



K21U 6558

Reg. No. :

Name :



I Semester B.Sc. Degree (C.B.C.S.S. – Supplementary)

Examination, November 2021

(2017-2018 Admissions)

CORE COURSE IN MATHEMATICS

1B01MAT : Differential Calculus

Time : 3 Hours

Max. Marks : 48

SECTION – A

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

1. If $p(x)$ is a polynomial in x , then $\lim_{x \rightarrow c} p(x) =$.
2. State Sandwich theorem.
3. Write the domain of the function $w = \sqrt{y - x^2}$.
4. Find the equation of the level curve of $f(x, y) = 16 - x^2 - y^2$ that passes through $(2\sqrt{2}, \sqrt{2})$.

SECTION – B

Answer any 8 questions from among the 5 to 14. These questions carry 2 marks each :

5. Show that $D^n \sin(ax + b) = a^n \sin(ax + b + n\frac{\pi}{2})$.
6. Find all the polar coordinates of the point $(2, \frac{\pi}{6})$.
7. Translate the equation $x^2 + y^2 + (z - \frac{1}{2})^2 = \frac{1}{4}$ into cylindrical and spherical coordinate systems.

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8. Find the rectangular and cylindrical coordinates corresponding to $(\sqrt{2}, \pi, \frac{\pi}{2})$.
9. Sketch the set of points whose cylindrical coordinates satisfies $r = 2\cos\theta$.
10. Find the Maclaurin series of $\log(1 + x)$.
11. Show that Rolle's theorem is a particular form of Lagrange's mean value theorem.
12. Find the critical points of the function $f(x) = x^4 - 4x^3 + 4x^2$.
13. Evaluate $\lim_{x \rightarrow 0} (e^x + x)^{\frac{1}{x}}$.
14. Find f_x and f_y if $f(x, y) = \frac{2y}{y + \cos x}$.

SECTION - C

Answer **any 4** questions from among the **15 to 20**. These questions carry **4** marks each :

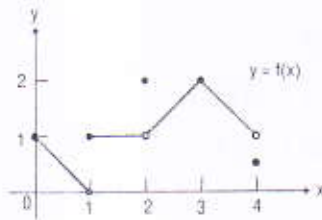
15. If $y = e^{ax}\sin bx$, prove that $y_2 - 2ay_1 + (a^2 + b^2)y = 0$.
16. Show that $\cosh^2 x - \sinh^2 x = 1$.
17. Find the radius of curvature at the point $(\frac{3a}{2}, \frac{3a}{2})$ of the curve $x^3 + y^3 = 3axy$.
18. Prove that $r = a(1 + \cos\theta)$ and $r = b(1 - \cos\theta)$ intersect at right angles.
19. Show that $f(x, y) = \begin{cases} \frac{2xy}{x^2 + y^2} & (x, y) \neq (0, 0) \\ 0 & (x, y) = (0, 0) \end{cases}$ is continuous at every point except the origin.
20. Evaluate $\frac{\partial w}{\partial r}$ and $\frac{\partial w}{\partial s}$ if $w = x + 2y + z^2$, $x = \frac{r}{s}$, $y = r^2 + \log_e s$, $z = 2r$.



SECTION – D

Answer **any 2** questions from among the **21** to **24**. These questions carry **6** marks each :

21. Discuss the continuity of f at $x = 0, 1, 2, 3$ and 4 .



22. Show that the evolute of the cycloid $x = a(\theta - \sin\theta)$, $y = a(1 - \cos\theta)$ is another equal cycloid.

23. Graph the function $y = x^3(8 - x)$.

24. If z be a homogeneous function of x, y of order n , then show that

$$x^2 \frac{\partial^2 z}{\partial x^2} + 2xy \frac{\partial^2 z}{\partial x \partial y} + y^2 \frac{\partial^2 z}{\partial y^2} = n(n-1)z.$$
