



K16U 2500

Reg. No. : .....

Name : .....

I Semester B.Sc. Degree (C.C.S.S. – Reg./Supple./Improv.)  
 Examination, November 2016  
**COMPLEMENTARY COURSE IN MATHEMATICS**  
**1C01 MAT-PH : Mathematics for Physics and Electronics – I**  
**(2014 Admn. Onwards)**

Time : 3 Hours

Total Marks : 40

SECTION – A

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

1. What is the derivative of  $\sinh^{-1} x$  ?
2. State Rolle's theorem.
3. Find  $\lim_{x \rightarrow 0} \frac{a^x - b^x}{x}$ .
4. State Euler's theorem on homogeneous functions. (4x1=4)

SECTION – B

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

5. Find the derivative of  $y = x^{\sin x}$ .
6. Expand  $\log(1 + x)$  by Maclaurin's theorem.
7. Find the  $n^{\text{th}}$  derivative of  $y = x^3 \cos x$ .
8. If in the Cauchy's mean value theorem  $f(x) = e^x$  and  $F(x) = e^{-x}$ , show that 'C' is the arithmetic mean between a and b.

P.T.O.



9. Find the radius of curvature at any point of the curve  $s = c \tan \psi$ .
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  $z = ax^2 + 2hxy + by^2$ .
12. Find all the polar coordinates of the point  $P(2, \pi/6)$ .
13. Find the Cartesian coordinate of the points  $(3, 0)$  and  $(-3, \pi)$ . (7×2=14)

## SECTION - C

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

14. If  $y = \cos(m \sin^{-1} x)$ , show that  $(1 - x^2)y_{n+2} - (2n+1)xy_{n+1} + (m^2 - n^2)y_n = 0$ .
15. If  $f\left(\frac{x+y}{2}\right) = \frac{f(x)+f(y)}{2}$ ,  $f'(0) = a$  and  $f(0) = b$ , then find  $f''(x)$  where  $y$  is independent of  $x$ .
16. Prove that for any quadratic function  $px^2 + qx + r$ , the value of  $\theta$  in Lagrange's theorem is always  $1/2$ , whatever  $p, q, r, a, h$  may be.
17. Determine  $\lim_{x \rightarrow 0} (\cot x)^{1/\log x}$ .
18. If  $u = \tan^{-1}\left(\frac{x^3 + y^3}{x - y}\right)$ ,  $x \neq y$ , show that  $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} = \sin 2u$ .
19. Show that for the curve  $s^2 = 8ay$ ,  $\rho = 4a \sqrt{1 - \frac{y}{2a}}$ . (4×3=12)



## SECTION - D

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

20. If  $y^{\cot x} + (\tan^{-1} x)^y = 1$ , find  $\frac{dy}{dx}$ .
21. Discuss the applicability of Rolle's theorem to the function
- $$f(x) = \begin{cases} x^2 + 1, & 0 \leq x \leq 1 \\ 3 - x, & 1 < x \leq 2 \end{cases}$$
22. Obtain the evolute of the parabola  $y^2 = 4ax$ .
23. Find the spherical coordinate equation for the sphere  $x^2 + y^2 + (z - 1)^2 = 1$ . (2×5=10)