

END TERM EXAMINATION

FIRST SEMESTER [BCA] JANUARY 2024

Subject: Mathematics-I

Paper Code: BCA-101

Time: 3 Hours

Maximum Marks: 60

Note: Attempt five questions in all including Q.no.1 which is compulsory. Select one question from each unit.

- Q1 a) Solve the equation for x: $\begin{vmatrix} x+1 & 2x+1 & 3x+1 \\ 2x & 4x+3 & 6x+3 \\ 4x+1 & 6x+4 & 8x+4 \end{vmatrix} = 0$ (4)
- b) Evaluate the limit: $\lim_{x \rightarrow 2} \frac{(e^x - e^2)}{(x-2)}$ (4)
- c) If $y = \frac{(\sin x + \cos x)}{(\sin x - \cos x)}$ Then Find second derivative for y with respect to x: (4)
- d) Express the given matrix as the sum of symmetric and skew symmetric matrix: (4)

$$\begin{bmatrix} 8 & 6 & 12 \\ -6 & 7 & 44 \\ 2 & -4 & 3 \end{bmatrix}$$

- e) Solve the integral $\int \tan x \, dx$. (4)

UNIT-1

- Q2 a) Solve the system of equation using Cramer's Rule: $3x - 4y - z = 2, 6x + 6y + 3z = 7, \text{ and } 9x - 8y - 5z = 0$ (5)
- b) Find Eigen values and corresponding Eigen vector for the matrix $\begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$ (5)

$$\begin{bmatrix} 1 & 2 & 3 \\ 2 & 3 & 1 \\ 3 & 2 & 1 \end{bmatrix}$$

- Q3 a) Find the Rank of the Matrix: (5)
- b) Show that the vectors $x_1 = (1, 2, 4), x_2 = (2, -1, 3), x_3 = (0, 1, 2), x_4 = (-3, 7, 2)$ are linearly dependent. (5)

UNIT-II

- Q4 a) Determine the value of K for which the following function is continuous at $x = 3$ (5)

$$F(x) = \begin{cases} (x+3)^2 - 36 & x \neq 3 \\ x-3 & x = 3 \end{cases}$$

K, $x = 3$

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- b) Solve the Limit: $\lim_{x \rightarrow 3} \frac{\sqrt{2x+22} - 4}{(x+3)}$, (5)
- Q5 a) Solve the Limit: $\lim_{y \rightarrow -7} \frac{y^2 - 4y - 21}{3y^2 - 17y - 28}$, (5)
- b) Check whether the functions $f(x) = \frac{x^2 - 9}{3x^2 - 2x - 8}$, is discontinuous, if so then find the points of discontinuities. (5)

UNIT-III

- Q6 a) Find the maximum and minimum value for the function if exists: $x^3 - 3x + 3$. (5)
- b) Obtain the Maclaurin series expansion for the function: $f(x) = \sin(\text{msin}^{-1}x)$, where m is a constant. (5)
- Q7 a) Find all asymptotes of the curve: $X^2 Y^2 = a^2 (x^2 + y^2)$ (5)
- b) Find the nth derivative of $y = \tan^{-1} \left(\frac{x}{a} \right)$ Using Leibnitz Theorem. (5)

UNIT-IV

- Q8 a) Solve the following integrals: $\int \frac{dx}{(x-1)(x-2)(x-3)(x-4)}$ using partial fractions; (5)
- b) Find the reduction formula for $\int (\cos x)^n \, dx$ (5)
- Q9 a) Evaluate the following integrals i) $\int_0^1 x^4 (1-x^3) \, dx$.
ii) $\int_0^1 \sqrt{x} (1-\sqrt{x}) \, dx$. (5)
- b) If $I_n = \int_0^{\pi/2} (\tan x)^n \, dx$ then show that $I_n + I_{n-2} = \frac{1}{n-1}$ (5)
