### Important Note

Show all work.
Use of programmable calculators is not allowed.
Mobiles and paging devices should not be carried during examination.

Instructor: F. D. Zaman
Q # 1) Evaluate the line integral \( \int_{C} \mathbf{F} \cdot d\mathbf{R} \) along the line C joining point \( A(2,3,4) \) to \( B(-2,1,2) \) and
\[
\mathbf{F} = -yi + xj + k. \]
Q2) Use Green’s theorem to evaluate \[ \oint_C \mathbf{F} \cdot d\mathbf{R} \] where \( \mathbf{F} = xy^2 \mathbf{i} - x^2 y \mathbf{j} \) and \( C \) : triangle with vertices \( O(0,0), A(3,0) \) and \( B(3,2) \) in anti-clockwise direction. (3)
Q3) Show that the integral $\int_C \mathbf{F} \cdot d\mathbf{R}$ is independent of path and hence evaluate it from $A(1,1)$ to $B(2,3)$ along any path from $A$ to $B$ where

$\mathbf{F} = (3x^2y - \sin x)i + (x^3 + 4y)j$.  

(3)
Q 4) Evaluate the surface integral \[ \iiint_{\Sigma} z \, d\sigma, \] where \( \Sigma \) is the surface \( z = 10 - x^2 - y^2 \), in the first octant for \( 1 \leq z \leq 6 \). (4)
Q5) Use the Divergence theorem to evaluate $\iiint F \cdot N d\sigma$ where

$F = x^2 i - \cos z j + zk$ and $\Sigma : x^2 + y^2 \leq 9, 0 \leq z \leq 3.$  (3)
Q6) (a) Write \( z = \frac{2-i}{4+i} \) in the **standard form** and then in the **polar form**

\[ z = re^{i\theta}. \] What is \( \arg z \)?

(b) Find all points where the Cauchy-Riemann equations are satisfied by

\[ f(z) = \frac{1+z}{z}. \]