

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. $\lim_{x \rightarrow 0} x \log x$ 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 $\frac{d^2 y}{dx^2} = \frac{f_1 \phi_2 - f_2 \phi_1}{f_1^3}$ where suffixes denote differentiation with respect to t .



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 $(-3, 2\pi)$.

(7×2=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. Verify 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 $u = \frac{x^2 y^2}{x^2 + y^2}$, 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 $s^2 = 8ay$, $\rho = 4a \sqrt{\left(1 - \frac{y}{2a}\right)}$.

(4×3=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 $\lim_{x \rightarrow 0} \frac{1 + \sin x - \cos x + \log(1-x)}{x \tan^2 x}$.

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) $r = \frac{4}{2 \cos \theta - \sin \theta}$.

(2×5=10)
