

XAVIER INSTITUTE OF ENGINEERING, MAHIM

SE(IT)

APPLIED MATHEMATICS-III

TEST-II

MM-20

NOTE: (1) All questions are compulsory.

(2) Only one sub-question **(a) or (b)** is to be solved for every question.

Q.1 Find the image under the transformation $w = \frac{1}{z}$ (3)
 a) $x^2 + y^2 = 2x$ b) $x = 2y$

Q.2 a) Check the injectivity, surjectivity and hence bijectivity of $f: \mathbb{N} \rightarrow \mathbb{N}$ given by (3)

$$f(n) = \begin{cases} \frac{n+1}{2} & \text{if } n \text{ is odd} \\ \frac{n}{2} & \text{if } n \text{ is even} \end{cases}$$

b) Let $f: \mathbb{R} \rightarrow \mathbb{R}$ be given by $f(x) = x^2 - 1$ (3)
 and $g: \mathbb{R} \rightarrow \mathbb{R}$ be given by $g(x) = 4x^2 + 2$.
 Find $f \circ g$ and $f \circ (g \circ f)$

Q.3 Prove or disprove the following : (4)

a) $\mathcal{P}(A \cup B) = \mathcal{P}(A) \cup \mathcal{P}(B)$ b) $\mathcal{P}(A \cap B) = \mathcal{P}(A) \cap \mathcal{P}(B)$

Q.4 Determine whether the relation is reflexive, symmetric, anti-symmetric and transitive (5)

a) Relation R in \mathbb{R} , $R = \{(a, b) / a \leq b^3\}$

b) Relation R on a set $A = \{1, 2, 3, 4, 5, 6\}$ as
 $R = \{(x, y) / y \text{ is divisible by } x\}$

Q.5 a) Find the bilinear transformation which maps the points (5)
 $z = 1, i, i - 1$ onto the points $w = i, 0, -i$

b) Find the orthogonal trajectories of the curves given by (5)
 $e^{-x}(x \sin y - y \cos y) = c$