



NP – 220

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I Semester B.Sc. Examination, January/February 2025
(NEP) (Repeaters)
MATHEMATICS (Major)
Algebra – I and Calculus – I

Time : 2½ Hours

Max. Marks : 60

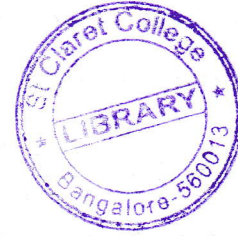
Instruction : Answer all questions.

PART – A

I. Answer **any four** questions.

(4×2=8)

- 1) Define equivalent matrices.
- 2) Find the angle between the radius vector and the tangent to the curve
 $r = a(1 + \sin\theta)$ at $\theta = \frac{\pi}{6}$.
- 3) State Cauchy's mean value theorem.
- 4) Evaluate $\lim_{x \rightarrow 0} \frac{1 - \cos x}{x^2}$.
- 5) State Leibnitz theorem.
- 6) Find the n^{th} derivative of $e^{2x}\sin 5x$.



PART – B

II. Answer **any four** questions.

(4×5=20)

7) Find the inverse of the following matrices by using elementary transformation.

$$\begin{bmatrix} 1 & 2 & 5 \\ 2 & 3 & 1 \\ -1 & 1 & 1 \end{bmatrix}$$

- 8) Solve the following system of equations $x + 2y + 3z = 0$, $2x + 3y + 4z = 0$,
 $7x + 13y + 19z = 0$.
- 9) With usual notation prove that $\tan\phi = r \frac{d\theta}{dr}$ for the polar curve $r = f(\theta)$.
- 10) Find the angle of intersection of the curves $r = a(1 + \cos\theta)$ and $r = b(1 - \cos\theta)$.
- 11) Expand $\tan x$ by using Maclaurin's series upto the term containing x^4 .
- 12) If $y = (x^2 - 1)^n$, show that $(x^2 - 1)y_{n+2} + 2xy_{n+1} - n(n+1)y_n = 0$.

P.T.O.



PART – C

III. Answer **any four** questions.

(4×8=32)

- 13) Verify Cayley Hamilton theorem for the following matrice and hence find its inverse.

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

- 14) For what values of λ and μ the following system of equation has

- 1) No solution
- 2) Infinite number of solution
- 3) Unique solution ?

$$x + y + z = 6, x + 2y + 3z = 10, x + 2y + \lambda z = \mu.$$

- 15) With usual notations prove that the radius of the curvature of the curve

$$y=f(x) \text{ is } \rho = \frac{(1+y_1^2)^{3/2}}{y_2}.$$

- 16) Find all the asymptotes of the curve

$$x^3 + x^2y - xy^2 - y^3 + x^2 - y^2 - 2 = 0.$$

- 17) State and prove Rolle's theorem.

- 18) Trace the curve cardioid $r = a(1 + \cos\theta)$.
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