

## FIRST SEMESTER (CBCSS—UG) DEGREE EXAMINATION

NOVEMBER 2020

Mathematics

MTS 1C 01—MATHEMATICS—I

(2019 Admissions)

Time : Two Hours

Maximum : 60 Marks

## Section A

*Answer at least eight questions.**Each question carries 3 marks.**All questions can be attended.**Overall Ceiling 24.*

1. A train has position  $x = 3t^2 + 2 - \sqrt{t}$  at time  $t$ . Find the velocity of the train at  $t = 2$ .
2. Find  $\lim_{x \rightarrow 2} \frac{-3x}{x^2 - 4x + 4}$ .
3. Find the slope of the line tangent to the graph of  $f(x) = x^8 + 2x^2 + 1$  at  $(1, 4)$ .
4. Suppose that  $f(t) = \frac{1}{4}t^2 - t + 2$  denotes the position of a bus at time  $t$ . Find and plot the speed as a function of time.
5. Find  $\frac{d^2}{dr^2}(8r^2 + 2r + 10)$ .
6. If  $x^2 + y^2 = 3$ , compute  $\frac{dy}{dx}$  when  $x = 0$  and  $y = \sqrt{3}$ .
7. On what interval is  $f(x) = x^3 - 2x + 6$  increasing or decreasing?

Turn over

8. Use the second derivative test to analyze the critical points of the function  $f(x) = x^3 - 6x^2 + 10$ .
9. Discuss the concavity of  $f(x) = 4x^3$  at the points  $x = -1$  and  $x = 1$ .
10. Find  $\int_2^6 (x^2 + 1) dx$ .
11. Find the area between the graph of  $y = x^2$  and  $y = x^3$  for  $x$  between 0 and 1.
12. Find the average value of  $f(x) = x^2$  on  $[0, 2]$ .

(8 × 3 = 24 marks)

**Section B***Answer at least five questions.**Each question carries 5 marks.**All questions can be attended.**Overall Ceiling 25.*

13. (a) Find  $\frac{d}{dx} \left( \frac{\sqrt{x}}{1 + 3x^2} \right)$ .

(b) Calculate approximate value for  $\sqrt{9.02}$  using linear approximation around  $x_0 = 9$ .

14. Find the equation of the tangent line to the curve  $2x^6 + y^4 = 9xy$  at the point  $(1, 2)$ .
15. Find the slope of the parametric curve given by  $x = (1 + t^3)^4 + t^2$ ,  $y = t^5 + t^2 + 2$  at  $t = 1$ .
16. State mean value theorem. Verify mean value theorem for the function  $f(x) = x^2 - x + 1$  on  $[-1, 2]$ .
17. Find  $\lim_{x \rightarrow 0} \left( \frac{1}{x \sin x} - \frac{1}{x^2} \right)$ .