M 7899

Reg. No. : SP14CDHR026

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# 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 $1 \le r \le 2$ and $0 \le \theta \le \frac{\pi}{2}$.

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 $\theta$ in the equation

$$\frac{d^2y}{dx^2} + \frac{2x}{1+x^2}\frac{dy}{dx} + \frac{y}{(1+x^2)^2} = 0$$ by means of the transformation $x = \tan\theta$.

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

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

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

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18. Find $f_{xy}(0, 0)$ for the function f given by $f(x, y) = \begin{cases} \dfrac{xy\left(x^2 - y^2\right)}{x^2 + y^2}; & (x, y) \neq (0, 0) \\ 0 \quad ; & (x, y) = (0, 0) \end{cases}$.

19. Prove that if $y^3 - 3ax^2 + x^3 = 0$, then $\dfrac{d^2y}{dx^2} + \dfrac{2a^2x^2}{y^5} = 0$. **(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 $\tan^{-1}(x + h) = \tan^{-1} x + (h \sin z) \dfrac{\sin z}{1}$

$- (h \sin z)^2 \dfrac{\sin 2z}{2} + \ldots$ where $z = \cot^{-1} x$.

21. Find the value of a and b in order that $\lim\limits_{x \to 0} \dfrac{x(1 + a\cos x) - b \sin x}{x^3}$ may be equal to 1.

22. Show that the curvature of the point $\left(\dfrac{3a}{2}, \dfrac{3a}{2}\right)$ on the folium $x^3 + y^3 = 3axy$ is $\dfrac{-8\sqrt{2}}{3a}$.

23. Translate the equation $\rho = 6 \cos \phi$ into Cartesian and cylindrical equations. **(2×5=10)**

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