



M 7899

Reg. No. :

Name :

I Semester B.Sc. Degree (CCSS – Regular) Examination, Nov. 2014
(2014 Admn.)

COMPLEMENTARY COURSE IN MATHEMATICS
1C01 MAT – PH : Mathematics for Physics and Electronics – I

Time : 3 Hours

Max. Marks : 40

SECTION – A

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

1. Find the n^{th} derivative of e^{5x} .
2. State Rolle's Theorem.
3. Is $\infty + \infty$ an indeterminate form ?
4. Find the first order partial derivatives of $e^{ax} \sin by$. (4×1=4)

SECTION – B

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

5. If $x = e^{-t^2}$ and $y = \tan^{-1} (2t + 1)$, find $\frac{dy}{dx}$.
6. Find the n^{th} derivative of $y = \cos^4 x$.
7. Obtain the expansion of $\log \cos hx$ in powers of x by Maclaurin's theorem.
8. Discuss the continuity at the origin when $f(x) = x \log \sin x$.
9. Verify Euler's theorem for $z = ax^2 + 2hxy + by^2$.

P.T.O.



10. Find the radius of curvature at any point of the curve $s = 4a \sin \frac{1}{3}\psi$.
11. If $u = 3(lx + my + nz)^2 - (x^2 + y^2 + z^2)$ and $l^2 + m^2 + n^2 = 1$, show that $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} + \frac{\partial^2 u}{\partial z^2} = 0$.
12. Graph the set of points whose polar coordinates satisfy the conditions $1 \leq r \leq 2$ and $0 \leq \theta \leq \frac{\pi}{2}$.
13. Find a polar equation for the circle $x^2 + (y - 3)^2 = 9$. (7×2=14)

SECTION - C

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

14. Change the independent variable to θ in the equation $\frac{d^2 y}{dx^2} + \frac{2x}{1+x^2} \frac{dy}{dx} + \frac{y}{(1+x^2)^2} = 0$ by means of the transformation $x = \tan \theta$.

15. Find $y_n(0)$ when $y = \log(x + \sqrt{1+x^2})$.

16. Use Cauchy's mean value theorem to evaluate $\lim_{x \rightarrow 1} \left[\frac{\cos \frac{\pi}{2} x}{\log \left(\frac{1}{x} \right)} \right]$.

17. Prove that for any quadratic function $px^2 + qx + r$, the value of θ in Lagrange's theorem is always $\frac{1}{2}$ whatever p, q, r, a, h may be.



18. Find $f_{xy}(0, 0)$ for the function f given by $f(x, y) = \begin{cases} \frac{xy(x^2 - y^2)}{x^2 + y^2}; & (x, y) \neq (0, 0) \\ 0 & ; (x, y) = (0, 0) \end{cases}$.
19. Prove that if $y^3 - 3ax^2 + x^3 = 0$, then $\frac{d^2 y}{dx^2} + \frac{2a^2 x^2}{y^5} = 0$. (4×3=12)

SECTION - D

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

20. Use Taylor's theorem to prove that $\tan^{-1}(x+h) = \tan^{-1} x + (h \sin z) \frac{\sin z}{1} - (h \sin z)^2 \frac{\sin 2z}{2} + \dots$ where $z = \cot^{-1} x$.
21. Find the value of a and b in order that $\lim_{x \rightarrow 0} \frac{x(1+a \cos x) - b \sin x}{x^3}$ may be equal to 1.
22. Show that the curvature of the point $\left(\frac{3a}{2}, \frac{3a}{2} \right)$ on the folium $x^3 + y^3 = 3axy$ is $\frac{-8\sqrt{2}}{3a}$.
23. Translate the equation $\rho = 6 \cos \phi$ into Cartesian and cylindrical equations. (2×5=10)