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B.A./B.Sc. (First Semester) EXAMINATION, 2025-26

MATHEMATICS
(Differential Calculus)
(Major / Minor)

Time : Three Hours] [Maximum Marks : 70

Note :

(i) Attempt any five questions from Section (A) and three questions from Section B.

(ii) Answer each question of Section (A) within 50 words.

(iii) Limit your answer within the given answer book. Additional answer book (B-Answer book) should not be provided.

SECTION – A

Note : Attempt any five question. Each question carries 5 marks.

1. Define limit of a function and show that

$$lim\ [f(x).\ g(x)] = l, m$$

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if $\lim_{x \to a} f(x) = l$

and $\lim_{x \to a} g(x) = m$.

2. Verify Rollc's Theorem for the following function

$$f(x) = 2x^3 + x^2 - 4x - 2$$

3. If $x = a(\cos \theta + Q \sin \theta)$ and

$y = a(\sin \theta - Q \cos \theta)$ then find $\frac{d^2y}{dx^2}$.

4. If $u = \sin^{-1}\left(\frac{x}{y}\right) + \tan^{-1}\left(\frac{y}{x}\right)$, then

evaluate $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y}$.

5. Find the equation of tangent to the

curve $x^{\frac{2}{3}} + y^{\frac{2}{3}} = a^{\frac{2}{3}}$.

6. Find the curvature of the curve $x^3 + y^3 = 3axy$

at the point $\left(\frac{39}{2}, \frac{39}{2}\right)$.

Contd.

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7. Define asymptote of a curve and find the asymptote of the curve $x^3 + y^3 = 3axy$.

SECTION – B

Note : Attempt any three question. Each question carries 15 marks.

8. State Cauhy's mean value theorem and with the help of Caüchy's mean value theorem evaluate

$$\lim_{x \to 1} \left[\frac{\cos \pi \frac{x}{2}}{\log\left(\frac{1}{x}\right)} \right]$$

9. If $y = a \cos (\log x) + b \sin (\log x)$.

Show that $x^2 y_2 + x y_1 + y = 0$ and

$$(2n + 1)x y_{x+1} + (x^2 + 1) y_n = 0.$$

10. Expand the following by Maclaurin's theorem

(a) $\log (1 + \sin x)$

(b) $e^{\sin x}$.

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11. Prove that in the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$, then the length of normal varies inversely as the length of perpendicular from origin to tangent.

12. Trace the curve $y^2(2a-x)=x^3$.

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