



NP – 099

I Semester B.Sc. Examination, May 2022

(NEP) (Semester Scheme)

(2021-22 and Onwards)

Paper – I : MATHEMATICS (Major)

Algebra – 1 and Calculus – 1

Time : 2½ Hours

Max. Marks : 60

**Instruction** : Answer **all** questions.

## PART – A

I. Answer **any four** questions. (4×2=8)

- 1) State Cayley-Hamilton theorem.
- 2) Find the angle between the radius vector and the tangent to the curve  $r = ae^{9\cot\alpha}$ .
- 3) Find the envelope of the family of lines  $x \cos \alpha + y \sin \alpha = P$ , where  $\alpha$  is a parameter.
- 4) Discuss the continuity of the function  $f(x) = \frac{1}{x-a}$  in  $[-a, a]$ .
- 5) Find the  $n^{\text{th}}$  derivative of  $e^{3x} \sin 5x$ .
- 6) Evaluate  $\lim_{x \rightarrow 0} \frac{1 - \cos x}{x^2}$ .

## PART – B

II. Answer **any four** questions. (4×5=20)

- 7) Find the inverse of the matrix  $\begin{bmatrix} 1 & 2 & 5 \\ 2 & 3 & 1 \\ -1 & 1 & 1 \end{bmatrix}$  by using elementary transformations.
- 8) Solve for consistency :  $x + y + z = 1$ ,  $x + 2y + 3z = 4$ ,  $x + 3y + 5z = 7$ .
- 9) Find the angle of intersection of the curves  $r = a(1 + \cos \theta)$  and  $r = b(1 - \cos \theta)$ .
- 10) Find the Pedal equation of the circle  $x^2 + y^2 = 2ax$ .

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- 11) Discuss the differentiability of the function  $f(x) = \begin{cases} x^2, & x \leq 3 \\ 6x - 9, & x > 3 \end{cases}$  at  $x = 3$ .
- 12) If  $x = \sin t$  and  $y = \cos pt$ , show that  $(1 - x^2)y_{n+2} - (2n + 1)xy_{n+1} - (n^2 - p^2)y_n = 0$ .

## PART - C

III. Answer any four questions.

(4×8=32)

- 13) Verify Cayley-Hamilton theorem for the matrix  $\begin{bmatrix} 2 & -1 & 3 \\ 1 & 0 & 2 \\ 4 & -2 & 1 \end{bmatrix}$  and hence find its inverse.

- 14) Find all the asymptotes of the curve  $y^3 - x^2y + 2y^2 + 4y + 1 = 0$ .

- 15) State and prove Rolle's theorem.

- 16) Trace the curve Astroid  $x^{2/3} + y^{2/3} = a^{2/3}$ ,  $a > 0$ .

- 17) a) Evaluate  $\lim_{x \rightarrow 0} (1 + \sin x)^{\cot x}$ .

- b) Find the value of K such that the rank of the matrix  $\begin{bmatrix} 6 & K & -1 \\ 2 & 3 & 1 \\ 3 & 4 & 2 \end{bmatrix}$  is 2.

- 18) a) Find the  $n^{\text{th}}$  derivative of  $\frac{x}{(x-1)(2x+3)}$ .

- b) For the curve  $y = a \log \sec\left(\frac{x}{a}\right)$ , find  $\frac{ds}{dx}$  and  $\frac{ds}{dy}$ .