K17U 2543

Reg. No. : .....

Name : .....

I Semester B.Sc. Degree (CBCSS – Reg./Supple./Improv.) Examination, November 2017

COMPLEMENTARY COURSE IN MATHEMATICS

1C01 MAT-PH : Mathematics for Physics and Electronics – I

(2014 Admn. Onwards)

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 log (cosh x).

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

3. Find $\frac{\partial u}{\partial x}$ of $u = e^{xyz}$.

4. Convert the coordinates $(3, \pi/3, -4)$ from cylindrical to Cartesian. **(1×4=4)**

SECTION – B

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

5. If $x = a(\cos\theta + \theta \sin\theta)$, $y = a(\sin\theta - \theta \cos\theta)$, find $\frac{d^2y}{dx^2}$.

6. Find the n^{th} derivative of $y = \frac{x^2}{(x+2)(2x+3)}$.

P.T.O.

7. If $I_n = \frac{d^n}{dx^n}(x^n \log x)$, prove that $I_n = nI_{n-1} + (n-1)!$

8. Expand log (1 + x) by Maclaurin's theorem.

9. 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).

10. Determine $\lim_{x \to \frac{\pi}{2}} \frac{\tan 3x}{\tan x}$.

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 $u = \tan^{-1} \frac{x^3 + y^3}{x - y}$, $x \neq y$ show that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = \sin 2u$.

13. Find $\frac{dz}{dt}$ when $z = xy^2 + x^2y$, $x = at^2$, $y = 2at$. **(2×7=14)**

SECTION – C

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

14. Expand $2x^3 + 7x^2 + x - 6$ in powers of (x – 2).

15. Separate the intervals in which $f(x) = 2x^3 - 15x^2 + 36x + 1$ is increasing or decreasing.

16. Find $\lim_{x \to 0} \left(\frac{\tan x}{x}\right)^{1/x}$.

17. If u = log $(x^3 + y^3 + z^3 - 3xyz)$, show that $\left(\frac{\partial}{\partial x} + \frac{\partial}{\partial y} + \frac{\partial}{\partial z}\right)^2 u = \frac{-9}{(x+y+z)^2}$.

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. Find the Cartesian equation equivalent to the polar equation, $r = \frac{4}{2\cos\theta - \sin\theta}$ and draw its graph. **(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. Show that $\frac{2}{\pi} < \frac{\sin x}{x} < 1, 0 < x < \frac{\pi}{2}$.

22. Find the evolute of the parabola, $y^2 = 4ax$.

23. Translate the equation $\rho = 5\cos\phi$ into Cartesian and cylindrical equations. **(5×2=10)**