D **C2D002** **Pages: 3**

Reg. No.____________ Name:______________________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

SECOND SEMESTER MCA (REGULAR) DEGREE EXAMINATION, MAY 2017

Course Code: RLMCA108

Course Name: OPERATIONS RESEARCH

Max. Marks: 60 Duration: 3. Hours

PART A

Answer all questions. Three marks each.

1. State the Fundamental theorem of duality
2. Solve graphically the LPP
1. Minimise $z = 3x_1 - 6x_2$ subject to $x_1 + 3x_2 \le 6, 4x_1 + 3x_2 \le 12$
2. Where $x_1 \ge 0, x_2 \ge 0$
3. Write the algorithm for Least Cost method.
4. State the Dominance Property
5. 5.What is queue discipline?
6. What are the advantages of simulation?
7. State the Complementary slackness theorem.
8. Define slack and surplus variables in LPP

PART B

Answer one question from each MODULE. Six marks each

MODULE I

9. A company makes two kinds of leather belts and the respective profits are Rs.4 and Rs. 3 per belt. Each belt of type A requires twice as much time as abelt of type B requires, and if all the belts are of type B, the company could make 1000 belts per day. The total supply of leather is only for 800 belts per day. Belt A requires a fancy buckle and only 400 such buckles are available per day. There are only 700 buckles per day are available for belt B. Formulate this as a LPP and solve it graphically.
10. Use Big-M method to solve the LPP:

    Maximize $z = x_1 + 5x_2$

    subject to

    $3x_1 + 4x_2 \le 6$

    $x_1 + 3x_2 \ge 2$

    where $x_1, x_2 \ge 0$

MODULE II

11. Write the dual of the LPP and solve it.

Maximize $z = 4x_1 + 2x_2$

subject to the constraints

$$x_1 + x_2 \geq 3,$$
$$x_1 - x_2 \geq 2,$$

Where $x_1 \geq 0$ and $x_2 \geq 0$

12. Prove that the dual of the dual is the Primal problem.

MODULE III

13. Find an initial basic feasible solution by Vogel's approximation method

	D	E	F	G	Availability
A	11	13	17	14	250
B	16	18	14	10	300
C	21	24	13	10	400
Demand	200	225	275	250	

14. The Head of the Department has 5 jobs A, B, C, D and E and 5 subordinates V, W, X, Y and Z. The number of hours each person would take to perform each job is as follows. How should the jobs be allocated to minimize the total time

	V	W	X	Y	Z
A	3	5	10	15	8
B	4	7	15	18	8
C	8	12	20	20	12
D	5	5	8	10	6
E	10	10	15	25	10

MODULE IV

15. Obtain the optimal strategies for the two –person zero-sum game whose payoff matrix is as follows:

$$\begin{bmatrix} 1 & -3 \\ 3 & 5 \\ -1 & 6 \\ 4 & 1 \\ 2 & 2 \\ -5 & 0 \end{bmatrix}$$

16. Solve the following game:

		Player B			
		I	II	III	IV
Player A	I	3	2	4	0
	II	3	4	2	4
	III	4	2	4	0
	IV	0	4	0	8

MODULE V

17. Customers are arriving at a telephone booth according to a Poisson law with an average inter arrival time of 12 minutes. The duration of a phone call is assumed to be exponentially distributed with mean 4 minutes.

a. Find the average number of persons waiting in the system.

b. What is the probability of a person arriving at the booth will have to wait in the queue?

c. What is the fraction of the day when the phone is in use?

d. What is the probability of a person taking more than 10 minutes to leave the booth?

e. What is the average length of the queue if the queue is always available?

18. A 2-person barber shop has 5 chairs to accommodate waiting customers. Customers who arrive when all the 5 chairs are full leave without entering the barber shop. Customers arrive at the average rate of 4 per hour and spend an average of 12 minutes in the barber's chair. Compute $P_0, P_1, P_7, E(n_q) and E(W)$

MODULE VI

19. (a) What are the steps in the methodology of simulation
(b) Explain why simulation is used

20. Customers arrive at a milk booth for the required service. Assume that the inter-arrival service timesare constant and given by 1.8 and 4 time units, respectively. Simulate the system by hand computations for 14 time units. What is the average waiting time per customer? What is the percentage idle time of the facility? (Assume that the starts at $t = 0$)