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MMT-005

**M. Sc. (MATHEMATICS WITH
APPLICATIONS IN COMPUTER
SCIENCE)**

M. Sc. (MASC)

Term-End Examination

December, 2020

MMT-005 : COMPLEX ANALYSIS

Time : $1\frac{1}{2}$ Hours

Maximum Marks : 25

Note : (i) *Question No. 1 is compulsory.*

(ii) *Attempt any **three** questions from
Question No. 2 to 5.*

(iii) *Use of calculator is not allowed.*

1. State, giving reasons whether the following statements are True or False : $5 \times 2 = 10$

(a) $f(z) = \operatorname{Re} z$ is analytic everywhere.

- (b) There is no Möbius transformation with three or more fixed points.
- (c) $\int \frac{dz}{(z-2)^n} \neq 0$ for all $n \geq 2$ along the circle $|z-2| = r$.
- (d) $z = 0$ is a pole of $e^{1/z}$.
- (e) $\left| \int_C e^z dz \right| \leq 2\pi e$, where C is the unit circle.
2. (a) Find the Laurent series expansion of the function $f(z) = \frac{z}{(z-1)^3(z+3)}$ valid for $|z-1| < 4$. 3
- (b) Find the residue of $f(z) = \frac{\sin z}{z^{2n+1}}$ at $z = 0$. 2
3. (a) Find the analytic function :

$$f(z) = u(x, y) + iv(x, y)$$
if $u(x, y) = e^x \sin y$. Is u harmonic? 3
- (b) Find a conformal map from open half plane $\pi := \{z : \text{Im } z > 0\}$ onto the open unit disc $|z| < 1$. 2

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4. (a) Find all the roots of the equation $\sinh z = i$. 3
- (b) Find the maximum and minimum moduli of $(z^2 - z)$ in the disc $|z| \leq 1$. 2
5. Evaluate $\int_0^\infty \frac{\sin x}{x} dx$ using contour integration. 5