K15U 0585

Reg. No. : .....

Name : .....

I Semester B.Sc. Degree (CCSS-Reg./Supple./Improv.) Examination, November 2015

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 $\sin^{-1}\sqrt{x}$.

2. State Cauchy's mean value theorem.

3. $\lim_{x\to 0} x \log x$ is equal to _____

4. Find $\frac{\partial z}{\partial x}$ if $z = \log(x^2 + y^2)$. **(4×1=4)**

SECTION – B

Answer **any 7** questions from **5** to **13**. They carry **2** marks **each** :

5. If $x^y y^x = 1$, find $\frac{dy}{dx}$.

6. If $y = \sin ax + \cos ax$, prove that $y_n = a^n\sqrt{\{1+(-1)^n \sin 2ax\}}$.

7. If $x = f(t)$ and $y = \phi(t)$, prove that $\frac{d^2y}{dx^2} = \frac{f_1\phi_2 - f_2\phi_1}{f_1^3}$ where suffixes denote differentiation with respect to t.

P.T.O.

8. Discuss the continuity of f at the origin when $f(x) = x \log \sin x$.

9. Find the radius of curvature at any point of the curve $S = 4a\sin\psi$.

10. If $u = \frac{1}{\sqrt{x^2+y^2+z^2}}$; $x^2+y^2+z^2 \neq 0$, show that $\frac{\partial^2 u}{\partial x^2}+\frac{\partial^2 u}{\partial y^2}+\frac{\partial^2 u}{\partial z^2}=0$.

11. Verify Euler's theorem for $z = (x^2 + xy + y^2)^{-1}$.

12. Graph the set of points whose polar coordinates satisfy $r \geq 1$.

13. Find the Cartesian coordinates of the points $(-3, \pi)$ and $(-3, 2\pi)$. **(7x2=14)**

SECTION – C

Answer **any 4** questions from **14** to **19**. They carry **3** marks **each**.

14. Find $\frac{dy}{dx}$ when $x = 3\cos t - 2\cos^3 t$ and $y = 3\sin t - 2\sin^3 t$.

15. Expand $2x^3 + 7x^2 + x - 6$ in powers of $x - 2$.

16. Velocity Rolle's theorem for the function $f(x) = x(x+3)e^{-x/2}$ in $[-3, 0]$.

17. Find 'C' of the mean value theorem if $f(x) = x(x-1)(x-2)$; $x \in \left[0, \frac{1}{2}\right]$.

18. If $u = \frac{x^2y^2}{x^2+y^2}$, show that $x\frac{\partial^2 u}{\partial x^2}+y\frac{\partial^2 u}{\partial y \partial x}=\frac{\partial u}{\partial x}$.

19. Show that for the curve $s^2 = 8ay$, $\rho = 4a\sqrt{\left(1-\frac{y}{2a}\right)}$. **(4x3=12)**

SECTION – D

Answer **any 2** questions from **20** to **23**. They carry **5** marks **each** :

20. If $y = \frac{\sin^{-1}x}{\sqrt{1-x^2}}$ where $-1 < x < 1$ and $-\frac{\pi}{2} < \sin^{-1}x < \frac{\pi}{2}$, prove that $(1-x^2)y_{n+1} - (2n+1)xy_n - n^2y_{n-1} = 0$.

21. Find $\lim_{x\to 0}\frac{1+\sin x-\cos x+\log(1-x)}{x\tan^2 x}$.

22. Find the centre of curvature of the four cusped hypocycloid

$x = a\cos^3\theta$, $y = a\sin^3\theta$.

23. Replace the following polar equations by equivalent Cartesian equations :

a) $r^2 = 4r\cos\theta$

b) $r = \frac{4}{2\cos\theta - \sin\theta}$. **(2x5=10)**