



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. **(4×1=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^{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 θ 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)
