



K22U 3419

Reg. No. : .....

Name : .....

I Semester B.Sc. Degree (C.B.C.S.S.– O.B.E. – Regular/Supplementary/  
Improvement) Examination, November 2022  
(2019 Admission Onwards)  
CORE COURSE IN MATHEMATICS  
1B01 MAT : Set Theory, Differential Calculus and Numerical Methods

Time : 3 Hours

Max. Marks : 48

PART – A

Answer **four** questions from this Part. **Each** question carries **one** mark.

1. Define a relation on set of integers.
2. Find the  $n^{\text{th}}$  derivative of  $x^3 + 5x^2 + 3$ .
3. Find the domain of  $\log x$ .
4. State Euler's theorem on homogeneous functions.
5. Let  $w = x^2y + 2y$ . Find  $\frac{\partial w}{\partial x}$  and  $\frac{\partial w}{\partial y}$ .

PART – B

Answer **any eight** questions from this Part. **Each** question carries **two** marks.

6. Define reflexive relation on a set and give an example.
7. Show that the relation  $\leq$ , is a partial relation on set of all real numbers.
8. Give an example of a function which is one-one, but not on-to.
9. Give an example of algebraic and transcendental equation.
10. Find  $\lim_{x \rightarrow 0} f(x)$ , where  $f(x) = \begin{cases} 0 & \text{if } x \geq 0 \\ 1 & \text{if } x < 0 \end{cases}$

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11. Show that  $\lim_{\theta \rightarrow 0} \sin \theta = 0$ .
12. For what values of  $a$  is  $f(x) = \begin{cases} a^2x - 2a, & \text{if } x \geq 2 \\ 12 & \text{if } x \leq 2 \end{cases}$  continuous at every  $x$ ?
13. Describe the domain of the function  $f(x, y) = \sqrt{y - x^2}$ .
14. Find the values of  $\frac{\partial f}{\partial x}$ ,  $\frac{\partial f}{\partial y}$  at the point  $(4, -5)$  if  $f(x, y) = x^2 + 3xy + y - 1$ .
15. Let  $f(x, y) = 2x + 3y - 4$ . Find the slope of the line tangent to this surface at the point  $(2, -1)$  and lying in the plane  $x = 2$ .
16. Find  $\frac{dy}{dx}$  using implicit differentiation, if  $y^2 - x^2 - \sin xy = 0$ .

## PART - C

Answer **any four** questions from this Part. **Each** question carries **four** marks.

17. Show that  $(A \times B) \cap (A \times C) = A \times (B \cap C)$ .
18. Let  $A = \{a, b\}$  and  $B = \{1, 2, 3\}$
- Find number of functions from  $A$  to  $B$
  - Find number of functions from  $B$  to  $A$ .
19. Determine the maximum number of positive and negative roots and intervals of length one unit in which the real roots lie for the following equation  $8x^3 - 12x^2 - 2x + 3 = 0$ .
20. If  $ax^2 + 2hxy + by^2 = 1$ , then show that  $\frac{d^2y}{dx^2} = \frac{h^2 - ab}{(hx + by)^3}$ .
21. Evaluate  $\lim_{x \rightarrow 0} \frac{\sqrt{x^2 + 100} - 10}{x^2}$ .
22. Describe the level surfaces of the function  $f(x, y, z) = \sqrt{x^2 + y^2 + z^2}$ .
23. State mixed partial theorem. Verify it for the function  $w = x \sin y + y \sin x + xy$ .



PART – D

Answer **any two** questions from this Part. **Each** question carries **six** marks.

24. i) Let  $f : \mathbb{R} \rightarrow \mathbb{R}$ , defined by  $f(x) = 2x - 3$ , find the formula for  $f^{-1}$ .
- ii) Consider the function  $f : A \rightarrow B$ ,  $g : B \rightarrow C$ , then prove that if  $g$  of is one-one, then  $f$  is one-one.
25. Find the root correct to two decimal places of the equation  $f(x) = xe^x - \cos x = 0$ , using the method of false position.
26. If  $y^{\frac{1}{m}} + y^{-\frac{1}{m}} = 2x$ , then show that  $(x^2 - 1)y_{n+2} + (2n + 1)xy_{n+1} + (n^2 - m^2)y_n = 0$ .
27. i) Find  $\lim_{(x,y) \rightarrow (0,0)} \frac{x^2 - xy}{\sqrt{x} - \sqrt{y}}$ .
- ii) At what points  $(x, y)$  in the plane are the function  $f(x, y) = \sin \frac{1}{xy}$  is continuous.

