K17U 2547

Reg. No. : .....

Name : .....

I Semester B.C.A. Degree (C.B.C.S.S. – Reg./Supple./Improv.)
Examination, November 2017
(2014 Admn. Onwards)
Complementary Course in Mathematics
1C01 MAT-BCA : MATHEMATICS FOR BCA I

Time : 3 Hours Max. Marks : 40

SECTION – A

All the first **4** questions are **compulsory**. They carry **1** mark **each**.

1. Find the derivative of tanx tanhx.

2. Find $\frac{dy}{dx}$ if $x = 2t + 3$, $y = t^2 - 1$.

3. State Euler's theorem on homogeneous functions.

4. In polar coordinates, what shape is described by $r = k$, where k is a constant ?

(1×4=4)

SECTION – B

Answer **any 7** questions from among the questions **5** to **13**. These questions carry **2** marks **each**.

5. Find the second derivative of $f(x) = \frac{x-1}{x+2}$.

6. Find the derivative of $y = x^{\cos x}$.

7. Find the n^{th} derivative of $f(x) = xe^x$.

8. Find the Maclaurin expansion of tanhx up to powers of x^3.

P.T.O.

9. Let $f(x) = \sqrt{x} - \frac{x}{3}$ on [0, 9]. Verify that the function satisfies all the hypotheses of Rolle's Theorem, then find the values of c that satisfy its conclusion.

10. Find $\lim_{x \to -2} \frac{x+2}{\log(x+3)}$.

11. If $u = x^2 \tan^{-1} \frac{y}{x} - y^2 \tan^{-1} \frac{x}{y}$; $xy \neq 0$, prove that $\frac{\partial^2 u}{\partial x \partial y} = \frac{x^2 - y^2}{x^2 + y^2}$.

12. If $u = \log \sqrt{x^2 + y^2}$, prove that $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$.

13. Find the coordinates of the centre of curvature at (c, c) of the curve $xy = c^2$.

(2×7=14)

SECTION – C

Answer **any 4** questions from among the questions **14** to **19**. These questions carry **3** marks **each**.

14. If $y = e^{-x \cos x}$, prove that $y_4 + 4y = 0$.

15. Find the regions where f is a) increasing b) decreasing : $f(x) = \frac{x}{(1+x)^2}$.

16. Determine $\lim_{x \to 0} (\cos x)^{1/x^2}$.

17. If $u = \log (x^3 + y^3 + z^3 - 3xyz)$, show that $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} + \frac{\partial^2 u}{\partial z^2} = \frac{-3}{(x+y+z)^2}$.

18. Show that the radius of curvature at any point of the catenary $y = c \cosh \frac{x}{c}$ varies as the square of the ordinate.

19. Describe the graph $\theta = \pi/4$ in cylindrical coordinates.

(3×4=12)

SECTION – D

Answer **any 2** questions from among the questions **20** to **23**. These questions carry **5** marks **each**.

20. If $y = \sin(m \sin^{-1} x)$, show that $(1 - x^2)\frac{d^2y}{dx^2} - x\frac{dy}{dx} + m^2y = 0$. Hence expand $\sin m\theta$ in powers of θ.

21. Use Cauchy's mean value theorem to evaluate $\lim_{x \to 1}\left(\frac{\cos\frac{\pi x}{2}}{\log\frac{1}{x}}\right)$.

22. If $ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0$, prove that $\frac{d^2y}{dx^2} = \frac{abc + 2fgh - af^2 - bg^2 - ch^2}{(hx + by + f)^3}$.

23. a) Convert the point $(1, -1, -\sqrt{2})$ from Cartesian to spherical coordinates.

    b) Find an equation in spherical coordinates for the surface $3x^2 - x + 3y^2 + 3z^2 = 0$.

(5×2=10)