



K17U 2543

Reg. No. :

Name :

I Semester B.Sc. Degree (CBCSS – Reg./Supple./Improv.) Examination,
November 2017

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 $\log (\cosh x)$.
2. Find $\frac{dy}{dx}$ if $x = 2t + 3, y = t^2 - 1$.
3. Find $\frac{\partial u}{\partial x}$ of $u = e^{xyz}$.
4. Convert the coordinates $(3, \pi/3, -4)$ from cylindrical to Cartesian. **(1×4=4)**

SECTION – B

Answer **any 7** questions from among the questions **5 to 13**. These questions carry **2 marks each**.

5. If $x = a (\cos \theta + \theta \sin \theta), y = a (\sin \theta - \theta \cos \theta)$, find $\frac{d^2 y}{dx^2}$.
6. Find the n^{th} derivative of $y = \frac{x^2}{(x+2)(2x+3)}$.

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7. If $I_n = \frac{d^n}{dx^n}(x^n \log x)$, prove that $I_n = nI_{n-1} + (n-1)!$
8. Expand $\log(1+x)$ by Maclaurin's theorem.
9. Let $f(x) = (x-a)(x-b)(x-c)$, $a < b < c$, show that $f'(x) = 0$ has two roots one belonging to (a, b) and other belonging to (b, c) .
10. Determine $\lim_{x \rightarrow \frac{\pi}{2}} \frac{\tan 3x}{\tan x}$.
11. If $u = x^2 \tan^{-1} \frac{y}{x} - y^2 \tan^{-1} \frac{x}{y}$; $xy \neq 0$, prove that $\frac{\partial^2 u}{\partial x \partial y} = \frac{x^2 - y^2}{x^2 + y^2}$.
12. If $u = \tan^{-1} \frac{x^3 + y^3}{x - y}$, $x \neq y$ show that $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} = \sin 2u$.
13. Find $\frac{dz}{dt}$ when $z = xy^2 + x^2y$, $x = at^2$, $y = 2at$. (2x7=14)

SECTION - C

Answer any 4 questions from among the questions 14 to 19. These questions carry 3 marks each.

14. Expand $2x^3 + 7x^2 + x - 6$ in powers of $(x-2)$.
15. Separate the intervals in which $f(x) = 2x^3 - 15x^2 + 36x + 1$ is increasing or decreasing.
16. Find $\lim_{x \rightarrow 0} \left(\frac{\tan x}{x} \right)^{\frac{1}{x}}$.
17. If $u = \log(x^3 + y^3 + z^3 - 3xyz)$, show that $\left(\frac{\partial}{\partial x} + \frac{\partial}{\partial y} + \frac{\partial}{\partial z} \right)^2 u = \frac{-9}{(x+y+z)^2}$.



18. Show that the radius of curvature at any point of the catenary $y = c \cosh \frac{x}{c}$ varies as the square of the ordinate.
19. Find the Cartesian equation equivalent to the polar equation, $r = \frac{4}{2 \cos \theta - \sin \theta}$ and draw its graph. (3x4=12)

SECTION - D

Answer any 2 questions from among the questions 20 to 23. These questions carry 5 marks each.

20. If $y = \sin(m \sin^{-1} x)$, show that $(1-x^2) \frac{d^2 y}{dx^2} - x \frac{dy}{dx} + m^2 y = 0$. Hence expand $\sin m\theta$ in powers of θ .
21. Show that $\frac{2}{\pi} < \frac{\sin x}{x} < 1$, $0 < x < \frac{\pi}{2}$.
22. Find the evolute of the parabola, $y^2 = 4ax$.
23. Translate the equation $\rho = 5 \cos \phi$ into Cartesian and cylindrical equations. (5x2=10)