25U111 (Pages: 2) Name : .....

Reg. No : .....

FIRST SEMESTER UG DEGREE EXAMINATION, NOVEMBER 2025

(FYUGP)

(Regular/Supplementary/Improvement)

CC24UMAT1MN103 - BASIC CALCULUS

(Mathematics - Minor Course)

(2024 Admission onwards)

Time: 2.0 Hours Maximum: 70 Marks

Credit: 4

Part A (Short answer questions)

Answer ***all*** questions. Each question carries 3 marks.

1. Find: (i) $\lim_{x\to 1} \frac{x}{x-1}$ (ii) $\lim_{x\to 1} \frac{x+2}{x^2-4}$ [Level:2] [CO2]

2. Check whether $\lim_{x\to 6} \frac{1}{x-6}$ exist or not. [Level:2] [CO2]

3. Simplify the following: (i) $25^{\frac{3}{2}}$ (ii) $(\frac{1}{4})^2 2^6$ [Level:2] [CO1]

4. Find the points at which the function $f(x) = \frac{5}{1-x}$ has discontinuities. [Level:2] [CO2]

5. Differentiate $f(x) = ln\sqrt{x+1}$ [Level:2] [CO3]

6. Given $x^2 + y^2 = 25$, find $\frac{dy}{dx}$. [Level:2] [CO3]

7. Determine the critical points for the function $f(x) = x^3 - 3x^2$. [Level:2] [CO4]

8. For $f(x) = 5 - \frac{4}{x}$, find all values of x in the open interval $(1, 4)$ such that $f'(x) = \frac{f(4) - f(1)}{4 - 1}$. [Level:2] [CO4]

9. State Fundamental Theorem of Calculus. [Level:2] [CO5]

10. Evaluate the definite integral (i)$\int_1^2 (x^2 + 1)\, dx$ (ii)$\int_0^2 e^x\, dx$. [Level:2] [CO5]

(Ceiling: 24 Marks)

Part B (Paragraph questions/Problem)

Answer ***all*** questions. Each question carries 6 marks.

11. Determine whether $h(s) = \frac{1}{s-2} - 3$ has an inverse function .If exist find the same. [Level:2] [CO1]

12. Given $f(x) = 2x$ and $g(x) = x^2 - 1$. Find $f(g(x))$ and $g(f(x))$. Find the Domain and Range of the functions $f(g(x))$ and $g(f(x))$. [Level:2] [CO1]

13. A billiard Ball is dropped from a height of 100 feet. The ball's height s at time t is the position function $s = -16t^2 + 100$, where s is measured in feet and t is measured in seconds. Find the average velocity over the following time interval
(a)$[1, 1.1]$ (b)$[1, 1.5]$ [Level:2] [CO3]

14. Using formal definition of derivatives, evaluate $f'(x)$ for the function $f(x) = 2x^2 + 1$. [Level:2] [CO3]

15. Sate Quotient Rule. Use it to differentiate the function $y = \frac{5x-2}{x^2+1}$. [Level:3] [CO3]

16. Find the open interval on which $f(x) = x^2 - \frac{3}{2}x^2$ is increasing or decreasing. [Level:3] [CO4]

17. Apply second derivative test for the function $f(x) = x^3 - 3x^2 + 3$ to find the relative extrema. [Level:3] [CO4]

18. Find the particular solution for the differential equation $f''(x) = x^{\frac{-3}{2}}$ that satisfies the initial condition $f'(4) = 2, f(0) = 0$. [Level:2] [CO5]

(Ceiling: 36 Marks)

Part C (Essay questions)

Answer any ***one*** question. The question carries 10 marks.

19. Sketch the graph of the function $y = -2x^3 - 6x^2 - 3$. [Level:3] [CO4]

20. (a) Find the average value of $f(x) = 3x^2 - 2x$ on the interval $[1, 4]$. [Level:2] [CO5]
(b) Find the derivative of $F(x) = \int_2^{x^2} \frac{1}{t^3}\, dt$.

(1 × 10 = 10 Marks)

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