

B.A./B.Sc. I - Semester Examination**CBS-1s/12****243689 (S)****MATHEMATICS/APPLIED MATH****Course No. : UMTTC - 101****Time Allowed- 2 ½ Hours****Maximum Marks-80****Part - A**

Note: Attempt ALL the questions in Part- A. Each question in Part-A carries 3 marks. $(5 \times 3 = 15)$

1. Determine the value of A so that the function

$$f(x) = \begin{cases} \frac{1-\cos x}{x^2}, & x \neq 0 \\ A, & x = 0 \end{cases}$$

is continuous at $x = 0$.

2. Find the first order partial derivatives of $\log(x^2 + y^2)$.
 3. Find the envelope of the family of semi-cubical parabolas
 $y^2 - (x + \alpha)^3 = 0$.
 4. Determine the polar co-ordinates of the point $(1, -1)$.
 5. Verify Lagrange's mean value theorem for the function
 $f(x) = 2x^2 - 10x + 29$ in $2 \leq x \leq 7$.

Part - B

Note: Attempt all the questions in Part-B. Each question in Part-B carries 7 marks. $(5 \times 7 = 35)$

6. Show that the function $f(x) = \begin{cases} 1+x, & x \leq 2 \\ 5-x, & x > 2 \end{cases}$ is not differentiable at $x = 2$.

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7. State and prove Euler's theorem for homogeneous functions.
 8. Find the position and nature of the double points of the curve
 $x^4 + x^3 + y^2 - x - 4y + 3 = 0$.
 9. Find the angle between the tangent and the radius vector in the case of the curve $r^n = a^n \sec(n\theta + \alpha)$.
 10. Use Maclaurin's theorem to show that

$$e^x = 1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \dots + \frac{x^{n-1}}{(n-1)!} + \frac{x^n}{n!} e^a, \quad 0 < \theta < 1.$$

Part - C

Note: Attempt any two questions in Part-C. Each question in Part-C carries 15 marks. <https://www.jktopper.com> ($2 \times 15 = 30$)

11. If $y = \log[x + \sqrt{x^2 + 1}]$, find $y_{(0)}$.
 12. Examine the extreme values, if any, of the function
 $f(x, y) = 2x^4 - 3x^2y + y^2$.
 13. Find all the asymptotes of the curve
 $x^3 - x^2y - xy^2 + y^3 + 2x^2 - 4y^2 + 2xy + x + y + 1 = 0$.
 14. Trace the curve $r^2 = a^2 \cos 2\theta$.
 15. State and prove Taylor's theorem with Lagrange's form of remainder.

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