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B.Sc. I Semester Degree Examination, March/April - 2023
MATHEMATICS
1 DSC : Fundamentals of Algebra and Calculus
(NEP)

Time : 2 Hours   Maximum Marks : 60

Note : *Answer **all** the sections.*

SECTION - A

Answer the following sub-questions. Each Sub-question carries **one** mark.   **10x1=10**

1. (a) Define symmetric matrix.
    (b) Define characteristic matrix of a square matrix.
    (c) Define system of linear equations.
    (d) Define characteristic vector of a square matrix.
    (e) Write the formula for Arc length in parametric form.
    (f) Write the co-ordinates centre of curvature.

    (g) If $f(x) = \begin{cases} x \cdot \sin \frac{1}{x} & \text{if } x \neq 0 \\ 0 & \text{if } x = 0 \end{cases}$ determine whether $f(x)$ is continuous at $x=0$.

    (h) Evaluate $\underset{x \to 0}{\text{lt}} \left[\dfrac{1 - \cos x}{\sin x} \right]$.

    (i) Find the nth derivative of e^{mx}.

    (j) If $y = e^{m\sin^{-1}x}$ find $\dfrac{dy}{dx}$.

SECTION - B

Answer **any four** of the following questions.   **4x5=20**

2. Find the rank of the matrix $A = \begin{bmatrix} 3 & 5 & 7 \\ 18 & 30 & 42 \end{bmatrix}$.

3. Find the eigen values of the matrices $\begin{bmatrix} 1 & 2 \\ 2 & 1 \end{bmatrix}$.

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4. Derive the formula for angle between the radius vector and the tangent at a point on the curve.

5. Verify the Roll's theorem for the function $f(x) = x^2 - 6x + 8$ in the interval [2, 4].

6. Find the nth derivative of $e^{ax}\cos(bx+c)$.

7. Find the point of inflexion on the curve $x = \log(y/x)$.

SECTION - C

Answer **any three** of the following question. **3x10=30**

8. (a) Verify the Cayley Hamilton theorem for the matrices $\begin{bmatrix} 1 & -2 \\ 3 & 4 \end{bmatrix}$. **6**

(b) If A is a symmetric (skew symmetric) matrix then KA is symmetric where K is scalar. **4**

9. (a) Solve the system of equation. **6**
$x + 2y - 3z = 0$
$3x - y + z = 0$
$5x + 3y + 2z = 0$

(b) Find Eigen vector $\begin{bmatrix} 2 & 2 & 1 \\ 1 & 3 & 1 \\ 1 & 2 & 2 \end{bmatrix}$ associated with value 1. **4**

10. (a) Show that the pedal equation of the ellipse $\dfrac{x^2}{a^2} + \dfrac{y^2}{b^2} = 1$ is **6**

$\dfrac{a^2 b^2}{p^2} + r^2 = a^2 + b^2 .0$

(b) Find the pedal equation of curve $r^m = a^m \cos m\theta$. **4**

11. (a) Expand the function $\log_e(1+x)$ upto term containing x^3 by Maclaurin's expansion. **5**

(b) Evaluate $\underset{x \to \pi/2}{lt}(\sin x)^{\tan x}$. **5**

12. (a) If $y = \left[\log cx + \sqrt{1+x^2}\right]^2$ show that $(1+x^2)y_{n+2} + (2n+1)xy_{n+1} - n^2 y_n = 0$. **6**

(b) Find the nth derivative of $\sin^2 x$. **4**

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