Progressive Education Society's

Modern College of Arts, Science & Commerce Ganeshkhind, Pune – 16 (Autonomous)

End Semester Examination: MAR / APR 2025

***Total No. of Questions**: 3/14* | ***Total No. of Pages**: 2*

F.Y.B.Sc. (Regular)
24MAT12101: Calculus of One Variable
(Semester II)

Program: BscGen03 | **Credits: 2**
Program Specific: Mathematics | **Time: 2 Hours**
Course Type: Core Course | **Max. Marks: 30**
SET: A

Instructions to the candidate:

1) *All questions are compulsory.*
2) *Figures to the right indicate full marks.*
3) *Draw a well labelled diagram wherever necessary.*

Q1) Attempt ANY FOUR of the following. [4 X 2 = 8]

a) Define (a) Modulus function (b) Limit of a function.

b) Find all $x \in \mathbb{R}$ which satisfy $|2x - 3| < 5$.

c) State Boundedness Theorem.

d) Discuss the continuity of the function f(x) if $f(x) = \frac{|x-2|}{x-2}$, $x \neq 2$
$= 0$, $x = 2$.

e) Does the root of the polynomial $f(x) = x^3 - 4x^2 + 7x + 1$ lies in the interval [-1 , 0] ? Justify your answer.

f) Find the maximum value of the function $f(x) = x^3 - 3x$.

Q2) Attempt ANY THREE of the following. [3 X 4 = 12]

a) Find the left hand and right hand limit of $\lim_{x\to 0} \frac{3|x|+2x}{-|x|-4x}$.

b) Sketch the graph of the function $f(x) = \frac{1}{x}$, $x \neq 0$.

c) Suppose that a function f is continuous on the closed interval [a , b] and derivable on the open interval (a , b) and $f'(x) = 0$ for every $x \in (a , b)$ then prove that f is constant on [a , b].

d) Discuss the continuity of the function f(x) defined as

$$f(x) = x \quad , \text{ if } 0 \leq x < \frac{1}{2}$$
$$= 1 - x \quad , \text{ if } \frac{1}{2} \leq x < 1$$
$$= x^2 \quad , \text{ if } 1 \leq x < 2.$$

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e) Verify Cauchy's Mean Value Theorem for the functions $f(x) = x^2$ and $g(x) = x^3$ in the interval [1 , 2]. Hence find the value of c.

Q3) Attempt ANY TWO of the following: [2 X 5 = 10]

a) State and prove Rolle's Theorem.

b) Evaluate $\lim_{x \to 0} \frac{e^x - 1 - x}{\log(1+x) - x}$.

c) Find α , β if the function f(x) is continuous on (-3 , 5) , where

$$f(x) = \begin{cases} x + \alpha , & -3 < x < 1 \\ 3x + 2 , & 1 \le x < 3 \\ \beta + x , & 3 \le x < 5. \end{cases}$$