

## FIRST SEMESTER UG DEGREE EXAMINATION, NOVEMBER 2024

(FYUGP)

## CC24U MAT1 MN103 - BASIC CALCULUS

(B.Sc. Mathematics - Minor Course)

(2024 Admission - Regular)

Time: 2.0 Hours

Maximum: 70 Marks

Credit: 4

**Part A** (Short answer questions)Answer *all* questions. Each question carries 3 marks.

1. Check whether  $\lim_{x \rightarrow 5} \frac{1}{x-5}$  exist or not. [Level:2] [CO2]
2. Find the Domain and Range of the function  $f(x) = 4x^2$  [Level:2] [CO1]
3. Show that  $f(x) = 5x + 1$  and  $g(x) = \frac{x-1}{5}$  are inverse functions of each other. [Level:2] [CO1]
4. Find the slope of the tangent line to the graph of  $f(x) = x^3 + 2x + 3$  at the point  $(0, 1)$ . [Level:2] [CO3]
5. Find the points at which the function  $f(x) = \frac{6}{x}$  has discontinuities. [Level:2] [CO2]
6. Determine the slope of the tangent line to the graph of  $\frac{x^2}{2} + \frac{y^2}{8} = 1$  at the point  $(1, 2)$ . [Level:2] [CO3]
7. Determine the critical points for the function  $f(x) = x^3 - 3x^2$ . [Level:2] [CO4]
8. State Mean Value Theorem. [Level:1] [CO4]
9. State Mean Value Theorem for Integrals. [Level:2] [CO5]
10. Evaluate the definite integral. [Level:2] [CO5]
  - (a)  $\int_1^2 (x^2 + 1) dx$
  - (b)  $\int_0^2 e^x dx$ .

**(Ceiling: 24 Marks)****Part B** (Paragraph questions/Problem)Answer *all* questions. Each question carries 6 marks.

11. Evaluate the following limits. [Level:2] [CO2]
  - (a)  $\lim_{x \rightarrow 0} \frac{\left(\frac{1}{3+x}\right) - \frac{1}{3}}{x}$
  - (b)  $\lim_{x \rightarrow 4} \frac{\sqrt{x+5} - 3}{x-4}$
  - (c)  $\lim_{x \rightarrow 4} \frac{x-2}{x^2-4}$ .

12. (a) Solve  $2^{2x+3} = 4^{3-x}$ . [Level:2] [CO1]  
 (b) If  $x^y = y^x$  and  $y = 2b$ , show that  $y = 2$
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. Differentiate the function  $y = \left(\frac{3x-1}{x^2+3}\right)^2$ . [Level:2] [CO3]
15. Apply the product rule to calculate the derivative of  $h(x) = (3x - 2x^2)(5 + 4x)$ . [Level:3] []
16. Apply first derivative test to find the intervals on which the function is increasing and decreasing.  
 $f(x) = 2x^3 - 15x^2 - 36x$  [Level:3] [CO4]
17. Determine the open interval on which the graph of  $f(x) = \frac{x^2+1}{x^2-4}$  is concave upward or concave downward. [Level:2] [CO4]
18. Find the particular solution for the differential equation  $f''(e^x) = 2$  that satisfies the initial condition  $f'(0) = 2, f(0) = 5$ . [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  $y = 2x^3 - 6x$ . [Level:3] [CO4]
20. (a) Find the average value of  $f(x) = 4x^2 + x - 3$  on the interval  $[1, 3]$ . [Level:2] [CO5]  
 (b) Find the derivative of  $F(x) = \int_2^{x^2} \frac{1}{t^2} dt$ .

**(1 × 10 = 10 Marks)**

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