

4. Examine the continuity of $f(x) = \begin{cases} \frac{x-|x|}{x}, & x \neq 0 \\ 1, & x = 0 \end{cases}$.
5. Find the derivative of $\sin x^{\cos x} + \cos x^{\sin x}$ w.r.t. x .

Section-C

Long Answer Type Questions

Note : Attempt **any one** questions from the following. Each question carries 15 marks. $[1 \times 15 = 15]$

6. Forces of magnitudes 2 and 7 units acting in the direction $\vec{a} = 6i + 2j + 3k$, $3i - 2j + 6k$, respectively, acts on the particle which is displaced from the point $A(2, -3, -1)$ to $B(4, 3, 1)$. Find the work done by the forces.
7. Find the value of λ so that four points with position vectors $-6i + 3j + 2k$, $3i + \lambda j + 4k$, $5i + 7j + 3k$, $-13i + 17j - k$ are coplanar.
8. (a) Evaluate integral $\int \frac{x^2 \tan^{-1} x}{1+x^2} dx$.
- (b) Evaluate integral $\int \frac{3x}{(x-1)(x-2)(x-3)} dx$.
9. Find the minimum and maximum value of $f(x) = 6e^{3x} + 4e^{-3x}$.

Roll No. :

BCA-1005T

BCA (FYUP) (Semester-I) (NEP) Examination, 2025-26

BASICS OF MATHEMATICS

[Paper : Fifth]

Time : 2 Hours]

[Maximum Marks : 75

- Note :** 1. This paper consists of three sections A, B and C. Attempt questions from **all** sections as directed.
2. The candidates are required to answer only in serial order. If there are many parts of a question, answer them in continuation.
3. "B" copy will not be provided.

Section-A

Short Answer Type Questions

Note : All questions are compulsory. Each question carries 5 marks. $[9 \times 5 = 45]$

1. (a). Evaluate the Determinant

$$\begin{bmatrix} a-b & b-c & c-a \\ b-c & c-a & a-b \\ c-a & a-b & b-c \end{bmatrix}$$

- (b) Find the characteristic equation of matrix

$$A = \begin{bmatrix} 1 & 0 & 2 \\ 0 & 2 & 1 \\ 2 & 0 & 3 \end{bmatrix}$$

- (c) Prove that limit of greatest integer function $[x]$ does not exist at x approaches to 1.

- (d) Discuss the continuity of the function

$$f(x) = \begin{cases} \frac{\sin 2x}{x}, & x \neq 0 \\ 1, & x = 0 \end{cases}$$

- (e) Find the unit vector in the direction of $\vec{a} = i + 2j + 3k$.

- (f) If $\vec{a} = i - 2j + 3k$, $\vec{b} = i - 3k$, then find $|(b \times 2a) \cdot \vec{a}|$.

- (g) If $y = e^{ax} \sin bx$, then find $\frac{dy}{dx}$.

- (h) If $t^2 + t^3$, $x = t - t^4$, then find $\frac{d^2y}{dx^2}$.

- (i) Evaluate the integral $\int \frac{\sin x}{1 + \cos^2 x} dx$.

Section-B

Long Answer Type Questions

Note : Attempt any one question from the following. Each question carries 15 marks. [1×15=15]

2. (a) Verify Caley Hamilton Theorem for matrix

$$A = \begin{bmatrix} 0 & 0 & 1 \\ 3 & 1 & 0 \\ -2 & 1 & 4 \end{bmatrix}$$

- (b) Evaluate A^{-1} for above matrix in part a.

3. (a) Compute $\lim_{x \rightarrow 1} f(x)$, where $\begin{cases} 3x-2, & x < 1 \\ 4x^2-3x, & x > 1 \end{cases}$

- (b) Show that :

$$\lim_{x \rightarrow 0} \frac{\frac{1}{e^x} - \frac{1}{e^{-x}}}{\frac{1}{e^x} + \frac{1}{e^{-x}}} \text{ does not exist.}$$