Roll No. ☐☐☐☐☐☐☐☐☐☐☐☐   Total No. of Pages : 02

Total No. of Questions : 07

B.Sc. (Computer Science) (Sem.–1)
CALCULUS
Subject Code : BCS-102
M.Code : 70879
Date of Examination : 12-01-2023

Time : 3 Hrs.   Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :
 1.   SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
 2.   SECTION-B contains SIX questions carrying TEN marks each and students have to attempt any FOUR questions.

SECTION-A

1.   **Write briefly :**

   a) Define left hand limit of a function with example.

   b) Evaluate : $\lim\limits_{x \to 1} \dfrac{x^{15}-1}{x^{10}-1}$

   c) Give an example of set which is bounded above but not bounded below.

   d) Discuss the continuity of sine function.

   e) Show that the function f given by

$$f(x) = \begin{cases} x^3 + 3, & if \ x \neq 0 \\ 1, & if \ x = 0 \end{cases}$$

   Is not continuous at $x = 0$.

   f) Find the derivative of $2\sqrt{\cosh^2(x^2)}$ with respect to x.

   g) State Maclaurin's theorem.

h) State Leibnitz's theorem.

i) Write a short note on asymptotes.

j) Define concavity with example.

SECTION-B

2. If $f(x) = \begin{cases} mx^2 + n, & x < 0 \\ nx + m, & 0 \le x \le 1 \\ nx^3 = m, & x > 1 \end{cases}$. For what integers m and n does both $\lim\limits_{x \to 0} f(x)$ and $\lim\limits_{x \to 1} f(x)$ exists? And if $\lim\limits_{x \to 1} f(x) = f(1)$ what are the possible values of a and b?

3. State and Prove Cantor theorem on Nested intervals.

4. Find all the points of discontinuity of f define by $f(x) = |x| - |x + 1|$

5. If $x = \sin t$ and $y \sin pt$, then show that $(1 - x^2)\dfrac{d^2y}{dx^2} - x\dfrac{dy}{dx} = p^2y = 0$.

6. Using Taylor's theorem, prove that $x - \dfrac{x^3}{6} < \sin x < x - \dfrac{x^2}{6} + \dfrac{x^5}{120}$ for $x > 0$.

7. Trace the curve whose equation is $y = \dfrac{x^2 + 1}{x^2 - 1}$.