4th SEM TDC BUMT (CBCS) C 409

Business Mathematics Question Paper 2022 (June/July)

COMMERCE (Core)

Paper: C-409 **(Business Mathematics)**

Full Marks: 80

Pass Marks: 32

Time: 3 hours

The figures in the margin indicate full marks for the questions

1. Answer any five questions: 2x5=10

(a) Find the value of

$$\begin{vmatrix} 2 & 1 & 14 \\ 3 & 0 & 21 \\ 5 & 2 & 35 \end{vmatrix}$$

(b) What do you mean by duality in an LPP?

(c) If $f(x)=2x^2+5x-7$, then find the values of $f(0)$ and $f(-1)$.

(d) Define matrix.

(e) Find the value of $\lim_{x\to 4}\frac{x^2-16}{x-4}$.

(f) What do you mean by surplus variable in LPP?

(g) Give the geometric interpretation of $\frac{dy}{dx}$.

2. (a) (1) If $\begin{bmatrix} 1 & x+y \\ x-y & 0 \end{bmatrix}$ then what will be the values of x and y. 2

(2) Prove that $\begin{vmatrix} 1 & a & a^2 \\ 1 & b & b^2 \\ 1 & c & c^2 \end{vmatrix}=(b-c)(c-a)(a-b)$. 3

(3) Find the values of A and B when 4

$$A+B=\begin{bmatrix} 1 & 0 & 2 \\ 2 & 2 & 2 \\ 1 & 1 & 2 \end{bmatrix} \text{ and } A-B=\begin{bmatrix} 1 & 4 & 4 \\ 4 & 2 & 0 \\ -1 & -1 & 2 \end{bmatrix}$$

(4) If $A=\begin{bmatrix} 2 & 1 & 3 \\ 1 & 4 & 2 \\ 5 & -2 & 6 \end{bmatrix}$ then what will be? A^{-1}?

Or

(b) (1) Write the differences between a matrix and a determinant. 2

Or

(b) (1) Define 'homogenous function'. 2

(2) If $y = f(x_1, x_2)$ is the function, what will be the second-order partial derivatives of f? 3

(3) For the function $u = f(x, y) = 2x^2 - xy^2 + 10y$ find $\frac{\partial^2 u}{\partial x \partial y}, \frac{\partial^2 u}{\partial x^2}$. 4

(4) If $u(x, y) = \log\left(\frac{x^2 - y^2}{x^2 + y^2}\right)$ then show that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = 0$. 5

5. (a) (1) Define perpetuity and deferred annuity. 2

(2) At what time an amount of money will double itself at 5% p.a. rate of compound interest? 3

(3) What is the nominal rate of interest p.a. payable quarterly which is equivalent to the effective rate of 4% p.a? 4

(4) A machine is depreciated at 10% per year. A machine was purchased at Rs. 50,000 and after some years its depreciated value become Rs. 5,750. Find the life period of the machine. 5

Or

(b) (1) What do you mean by present worth of annuities? 2

(2) Write the difference between nominal rate of interest and effective rate of interest. 3

(3) An amount of money with compound interest turned to be Rs. 4,840 in 2 years and Rs. 5,324 in 3 years. What is the rate of interest? 4

(4) A house was purchased on instalment basis such that Rs. 50,000 is to be paid at the time of purchase and the remaining amount by 4 yearly instalments of Rs. 30,000 each. Find the credit price of the house when compound rate of interest is 5% p.a. 5

6. (a) (1) Write the general mathematical model for LPP. 2

(2) Write a short note on unbounded solution. 3

(3) A company produces two products A and B. The amount of machine hours, labour and raw materials required are given in the following table. Profits from each unit of A and B are Rs. 3 and Rs. 4 respectively. Formulate the problem in LPP:

Variable	Product	Machine hour	Labour	Raw Material	Profit (Rs.)
X	A	4	4	1	3
Y	B	2	6	1	4
Available		100	180	40	

(4) Solve the following LPP graphically: 5

$$\text{(Minimize)}$$
$$Z = 2x + 3y$$
$$\text{(subject to)}$$
$$6x + y \geq 36$$
$$x + 4y \geq 12$$
$$2x + y \geq 10$$
$$x, y > 0$$

(2) Solve: $\begin{vmatrix} x & 1 & 1 \\ 1 & x & 1 \\ 1 & 1 & x \end{vmatrix} = 0$ 3

(3) If $A = \begin{bmatrix} -1 & -1 \\ 2 & -2 \end{bmatrix}$, then prove that $A^2 + 3A + 4I = 0$. 4

(4) Solve using Cremer's rule: 5

$$2x + y + z = 1$$
$$x - y + 2z = -1$$
$$3x + 2y - z = 4$$

3. (a) (1) If $f(x) = \frac{1}{x}$, then prove that $f(p) - f(q) = f\left(\frac{pq}{q-p}\right)$. 2

(2) Find the value of $\lim_{x \to 2} \frac{x^2 - 3x + 2}{x^2 + x - 6}$. 3

(3) If $x^3 + y^3 - 3axy = 0$, what will be the value of $\frac{dy}{dx}$? 4

(4) Find the maximum and minimum values of the following function:

$$y = 4x^3 - 15x^2 + 15x - 2$$

Or

(b) (1) What are the conditions for the existence of the limit of a function at a point? 2

(2) Given $f(x) = 3x^2 - 6x + 4$ for what values of x will $3f(x) = f(3x)$? 3

(3) A function $f(x)$ is defined as follows: 4

$$f(x) = \begin{cases} -x, & x \le 0 \\ x, & 0 < x \le 1 \\ 2 - x, & x > 1 \end{cases}$$

Is the function continuous at $x = 1$?

(4) A company produces x units of copper per day at a total cost of $TC = \frac{1}{3}x^3 - 5x^2 + 6x + 55$. Find the output level of the company at which total cost will be minimum.

4. (a) (1) If $u = f(x, y)$ is a function, then define the partial derivatives $\frac{\partial u}{\partial x}$ and $\frac{\partial u}{\partial y}$. 2

(2) If $u = x^3 + xy$, then find the partial derivatives $\frac{\partial u}{\partial x}$ and $\frac{\partial u}{\partial y}$. 3

(3) Verify Euler's theorem for the function $u = \frac{xy}{x+y}$. 4

(4) Find the total differential for the following function: 5

$$y = x_1^2 x_2 - 2x_1^3 + x_2^2$$

Or

(b) (1) What do you mean by LPP? 2

(2) Write the assumptions of an LPP. 3

(3) Discuss about the limitations of LPP. 4

(4) A company produces three products A, B and C and net profit available from them are Rs. 18, Rs. 12 and Rs. 24 respectively. To produce these two machines M_1 and M_2 are to be engaged, requirement of each machine is given below:

	A	B	C	Available
M_1	14	13	15	2,000
M_2	12	12	14	2,500

Prepare an LPP to maximize profit. 5

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