TB2515270 Reg. No :.....

Name :.....

BACHELOR'S DEGREE EXAMINATION, OCTOBER 2025

2025 ADMISSIONS REGULAR

SEMESTER I - MAJOR (MATHEMATICS)

MT1DSCA01B24 - Ground Roots of Mathematics

Time : 1.5 Hours **Maximum Marks : 50**

Part A

Answer all questions. Each question carries 1 mark. **(1x10=10)**

1. Calculate $f(g(0))$ where $f(x) = x + 5$ and $g(x) = x - 9$. [CO1,Understand]
2. Explain one-to-one functions. [CO2,Understand]
3. Describe Identity function. [CO2,Understand]
4. Calculate $(fg)(x)$ where $f(x) = x^3$ and $g(x) = 7x - 2$. [CO2,Apply]
5. $y = \frac{1}{\cos x}$, Determine $\frac{dy}{dx}$ at x = $\frac{\pi}{3}$. [CO3,Apply]
6. Calculate $\frac{dy}{dx}$, if $y = x^2 + sinx$. [CO3,Understand]
7. If $y = x \sin x$, then estimate $\frac{dy}{dx}$ [CO3,Understand]
8. Compare concave up and concave down functions. [CO4,Understand]
9. Identify the critical points of the function $f(x)$, given f '(x) = x (x - 4)^2 [CO4,Understand]
10. The function f(x) = x^2 – 4x +3 is concave up on the interval (-∞, +∞). Interpret. [CO4,Understand]

Part B

Answer any 2 questions from the bunch of CO2. Each question carries 5 mark. **(5x2=10)**

11. Calculate $g \circ f(2)$ and $g \circ g(x)$ if $f(x) = x - 7$ and $g(x) = 8x^2 + 2$. [CO2,Apply]
12. Compute $(f + g)(x), (g + h)(x)$ and $(g - h)(x)$ if $f(x) = x\ h(x) = 2x^2 - 14x + 11$ and $g(x) = x^8 - 6$. [CO2,Apply]
13. Compute $f \circ g(x)$, if $f(x) = x + 19$ and $g(x) = \sqrt{x - 1}$. [CO2,Apply]

Part B

Answer any 2 questions from the bunch of CO3. Each question carries 5 mark. **(5x2=10)**

14. f(x) = (x -1), g(x) = $\frac{1}{x+1}$. Determine $(fog)(x)$ and $(fog)'(x)$. [CO3,Understand]
15. Compute $f'(x)$, if $f(x) = \frac{5-\cos x}{5+\sin x}$. [CO3,Apply]
16. Compute $f'(x)$ if $f(x) = \frac{\sin x}{x^2+\sin x}$. [CO3,Apply]

Part B

Answer any 2 questions from the bunch of CO4. Each question carries 5 mark. **(5x2=10)**

17. Determine the intervals on which the function f(x) = x^2 - 3x + 8 is increasing or decreasing. [CO4,Apply]
18. Deduce the absolute maximum and minimum values of the function f(x) = 4x^2 – 12x + 10 on the interval [1, 5]. [CO4,Analyse]

19. Illustrate that f(x) = x^3- 3x + 3 has a relative minimum at x=1 and a relative maximum at x = -1. [CO4,Analyse]

Part C

Answer any 1 question from the bunch of CO1. Each question carries 10 mark. **(10x1=10)**

20. Let $A = \{1, 2, 6, 7\}$, $B = \{0, 6, 7, 8\}$ and $C = \{1, 4\}$. Estimate the following

    1. $A \times A$
    2. $A \times B$
    3. $B \times C$
    4. $A \times C$
    5. $C \times C$

[CO1,Understand]

21. a. In a library, set A = books that are fiction, Set B = books that are by Indian authors. There are 200 books and among them 80 are fiction, 90 are by Indian authors and 30 are both. Using Venn Diagram estimate and illustrate the following:

    1. Number of books that are fiction but not by Indian authors.
    2. Number of books that are neither fiction nor by Indian authors?

    b. Using Venn Diagram, show that $\overline{A \cup B} = \overline{A} \cap \overline{B}$ [CO1,Understand]