LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

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

THIRD SEMESTER – **NOVEMBER 2019**

18/17/16UMT3AL01 – BUSINESS MATHEMATICAL TECHNIQUE

Date: 06-11-2019 Dept. No. Max. : 100 Marks

Time: 01:00-04:00

Part A

Answer **ALL** questions **(10 x 2 = 20)**

1. Find $\frac{d^2y}{dx^2}$ for $y = a\sin x + b\cos x$.
2. If $u = 3x^2 + 2xy + 4y^2$, then find $\frac{\partial u}{\partial x}$ and $\frac{\partial u}{\partial y}$.
3. Evaluate $\int \left(4x^2 + 5\right) dx$.
4. State any two properties of definite integrals.
5. Define surplus variables.
6. Define an optimal solution.
7. What are the methods of finding initial basic feasible solution of transportation problem?
8. What is Assignment problem?
9. Draw a network diagram for the following set of activities:

   A < B, C ; D, C < G, F ; E , F < H.
10. What do we mean by dummy activity in Network analysis?

Part B

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

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

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

13. Evaluate $\int \frac{x+5}{(x+1)(x+3)^2} dx$.

14. Integrate $\int \frac{dx}{3x^2 + 2x + 5}$.

15. Solve the following LPP by graphical method.

Maximize $z = 3x_1 + 4x_2$

Subject to the constraints, $x_1 + x_2 \leq 450$,

$2x_1 + x_2 \leq 600$

and $x_1, x_2 \geq 0$.

16. Determine the starting solution to the following transportation problem using Vogel's Approximation method.

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

17. 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
Jobs	B	3	9	18	3
	C	10	7	3	2
	D	5	11	9	7

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

18. The following table indicates the details of the project where the duration are in days, *'a'* refers to optimistic time, *'m'* refers to most likely time and *'b'* refers to pessimistic time.

Activity	1 – 2	1 – 3	1 – 4	2 – 4	2 – 5	3 – 4	4 – 5
a	2	3	4	8	6	2	2
m	4	4	5	9	8	3	5
b	5	6	6	11	12	4	7

(i) Draw the network and

(ii) Find the critical path.

Part C

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

19. a) Investigate the maxima and minima of the function $x^3 - 2x^2 - 4x - 1$.

b) Let the cost function of a firm be $C = 300x - 10x^2 + \frac{1}{3}x^3$.

Calculate (i) Output at which, MC is minimum,
(ii) Output at which, AC is minimum,
(iii) Output at which, AC = MC.

(8 + 12)

20. a) Evaluate $\int_0^{\pi/2} \frac{\sqrt{\sin x}}{\sqrt{\sin x} + \sqrt{\cos x}} dx$.

b) Find (i) Market price
(ii) Consumer surplus and
(iii) Producer surplus for the demand curve $y = 16 - x^2$ and supply curve $y = 2x^2 + 4$ under pure competition.

(8 + 12)

21. a) Solve the following LPP by simplex method.

Minimize $z = 8x_1 - 2x_2$

Subject to the constraints, $-4x_1 + 2x_2 \le 1$,

$5x_1 - 4x_2 \le 3$

and $x_1, x_2 \ge 0$.

b) Compute the earliest start, earliest finish, latest start and latest finish of each activity of the project given below:

Activity	1 – 2	1 – 3	2 – 4	2 – 5	3 – 4	4 – 5
Duration (in days)	8	4	10	2	5	3

(12 + 8)

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

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

(20)

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