8	4

Determine a sequence for the five jobs that will minimize the total elapsed time.

OR

Q.10	a.	Six jobs A, B, C, D, E and F have arrived at one time to be processed on single machine. Determine (i) Optimal sequence as per SPT rule. (ii) Completion time of the jobs. (iii) Mean flow time. (iv) Average in process inventory.	10	L3	CO5

Job	A	B	C	D	E	F
Processing time	7	6	8	4	3	5

	b.	Use graphical method, determine the optimal sequence needed to process jobs 1 and 2 on five machines A, B, C, D and E. For each machine find the job which should be done first. Also calculate the total time needed to complete both the jobs.	10	L4	CO5

Job1	Sequence	A	B	C	D	E
	Time	1	2	3	5	1
Job2	Sequence	C	A	D	E	B
	Time	3	4	2	1	5

* * * * *