Reg. No. : ....

Name : ....

I Semester B.Sc. Degree (CBCSS – Supplementary) Examination, November 2021
(2015 – 2018 Admissions)
COMPLEMENTARY COURSE IN MATHEMATICS
1C01MAT – PH : Mathematics for Physics and Electronics – I

Time : 3 Hours

Max. Marks : 40

SECTION – A

Answer **all** the questions. **Each** question carries **1** mark.

1. Cosh $(x + y)$ = _____.

2. State the Rolle's theorem.

3. What is the condition for partial derivatives f_{xy} and f_{yx} are equal ?

4. Write the equations relating polar and Cartesian coordinates.

SECTION – B

Answer **any seven** questions. **Each** question carries **2** marks.

5. $\dfrac{d}{dx}\left(\tanh^{-1}x\right)$.

6. Find $\dfrac{dy}{dx}$, when $x = a(\cos t + t \sin t)$ and $y = a(\sin t - t \cos t)$.

7. State the Leibnitz's theorem.

8. Let $f(x) = (x - a)(x - b)(x - c)$, $a < b < c$, show that $f'(x) = 0$ has two roots one belonging to $]a, b[$ and other belonging to $]b, c[$.

9. Show that $\lim\limits_{x \to 0} \dfrac{e^x - e^{-x} - 2\log(1 + x)}{x \sin x} = 1$.

10. Evaluate $\lim\limits_{x \to \infty} \dfrac{\log x}{\sqrt{x}}$.

11. Find the first order partial derivatives of $\log(x^2 + y^2)$.

12. If $u = e^{\sin(x+y)}$, find $\dfrac{\partial^2 u}{\partial x^2}$.

13. Define Chord of curvature and write the equation of chord of curvature parallel to y-axis.

SECTION – C

Answer **any four** questions. **Each** question carries **3** marks.

14. Find the nth derivatives of $e^x \sin^2 x$.

15. Prove that $f\left(\dfrac{x^2}{1+x}\right) = f(x) - \dfrac{x}{1+x} f'(x) + \dfrac{x^2}{(1+x)^2} \dfrac{f''(x)}{2!} + \ldots$ using Taylor's theorem.

16. Find the Maclaurin's series expansion of $\sin x$.

17. If $u = 3(lx + my + nz)^2 - (x^2 + y^2 + z^2)$ and $l^2 + m^2 + n^2 = 1$, show that $\dfrac{\partial^2 u}{\partial x^2} + \dfrac{\partial^2 u}{\partial y^2} + \dfrac{\partial^2 u}{\partial z^2} = 0$.

18. For a curve $s^2 = 8ay$, show that the radius of curvature $\rho = 4a\sqrt{\left(1 - \dfrac{y}{2a}\right)}$.

19. Graph the sets of points $1 \le r \le 2$ and $0 \le \theta \le \dfrac{\pi}{2}$ in the polar plane.

SECTION – D

Answer **any two** questions. **Each** question carries **5** marks.

20. If $y = a \cos(\log x) + b \sin(\log x)$, show that $x^2 \dfrac{d^2 y}{dx^2} + x \dfrac{dy}{dx} + y = 0$.

21. Determine $\lim\left(\dfrac{\pi}{2} - x\right)^{\tan x}$ as $x \to \left(\dfrac{\pi}{2} - 0\right)$.

22. In the curve $r^m = a^m \cos m\theta$, prove that $a^{2m} \dfrac{d^2 r}{ds^2} + mr^{2m-1} = 0$.

23. Translate the equation $\rho = 5\cos\phi$ into Cartesian and cylindrical equations.