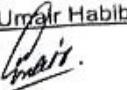




Subjective Part
(To be solved on Answer Books only)

Subject: Calculus and Analytical Geometry
Class: BSCYS-III
Section(s): A, B (Morning Session)
Course Code: MA-110

Time Allowed: 180 Minutes**Max Marks:** 100**Date:** 17-JAN-2026**Time:** 09:00-12:00**FM's Name:** Mr. Umair Habib**FM's Signature:** **INSTRUCTIONS**

- Attempt responses on the answer book only.
- Nothing is to be written on the question paper.
- Rough work or writing on question paper will be considered as use of unfair means.
- Tables/calculators are allowed.

Q1**(CLO-1)****Marks (5+5+5)**

a) Find the domain and range of the given function. $f(x) = \frac{2x-1}{x+4}$

b) Sketch the graph of the following function by using Translation and reflection as appropriate.

$f(x) = 6 - x - x^2$ (NOTE: Sketch all the versions before the final graph).

c) State conditions under which two functions, f & g , will be the inverses of one another, and give at least 3 examples of such functions.

Q2**(CLO-2)****Marks (5+5+5+5)**

a) Discuss the continuity of the function $f(x) = \frac{1}{\sqrt{x}}$ on the interval $[1, 9]$.

b) Interpret the limit. $\lim_{x \rightarrow +\infty} \sqrt{x^6 + 5x^3} - x^3$

c) If $f(x) = \frac{\sin(x) - \sin(1)}{x-1}$. Use the identity $\sin(\alpha) - \sin(\beta) = 2\cos\left(\frac{\alpha+\beta}{2}\right)\sin\left(\frac{\alpha-\beta}{2}\right)$ to describe $\lim_{x \rightarrow 1} f(x)$.

d) Check (demonstrate) whether the function $f(x) = |x|$ is differentiable or not at $x = 0$.

Q3**(CLO-3)****Marks (5+8+5+7)**

a) Calculate the area between the graph of the function f and the interval $[a, b]$.

$f(x) = \sqrt{1 - x^2}; [a, b] = [-1, 1] \text{ & } n = 5$

b) Use Integration by Parts to Solve. $\int e^x \sin(x) \cos(x) dx$

c) Solve the Initial Value Problem $\frac{dy}{dt} = \sec^2 t - \sin t; y\left(\frac{\pi}{4}\right) = 1$

d). Consider x_k^* as the midpoint of each subinterval to calculate the area under the curve $y = f(x)$ over the specified interval. $f(x) = 9 - x^2; [0, 3]$.



(CLO-4)

Marks (10+10)

Q4

- a) Find the radius and height of the right circular cylinder of largest volume that can be inscribed in a right circular cone with radius 6 inches and height 10 inches.

b) Find the point on the graph of the curve $y = 4 - x^2$ which is closest to the point (3,4).

(CLO-5)

Marks (7+13)

Q5

- a) Suppose $f(x)$ is a differentiable function with derivative $f'(x) = (x - 1)^2(x - 2)(x - 4)(x - 5)^4$. Find all critical values of $f(x)$ and determine whether each corresponds to a relative maximum, a relative minimum, or neither.

- b) Sketch a graph of the polynomial and label the coordinates of the intercepts, stationary points, and inflection points. $p(x) = x(x^2 - 1)^2$