LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

B.Com. DEGREE EXAMINATION – **COMMERCE – ALLIED**

THIRD SEMESTER – **NOVEMBER 2022**

17/18UMT3AL01 – BUSINESS MATHEMATICAL TECHNIQUE

Date: 01-12-2022   Dept. No.   Max. : 100 Marks
Time: 09:00 AM - 12:00 NOON

Part – A

Answer ALL the Questions   **(10 x 2 = 20)**

1. If $u(x,y) = 4x^2 + 9xy - 5y^2$, then find $\frac{\partial u}{\partial x}$ and $\frac{\partial u}{\partial y}$.

2. If $y = 3\sin x + 5\cos x$ find $\frac{d^2 y}{dx^2}$.

3. State any two properties of definite integrals.

4. Evaluate $\int (6x^2 + 7)dx$

5. Define an optimal solution of linear programming problem.

6. Write the dual of the following LPP

    $\text{Max } Z = x_1 - x_2 + 3x_3$

    Subject to constraints:

    $x_1 + x_2 + x_3 \leq 10$

    $2x_1 - x_2 - x_3 \leq 2$

    $2x_1 - 2x_2 - 3x_3 \leq 6$ where $x_1, x_2, x_3 \geq 0$

7. Define transportation problem.

8. State any applications of assignment problem.

9. Define critical path.

10. What is a project in network analysis?

Part – B

Answer any FIVE Questions   **(5 x 8 = 40)**

11. If $y = \left(x + \sqrt{1 + x^2}\right)^m$ show that $(1 + x^2)y_2 + xy_1 = m^2 y$.

12. Integrate $\int \frac{x+5}{(x+1)(x+3)} dx$.

13. Find the maxima and minima of the function $2x^3 - 3x^2 + 6$.

14. Find consumer and producer surplus for $y = 16 - x^2$ and $y = 4 + 2x^2$.

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15. Solve the following LPP by graphical method.

   Maximize $z = 5x_1 + 8x_2$

   Subject to the constraints: $15x_1 + 10x_2 \leq 180$,

$$10x_1 + 20x_2 \leq 200,$$

$$15x_1 + 20x_2 \leq 210 \quad \text{where } x_1, x_2 \geq 0.$$

16. Consider the problem of assigning four jobs to four persons. The assignment costs are given as follows

	Persons	I	II	III	IV
	A	5	7	11	6
Jobs	B	8	5	9	6
	C	4	7	10	7
	D	10	4	8	3

   Determine the optimum assignment schedule.

17. Find the initial basic feasible solution to the following transportation problem by

   (i) Vogel's approximation method (ii) Least cost method.

1	2	1	15	30
3	3	2	1	50
15	2	5	9	20
1020	40	30	10	

18. Draw the network for the following:

Activity	A	B	C	D	E	F	G	H	I
Immediate Predecessor	-	A	A	-	D	B,C,E	F	E	G,H

Part - C

Answer any TWO Questions   **(2 x 20 = 40)**

19. a) The total cost function of a firm is given by $C = \frac{1}{3}q^3 - 10q^2 + 300q$. Find

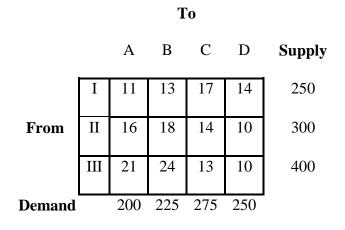   (i) Output at which, Average cost is minimum.

   (ii) Output at which, Marginal cost is minimum.

   (iii) Output at which, Average cost is equal to Marginal cost.

   b) Find $\frac{dy}{dx}$, if $y = x^x$.   **(12 + 8)**

20. Obtain the optimum transportation cost using MODI method with the initial basic feasible solution obtained using North west corner method.

To

	A	B	C	D	**Supply**
I	11	13	17	14	250
II	16	18	14	10	300
III	21	24	13	10	400
Demand	200	225	275	250	

From labels rows II; row labels I, II, III.

21. Solve the following LPP by simplex method.

Maximize $z = 4x_1 + 10x_2$

Subject to the constraints,

$$2x_1 + x_2 \leq 50,$$

$$2x_1 + 5x_2 \leq 100$$

$$2x_1 + 3x_2 \leq 90,$$

$$x_1, x_2 \geq 0.$$

22. Find the critical path and the project duration for the following:

Activity	Least time (days)
1 - 2	8
1 – 3	4
2 – 4	10
2 – 5	2
3 – 4	5
4 – 5	3

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