Q. Code:849965

Reg. No. | | | | | | | | | | | | | |

B.E. / B.TECH. DEGREE EXAMINATIONS, MAY 2024

Sixth Semester

ME18026 – OPERATIONS RESEARCH

(Mechanical Engineering)

(Regulation 2018/2018A)

TIME: 3 HOURS **MAX. MARKS: 100**

COURSE OUTCOMES	STATEMENT	RBT LEVEL
CO 1	Students will identify, develop and evaluate linear problem models to achieve the best solution for industrial scenarios.	**3**
CO 2	Students will select suitable methodology for analyzing the network problems.	**3**
CO 3	Students will select the suitable methodology for real time problems in inventory and Sequencing.	**3**
CO 4	Students will apply suitable technique for queuing problem.	**3**
CO 5	Students will evaluate a situation and suggest suitable decisions.	**3**

PART- A (10 x 2 = 20 Marks)

(Answer all Questions)

		CO	RBT LEVEL
1.	Elucidate the termination criteria for the simplex method.	**1**	**2**
2.	What method should be adopted to obtain solution as an integer in simplex method?	**1**	**3**
3.	A transportation problem has unequal supply and demand. How the problem has to be proceeded?	**2**	**3**
4.	Differentiate the assignment problem and sequencing model.	**2**	**2**
5.	Define the Elitism rule in Johnson's algorithm.	**3**	**2**
6.	Compare and contrast the concept of availability and Idle time.	**3**	**2**
7.	Justify the single server is complex than multi server models.	**4**	**2**
8.	What is the role of random numbers in simulation?	**4**	**2**
9.	What is the significance of decision making in operations research?	**5**	**2**
10.	What do you mean by the term Depreciation?	**5**	**2**

PART- B (5 x 14 = 70 Marks)

		Marks	CO	RBT LEVEL
11. (a)	A firm manufactures two products spring and washer on which the profits earned per unit are ₹3 and ₹4 respectively Each product is processed on two Machines; M1 and M2. Spring requires one minute of processing time on M1 and two minutes of processing time on M2 while processing of washer requires one minute on M1 and one minute on M2. Machine M1 is available for not more than 7 hours 30 minutes while Machine M2 is available for 10 hours during any working day. Find the number of units of springs and washers need to be manufactured to get maximum profit. Formulate and solve the above as a linear programming problem using corner point method.	**14**	**1**	**3**

(OR)

(b) **(i)** Solve the following linear programming problem graphically: **10** **1** **3**
Maximize $Z = 2x + 5y$
Subject to $x + 4y \leq 24$; $3x + y \leq 21$; $x + y \leq 9$ and x and y are non-negative.

(ii) Examine the properties of linear programming problem and state how it is used in industrial applications. **4** **1** **3**

12. (a) A product is produced by four factories F1, F2, F3 and F4. Their unit production costs are 2, 3, 1 and 5 (in ₹) respectively. Production capacities of the factories are 50, 70, 30 and 50 units respectively. The product is supplied to four stores S1, S2, S3 and S4 the requirements of which are 25, 35, 105 and 20 respectively. Unit costs of transportation are given in the following table. **14** **2** **3**

	S1	**S2**	**S3**	**S4**
F1	2	4	6	11
F2	10	8	7	5
F3	13	3	9	12
F4	4	6	8	3

Find the transportation plan such that the total production and transportation cost is minimum.

(OR)

(b) A company is faced with the problem of assigning four different salesmen to four territories for promoting its sales. Territories are not equally rich in their sales potential and the salesmen also differ in their ability to promote sales. The following table gives the expected annual sales (in thousands of ₹) for each salesman if assigned to various territories. **14** **2** **3**

		Territories			
		1	**2**	**3**	**4**
Salesmen	**A**	60	50	40	30
	B	40	30	20	15
	C	40	20	35	10
	D	30	30	25	20

Find the assignment of salesman so as to maximize the annual sales.

13. (a) A company has two machines, on which seven jobs are to be processed in the below mentioned order. The processing time (hours) is as follows. **14** **3** **4**

M/Cs	**Job 1**	**Job 2**	**Job 3**	**Job 4**	**Job 5**	**Job 6**	**Job 7**
A	10	12	13	7	14	5	16
B	15	11	8	9	6	7	16

Find the optimal sequence, processing time and Idle time of the machines using Johnson's algorithm.

(OR)

(b) A project consists of activities from 1 to 11 with the conditions given below. **14** **3** **4**

Activity	Preceding activities	Duration (Months)
1	-	4
2	1	2
3	1	3
4	3	4
5	2,3	5
6	4,5	6
7	5	7
8	7	8
9	4,6	7
10	9,8	6
11	10	6

Draw the activity on arrow diagram and compute the critical path and Float parameters.

14. (a) **(i)** A bike manufacturing company purchases 9000 parts of a machine for its annual requirements, ordering one month's usage at a time. Each part costs ₹20. The ordering cost per order is ₹15 and the carrying charges are at 15% of the average inventory per year. Evaluate the given situation and determine the best economical purchase policy for the company. **7** **4** **4**

(ii) A firm has several machines and wants to install its own service facility for the repair of its machines. The average breakdown rate of the machines is three per day. Assume that the internal-arrival times are independent exponential variables and the repair time has exponential distribution. The loss incurred due to the lost time caused by the breakdown of an inoperative machine is ₹40 per day. The form has two repair facilities: A and B. While facility A requires an installation cost of ₹20,000, facility B costs ₹40,000. The total labour cost per year is ₹5000 and ₹8000 per year for A and B respectively. While A can repair 4.5 machines per year and B can repair 5 machines per year. Both the facilities have a life of four years. Assess the facilities and which must be installed. 7 4 4

(OR)

(b) **(i)** Determine the major reasons for using simulation. Prepare the basic flow diagram and explain the basic steps involved in Monte Carlo simulation in the context of automatic tool changer in a CNC machining centre. **4** **4** **3**

(ii) The probability distributions of units produced (X) and the number of vehicles available (Y) are as follows: **10** **4** **3**

Units produced (X)	$P(X=x_i)$	Vehicles available (Y)	$P(Y=y_j)$
500	0.06	5	0.16
550	0.14	6	0.36
600	0.20	7	0.20
650	0.40	8	0.16
700	0.20	9	0.12

Simulate the model for 10 days in respect of the above changes to determine the average daily output, average number of vehicles available and average number of units stored overnight.

Note: Use the given random numbers for simulation

i) 80,87,34,21,48,15,22,69,56,83 for Units produced and

ii) 50,57,04,91,18,85,92,31,26,53 for Vehicles available.

15. (a) (i) Solve the following game and evaluate the optimal strategy using the graphical method. **10 5 3**

		Player B			
		1	**2**	**3**	**4**
Player A	**1**	2	3	11	8
	2	7	5	2	7
	3	6	4	-4	-9

(ii) Analyze the effects of pure and mixed strategies in a game theory. **4 5 3**

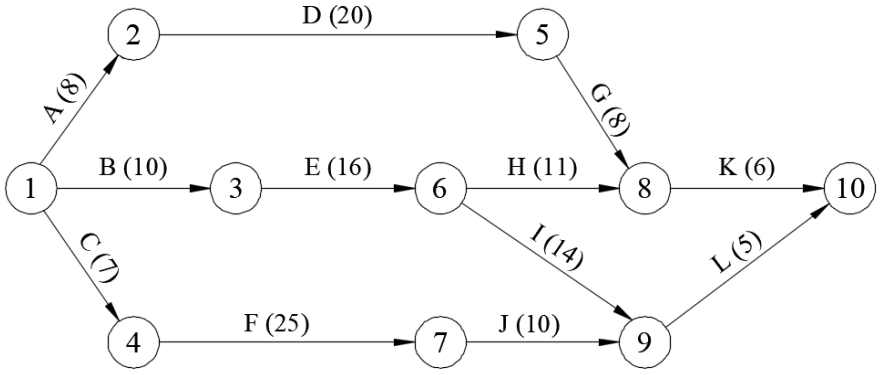
(OR)

(b) Alpha castings private limited, a small scale industry purchases a machine for ₹20,000. The operation cost is ₹2000 during the first year of its operation and it increases by ₹1000 every year thereafter. The maintenance cost is ₹200 during the first year of its operation and it increases by ₹100 every year thereafter. Evaluate the economic life of the machine. **14 5 3**

PART- C (1 x 10 = 10 Marks)

(Q.No.16 is compulsory)

		Marks	CO	RBT LEVEL
16.	In the activity diagram, evaluate the critical path and its duration along with the total float, free float and independent float.	**10**	**2**	**5**



The durations are in months.