LOYOLA COLLEGE (AUTONOMOUS) CHENNAI – 600 034

U.G. DEGREE EXAMINATION – **ALLIED**

THIRD SEMESTER – **NOVEMBER 2024**

16UMT3AL01 – BUSINESS MATHEMATICAL TECHNIQUE

Date: 15-11-2024 Dept. No. Max. : 100 Marks

Time: 09:00 am-12:00 pm

SECTION A

Answer ANY FOUR of the following **(4 x 10 = 40)**

1. The total cost function of a firm is given by $C = 0.04q^3 - 0.9q^2 + 10q + 10$. Find (i) Average cost (AC) (ii) Marginal cost (MC) (iii) Slope of Average Cost (iv) Slope of Marginal Cost.

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

3. Evaluate $\int \frac{x}{(x-1)(2x+1)} dx$.

4. Find Consumer Surplus and Producer Surplus for the demand curve $D(x) = 16 - x^2$ and supply curve $S(x) = 4 + x$.

5. Solve the following LPP by graphical method.
Maximize $Z = 15x_1 + 10x_2$ subject to constraints
$4x_1 + 6x_2 \le 360, 3x_1 + 0x_2 \le 180, 0x_1 + 5x_2 \le 200$ and $x_1, x_2 \ge 0$.

6. Find the starting solution of the following transportation model by using (i) North West Corner Rule and (ii) Least Cost method:

	Sink			
Origin	A	B	C	Supply
P	1	2	6	7
Q	0	4	2	12
R	3	1	5	11
Demand	10	10	10	

7. A company has four machines to do four jobs. Each job can be assigned to one and only one machine. The cost of each job on each machine is given in the following table.

	Machines			
	I	II	III	IV
A	10	5	13	15
B	3	9	18	3
C	10	7	3	2
D	5	11	9	7

What are the job assignments? Which will minimize the assignment cost?

8. Draw the network for the following:

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

Predecessor											

SECTION B

Answer ANY THREE of the following **(3 x 20 = 60)**

9. (a) Find the maximum and minimum values of the function $x^4 + 2x^3 - 3x^2 - 4x + 4$.

(b) Let the cost function of a firm be given by the following equation: $C = 300x - 10x^2 + \frac{1}{3}x^3$, where C stands for cost and *x* for output. Calculate (i) output, at which marginal cost is minimum (ii) output, average cost is minimum (iii) output, at which average cost is equal to marginal cost.

10. (a) Given the demand and cost function: *P = 20-4x* and *C = 4x*

(i) Find the optimum quantity, price and profit on this level

(ii) What will be the new equilibrium after a tax of Rs.0.50 is imposed?

(iii) Determine the tax rate that will maximize tax revenue and determine that tax revenue.

(iv) Find the total tax revenue if in addition 10% sales is also imposed.

(b) Evaluate $\int \frac{(3x+7)dx}{2x^2+3x-2}$.

11. Find the Critical path and the project duration for the following network:

Activity	1 – 2	1 – 3	2 – 4	2 – 5	3 – 4	4 – 5
Time(Days)	8	4	10	2	5	3

12. Solve the transportation problem

	1	2	3	4	Supply
I	21	16	25	13	11
II	17	18	14	23	13
III	32	27	18	41	19
Demand	6	10	12	15	

13. Solve the following LPP by simplex method.

Minimize $Z = 8x_1 - 2x_2$

subject to constraints $-4x_1 + 2x_2 \leq 1, 5x_1 - 4x_2 \leq 3$ and $x_1, x_2 \geq 0$.

14. Obtain the optimum transportation cost using MODI method with the initial basic feasible solution obtained using least cost method.

	Market						
Factory		A	B	C	D	E	Available
	P	4	1	2	6	9	100
	Q	6	4	3	5	7	120
	R	5	2	6	4	8	120
	Demond	40	50	70	90	90	

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