Roll No. | | | | | | | | | | |

ANNA UNIVERSITY (UNIVERSITY DEPARTMENTS)

B.E. /B. Tech / B. Arch (Full Time) - END SEMESTER EXAMINATIONS, APR / MAY 2024

Mechanical Engineering
VIIth semester
ME 5018 & Applied Operation Research
(Regulation 2019)

Time: 3 hrs. Max. Marks: 100

CO1	Select the constraints on the availability of resources, develop a model and render an optimal solution during the given circumstances
CO2	Appraise the challenges in the transportation and production problems and furnish a rational solution to maximize the benefits
CO3	Plan the purchase/ manufacturing policies, manage the spares/ stocks and meet the customer demands
CO4	Analyze the queue discipline and explore the avenues for better customer service
CO5	Investigate the nature of the project/ failure and offer methodical assistance towards decision making.

BL – Bloom's Taxonomy Levels
(L1-Remembering, L2-Understanding, L3-Applying, L4-Analysing, L5-Evaluating, L6-Creating)

PART- A (10x2=20Marks)
(Answer all Questions)

Q. No.	Questions	Marks	CO	BL
1	Write the disadvantages of operation research.	2	1	1
2	What is unbounded solution?	2	1	2
3	What is Degenerate solution with respect to transportation problem?	2	2	2
4	Write the mathematical representation of the Assignment model.	2	2	2
5	Write a short note on SDE inventory control techniques	2	3	2
6	Define Inventory. List the advantages of having inventories.	2	3	1
7	Write a short note on Kendall's notation in queuing theory	2	4	2
8	Define Balking	2	4	1
9	Write a short note on the different phases of project management.	2	5	2
10	What is expected time with respect to PERT? Write the formula for finding expected time.	2	5	1

PART- B (5x 13=65Marks)
(Restrict to a maximum of 2 subdivisions)

Q. No.	Questions	Marks	CO	BL
11 (a)	Maximize K = 2X+3Y+4Z Subject to 3X +Y + 4Z ≤600 2X + 4Y+2Z ≥480 2X + 3Y + 3Z = 540 Solve the above problem using BIG M Method.	13	1	3
	OR			
11 (b)	Solve by simplex method the following L.P.problem Minimize K = X- 3Y+3Z Subject to 3X – Y+2Z ≤ 7	13	1	3

12 (a)	Solve the given transportation problem by Vogel's Approximation, Least cost and North west corner method.	**13**	2	4

	D1	D2	D3	D4	Supply
S1	19	30	50	10	7
S2	70	30	40	60	9
S3	40	8	70	20	18
Demand	5	8	7	14	34

OR

12 (b)	A machine operator has to perform three operations: turning, threading and knurling on a number of different jobs. Th time required to perform these operations (in minutes) for each job is known. Determine the order in which the jobs should be processed in order to minimize the total time required to turn out all the jobs. Also find the idle time for the three operations.	**13**	2	4

Job	Time for turning (minutes)	Time for threading (Minutes)	Time for Knurling (Minutes)
1	3	8	13
2	12	6	14
3	5	4	9
4	2	6	12
5	9	3	8
6	11	1	13

13 (a)	(i) Write a short note on four costs considered in inventory control model. (ii) A particular item has a demand of 9000 units /year. The cost of one procurement is Rs.100 and the holding cost per unit is Rs.2.40 per year. The replacement is instantaneous and no shortages are allowed. Determine the economic lot size, the number of orders per year, the time between orders, and the total cost per year if the cost of one unit is Rs. 1.	**6+7**	3	3

OR

13 (b)	The following information is known about a group of items. Classify the items as A, B and C based on ABC analysis.	**13**	3	3

Item No	Annual Consumption in Pieces	Unit Price in Rs.
1	30000	10
2	280000	15
3	3000	10
4	110000	5
5	4000	5
6	220000	10
7	15000	5
8	80000	5
9	60000	15
10	8000	1

	come, first served basis at an average rate of 10 customers /hour with the service time exponential distribution. Find. (i) The probability that the queuing system is idle. (ii) the probability of the number of arrivals (o through 5) during 15 minute interval (iii) the time a customer spends in the queue (iv) The time a customer spends in the system.			
	OR			
14 (b)	A dentist schedules all his patients for 30 minute appointments. Some of the patients take more than 30 minutes, some less, depending on the type of dental work to be done. The following summary shows the various categories of work, their probabilities and time actually needed to complete the work: Category of service / Time Required (minutes) / Probability of category Filling / 45 / 0.40 Crown / 60 / 0.15 Cleaning / 15 / 0.15 Extraction / 45 / 0.10 Checkup / 15 / 0.20 Simulate the dentist's clinic for four hours and determine the average waiting time for the patients as well as the idleness of the doctor. Assume that all the patients show up at the clinic at exactly their scheduled arrival time starting at 8 am. Use the following random numbers for handling the above problem: 40, 82, 11, 34, 25, 66, 17, and 79.	**13**	4	4
15 (a)	The utility data for a network are given below. Determine the critical path, Early start time and latest finish time of each node. Also compute total float and free float. Activity / Predecessor / Duration (days) A / - / 6 B / A / 4 C / B / 7 D / A / 2 E / D / 4 F / E / 10 G / - / 2 H / G / 10 I / J,H / 6 J / - / 13 K / A / 9 L / C, K / 3	**13**	5	4

	OR			
15 (b)	A computer contains 10000 resistors. When any resistor fails, it is replaced. The cost of replacing a resistor individually is Rs 1 only. If all the resistors are replaced at the same time, the cost per resistor would be reduced to 35 paise. The percentage of surviving resistors say S (t) at the end of month t and the probability of failure P (t) during the month t are as follows: what is the optimal replacement plan?	**13**	5	4

t	0	1	2	3	4	5	6
S (t)	100	97	90	70	30	15	0
P(t)	-	0.03	0.07	0.20	0.40	0.15	0.15

PART- C (1x 15=15Marks)

(Q.No.16 is compulsory)

Q. No.	Questions	Marks	CO	BL
16.	The ABC company has been a producer of picture tubes for television and certain printed circuits for radios. The company has just expanded in to full scale production and marketing of AM and AM –FM radios. It has built a new plant that can operate 48 hours per week. Production of an AM radio in the new plant will require 2 hours and production of AM- FM radio will require 3 hours. Each AM radio will contribute Rs 40 to profits while an AM-FM radio will contribute Rs 80 to profits. The marketing department, after extensive research has determined that a maximum of 15 AM radios and 10 AM-FM radios can be sold each week. i) Formulate a linear programming model to determine the optimum production mix of AM and FM radios that will maximize profits. ii) Solve this problem using the graphical method.	**15**	1	6