Printed page:3 **Subject Code: AAS0301A**

Roll No: | | | | | | | | | | | | | | |

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute)

Affiliated to Dr. A.P. J. Abdul Kalam Technical University, Uttar Pradesh, Lucknow

Course: B.Tech **Branch: CSE/CS/IT**

Semester: III **Sessional Examination: I** **Year: (2022-2023)**

Subject Name: Eng. Maths III

Time: 1.15 Hours **Max. Marks:30**

General Instructions:

- This Question paper consists of 3 pages & 5 questions. It comprises of three Sections, A, B and C. You are expected to answer them as directed.
- **Section A** -Q. No- 1 is of 1 mark each & Q.No- 2 carries 2 mark each.
- **Section B** – Q. No-3 carries 5 marks each.
- **Section C** -Q. No. 4 & 5 carries 6 marks each.Attempt any one-part *a* or *b*.
- **Blooms Level:** K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create

SECTION – A

[8] CO Blooms level

1. Attempt all parts (4×1=4)

a. $\lim_{z\to 0}\left(\frac{\bar{z}}{z}\right)^2$ (1) CO1 K5

(i) Limit exists

(ii) Limit does not exist

(iii) Limit exists and equal to 1

(iv) None of these

b. If $f(z)=\frac{z}{z^2+9}$ then (1) CO1 K4

(i) $f(z)$ is continuous

(ii) $f(z)$ is discontinuous at $z=\pm 3i$

(iii) $\lim_{z\to i}\frac{z}{z^2+9}=-\frac{i}{8}$

(iv) None of these

c. The value of integral $\int_C (z - z^2)dz$ where C is upper half of circle $C: |z| = 1$ in clockwise direction: (1) CO2 K5

(i) $\frac{2}{3}$ (ii) $-\frac{2}{3}$ (iii) 0 (iv) None of these

d. The value of integral $\int_C \frac{\cos z}{z-\pi} dz$ where (1) CO2 K5

$C: |z - 1| = 3$ in clockwise direction:

(i) $2\pi i$ (ii) $-2\pi i$ (iii) 0 (iv) None of these

2. Attempt all parts (2×2=4)

a. Find the value of p for which the function $f(z) = r^2 cos2\theta + ir^2 sinp\theta$ is analytic. (2) CO1 K3

b. Find the bilinear transformation which maps the points $z = 0,1,\infty$ into the points $w = i,-1,-i$ respectively. (2) CO1 K5

SECTION – B

3. Answer any <u>two</u> of the following- [2×5=10]

a. Examine the nature of the function $f(z) = \frac{x^3y(y-ix)}{x^6+y^2}$, $z \neq 0, f(0) = 0$, prove that $\frac{f(z)-f(0)}{z} \to 0$ as $z \to 0$ along any radius vector but not as $z \to 0$ in any manner and also that $f(z)$ is not analytic at $z = 0$. (5) CO1 K4

b. Find the image of $|z - 1| = 1$ under the transformation $w = \frac{1}{z}$. (5) CO1 K5

c. Discuss the analyticity of function $f(z) = \cos \bar{z}$ in entire complex plane. (5) CO1 K3

SECTION – C

4 **Answer any one of the following-** [2×6=12]

a. If $w = \varphi + i\psi$ represent the complex potential for an electric field and $\psi = x^2 - y^2 + \frac{x}{x^2+y^2}$. Determine the function φ. (6) CO1 K5

b. Evaluate $\int_C \frac{z-1}{(z+1)^2(z-2)} dz$ where $C: |z-i| = 2$. (6) CO2 K5

5. **Answer any one of the following-**

a. Determine an analytic function $f(z) = u + iv$ in terms of z if $u - v = \frac{e^{-y} - \cos x + \sin x}{\cosh y - \cos x}$ and $f\left(\frac{\pi}{2}\right) = \frac{3-i}{2}$. (6) CO1 K5

b. Find an analytic function $f(z)$ in terms of z if $Re[f'(z)] = 3x^2 - 4y - 3y^2$ and $f(1+i) = 0$ & $f'(0) = 0$. (6) CO1 K5

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SECTION – A [8] CO

1. Attempt all parts (4×1=4)

a. Residue at $z = 0$ of the function $f(z) = z^2 \sin\frac{1}{z}$ is (1) CO2

(i) $-1/6$ (ii) $1/6$ (iii) 0 (iv) None of these

b. The value of $\int_C \frac{z\,dz}{\sin z}$ where C: $|z| = 4$ is (1) CO2

(i) -1
(ii) $1/2$
(iii) 0
(iv) None of these

c. The region of validity for Taylor's series about $z = 0$ of the function $f(z) = e^z$ is (1) CO2

(i) $|z| = 0$
(ii) $|z| < 1$
(iii) $|z| < \infty$
(iv) None of these

d. If $f(x)$ is continuous on $[a\ b]$ and $f(a).f(b) < 0$ then $f(x)$ has — CO4

(i) Exactly one root in $[a\ b]$
(ii) At-least odd numbers of root in $[a\ b]$
(iii) At-least ~~odd~~ odd numbers of root in $[a\ b]$
(iv) None of these

2. Attempt all parts (2×2=4)

a. State Cauchy Residue Theorem. (2) CO2

b. State Liouville's Theorem. (2) CO2

SECTION – B

3. Answer any two of the following- [2×5=10]

a. Find the root of an equation $3x - log_{10}x = 6$ correct to 4 decimal places by newton Raphson method. (5) CO4

b. Discuss the type of singularity of the following functions: (5) CO2

(i) $f(z) = \frac{z-sinz}{z^5}$ at $z = 0$

(ii) $f(z) = tan\frac{1}{z}$ at $z = 0$

c. Evaluate $\int_C \frac{1}{z^2(z^2-4)e^z} dz$ where C is $|z| = 1$. (5) CO2

SECTION – C

4 Answer any one of the following- [2×6=12]

a. Expand $f(z) = \frac{z+4}{(z-1)^2(z+3)}$ (6) CO2

(i) $0 < |z-1| < 4$
(ii) $|z-1| > 4$

b. Apply calculus of residues to evaluate: $\int_0^\infty \frac{\cos ax}{x^2+1} dx, a \geq 0.$ (6) CO2

5. **Answer any <u>one</u> of the following-**

a. Find the real root of an equation $x^3 - 2x + 5 = 0$ correct to 4-d places by method of false position. **(6) CO4**

b. Evaluate $\int_0^{2\pi} \frac{1}{3-2\cos\theta+\sin\theta} d\theta$ using contour integration. **(6) CO2**