ALLAMA IQBAL OPEN UNIVERSITY, ISLAMABAD.

(Department of Mathematics)

WARNING

1. **PLAGLARISM OR HIRING OF GHOST WRITER(S) FOR SOLVING THE ASSIGNMENT(S) WILL DEBAR THE STUDENT FROM AWARD OF DEGREE/CERTIFICATE, IF FOUND AT ANY STAGE.**
2. **SUBMITTING ASSIGNMENTS BORROWED OR STOLEN FROM OTHER(S) ONE'S WILL BE PENLIZED AS DEFINED IN "AIOU PLAGLARISM POLICY"**

Course: Calculus-I (MATH3004) Semester: Spring, 2026
Level: BS Total Marks: 100
Pass Marks: 50

Note: Attempt all questions and each question carries equal marks.

Assignment No. 1
(Unit 1-5)

Question No.1 **[20]**

(a) Determine the intervals of concavity and points of inflection for
$$f(x) = x^4 - 2x^2.$$

(b) Compute the indefinite integral:
$$\int (3x^2 - 4x + 5)\, dx$$

Question No.2 **[20]**

(a) Evaluate $\int_1^4 \left(\cos x - \frac{3}{x^5}\right) dx$

(b) Evaluate $\int_0^4 f(t)dt;\ \ f(t) = \begin{cases} 2t & if\ t > 1 \\ 1 - 3t^2\ if\ t \leq 1 \end{cases}$

Question No.3 **[20]**

(a) Define the domain and range of $f(x) = \frac{1}{x-2}$. Is the function continuous at $x = 2$? Explain.

(b) Sketch the graph of $f(x) = |\ x\ |$. Does it pass the vertical line test? Is it even, odd, or neither?

Question No.4 **[20]**

(a) Evaluate $\lim_{x\to 0} \frac{\sin x}{x}$. Why is this limit important in calculus?

(b) Using first principles, find the derivative of $f(x) = x^2$.

Question No.5 **[20]**

(a) Differentiate $f(x) = \frac{x^2+1}{x}$ using the quotient rule.

(b) Find the critical points of $f(x) = x^3 - 3x$. Use the first derivative test to classify them as local maxima or minima.

Total Marks: 100
Pass Marks: 40

Assignment No. 2
(Unit: 6-9)

Note: Attempt all questions and each question carries equal marks.

Question No.1 **[20]**

(a) Solve $\int xe^x\,dx$ using integration by parts.

(b) Show that $\sinh^2 x - \cosh^2 x = -1$. Compare this identity with the trigonometric identity $\sin^2 x + \cos^2 x = 1$.

Question No.2 **[20]**

(a) Find δy and dy if $y = \sin\sqrt{x^2+1}$ and when x changes from $\frac{\pi}{3}$ to π.

(b) Integrate $\int e^{-3x}\cos 3x\,dx$

Question No.3 **[20]**

(a) Find the area between the curves $y = x^2$ and $y = x + 2$ over the interval $[0, 2]$.

(b) Compute the arc length of $y = \sqrt{x}$ from $x = 0$ to $x = 4$.

Question No.4 **[20]**

(a) Derive the formula for the surface area generated by revolving $y = x^2$ around the x-axis from $x = 0$ to $x = 1$.

(b) Differentiate $f(x) = \ln(x^2 + 1)$ with respect to x.

Question No.5 **[20]**

(a) Evaluate $\int \frac{1}{x^2+1}\,dx$ using trigonometric substitution.

(b) Solve the first-order differential equation:

$$\frac{dy}{dx} = y, y(0) = 2$$

Interpret the solution in terms of exponential growth.