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6. Determine the eigen value and the eigen vector of the matrix

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

7. (i) Find n^{th} derivative of

$$y = \log(ax+b)$$

- (ii) Evaluate $\int_0^{\pi/2} \frac{1}{1+\cot x} dx$

8. (i) Discuss the continuity of

$$f(x) = \begin{cases} \frac{e^{1/x} - 1}{e^{1/x} + 1} & x \neq 0 \\ 0 & x = 0 \end{cases}$$

- (ii) If $f(x) = \begin{cases} 0 & x \text{ is irrational} \\ 1 & x \text{ is rational} \end{cases}$

Prove that $\lim_{x \rightarrow a} f(x)$ does not exist for any $a \in \mathbb{R}$.

9. Find the rank of matrix

$$A = \begin{bmatrix} 3 & -1 & 1 & 3 \\ -1 & -4 & -2 & -7 \\ 2 & 1 & 3 & 0 \\ -1 & -2 & 3 & 0 \end{bmatrix}$$

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BCA -105 (N)

Bachelor of Computer Applications

(First Semester)

EXAMINATION, MARCH - 2021

(New Course)

Paper Fifth

MATHEMATICS-I

Time : Three Hours]

[Maximum Marks : 75

Note : Attempt questions from all sections as directed.

Inst. : The candidates are required to answer only in serial order. If there are many parts of a question, answer them in continuation.

Section -A

(Short Answer Type Questions)

Note : Attempt all questions. Each question carries 3 marks.

- (a) Find the equation of line joining (1, 1) and (2, 2) using determinant method.
- (b) Prove that every square matrix is uniquely expressible as sum of a symmetric matrix and skew symmetric matrix.

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(c) If $A = \begin{bmatrix} 0 & 1 & 2 \\ 1 & 2 & 3 \\ 3 & 1 & 1 \end{bmatrix}$, find adjoint of A.

(d) Evaluate the following limits

(i) $\lim_{x \rightarrow 0} \frac{\tan x}{x}$

(ii) $\lim_{x \rightarrow 0} \frac{\log x}{x}$

(c) State Rolle's theorem and verify it for $f(x) = x^2 + 2$ in $[-2, 2]$.

(f) Differentiate the following functions w.r.t. x,

(i) $(x)^x$

(ii) $(x^2 - 5)^2$

(g) Evaluate integral $\int \frac{x^4}{x^2 + 1} dx$

(h) Find x for which $f(x) = x^5 - 5x^4 + 5x^3 - 1$ is maximum or minimum.

(i) if $\vec{a} = \hat{i} - 2\hat{j} + 3\hat{k}$

$\vec{b} = 2\hat{i} + 3\hat{j} - 5\hat{k}$

find $\vec{a} \times \vec{b}$

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Section -B (Long answer type questions)

Note : Attempt any 2 questions. Each question carries 12 marks.

2. State Cayley - Hamilton theorem and verify it for matrix

$$A = \begin{bmatrix} 0 & 1 & 2 \\ 2 & -3 & 0 \\ 1 & 1 & -1 \end{bmatrix}, \text{ hence find } A^{-1}$$

3. By using Maclaurin's theorem find the first four terms in the expansion of $\log(1 + \sin x)$.

4. If $y = \sin(m \sin^{-1} x)$, then show that

(i) $(1 - x^2)y_2 - xy_1 + m^2y = 0$

(ii) $(1 - x^2)y_{n+2} - (2n+1)xy_{n+1} - (n^2 - m^2)y_n = 0$

5. (i) Find the unit vector perpendicular to the plane of vectors $\vec{a}$ and $\vec{b}$ where $\vec{a} = \hat{i} - \hat{j} + 2\hat{k}$,

$\vec{b} = 2\hat{i} + 3\hat{j} - \hat{k}$

(ii) Find the work done by force $\vec{F} = 2\hat{i} + \hat{j} + \hat{k}$ in moving a particle from point A with position vector $2\hat{i} + 2\hat{j} + 2\hat{k}$ to B with position vector $3\hat{i} + 4\hat{j} + 5\hat{k}$.

Section -C (Long answer type questions)

Note : Attempt any 2 questions. Each question carries 12 marks.

BCA -105 (N)

P.T.O.