Printed Page:- 04 **Subject Code:- AAS0301B**

Roll. No:

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech

SEM: III - THEORY EXAMINATION (2024- 2025)

Subject: Engineering Mathematics-III

Time: 3 Hours **Max. Marks: 100**

General Instructions:

IMP: *Verify that you have received the question paper with the correct course, code, branch etc.*

1. *This Question paper comprises of* ***three Sections -A, B, & C.*** *It consists of Multiple Choice Questions (MCQ's) & Subjective type questions.*

2. *Maximum marks for each question are indicated on right -hand side of each question.*

3. *Illustrate your answers with neat sketches wherever necessary.*

4. *Assume suitable data if necessary.*

5. *Preferably, write the answers in sequential order.*

6. *No sheet should be left blank. Any written material after a blank sheet will not be evaluated/checked.*

SECTION-A 20

1. Attempt all parts:-

1-a. Bilinear Transformation preserve the cross ratio of _____ points. (K1,CO1) 1

(a) 1

(b) 3

(c) 4

(d) None of these

1-b. Analytic function is also known as (K1,CO1) 1

(a) Regular function

(b) Orthogonal Transformation

(c) Affine Function

(d) None of these

1-c. The value of the integral $\int_C \frac{dz}{z-a}$ where C is the circle $|z-a|=r$ (K1,CO2) 1

(a) $2\pi i$

(b) $\frac{\pi i}{2}$

(c) $-\pi i$

(d) None of these

1-d. $\int_0^i idz$ is equal to (K3,CO2) 1

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(a) $i - 1$

(b) i^2

(c) $-i$

(d) None of these

1-e. Solution of PDE r-4s+4t=0 is: (K3,CO3) 1

(a) $Z=f_1(y+2x)+xf_2(y+2x)$

(b) $Z=f_1(y-2x)+xf_2(y-2x)$

(c) $Z=f_1(y-2x)+f_2(y+2x)$

(d) None of these

1-f. Classification of pde: $u_{xx} + 2u_{xt} + u_{tt} = 0$ is: (K3,CO3) 1

(a) Parabolic

(b) Hyperbolic

(c) Elliptic

(d) None of these

1-g. $\mathbf{Z-Transform\ of\ sequence\ \{ab^k\}\ is}$ (K3,CO4) 1

(a) $\mathbf{a\frac{z}{z-b}}$

(b) $\mathbf{b\frac{z}{z-a}}$

(c) $\mathbf{a\frac{z}{z-a}}$

(d) None of these

1-h. **Fourier Transform of F(x) is define as−** (K1,CO4) 1

(a) $\int_{-\infty}^{\infty} F(x)\, e^{ipx}\, dx$

(b) $\int_{-\infty}^{\infty} F(x)\, e^{ix}\, dx$

(c) $\int_{-\infty}^{\infty} F(x)\, e^{ip}\, dx$

(d) None of these

1-i. Angle between the two hands of a clock at 10.25 pm will be.....(K3,CO5) 1

(a) 120°

(b) 146.5°

(c) 162.5°

(d) None of these

1-j. Raj swims 26 km downstream in same time as 14 km upstream. If speed of stream is 3 km/hr then his speed in still water is .....(K3,CO5) 1

.

(a) 10 km/hr

(b) 12 km/hr

(c) 7 km/hr

(d) None of these

2. Attempt all parts:-

2.a. Find the fixed points under the transformation $w = \frac{2z-5}{z+4}$. (K3,CO1) 2

2.b. Evaluate: $\oint_C \frac{e^{-z}}{z} dz \; ; \; C \equiv |z| = 1.$ (K3,CO2) 2

2.c. Write the solution of $1-d$ wave equation. (K1,CO3) 2

2.d. Write the change of scale property of Fourier Transform. (K1,CO4) 2

2.e. Two pipes A and B can fill a tank in 24h and 30 h respectively. If both the pipes are opened simultaneously in the empty tank, how much time will be taken by them to fill it? (K3,CO5) 2

SECTION-B 30

3. Answer any five of the following:-

3-a. Find the bilinear transformation which maps the points $z = 0, 1, \infty$ into the points $w = i, -1, -i$ respectively . (K3,CO1) 6

3-b. Calculate the value of a, b and c such that the function $f(z) = (-x^2 + xy + y^2) + i(ax^2 + bxy + cy^2)$ is analytic. (K3,CO1)) 6

3-c. Evaluate $\oint_C \frac{e^{2z}}{(z-1)(z-2)} dz \; ; \; C \equiv |z| = 3.$ (K3,CO2) 6

3-d. Discuss the nature of singularity of $f(z) = \frac{(z - \sin z)}{z^3}$ at $z = 0$. (K3,CO2) 6

3.e. Solve the PDE: $(D - D' - 1)(D - D' - 2)z = \sin(2x + 3y)$ (K3,CO3) 6

3.f. Find the inverse $Z-$transform of $F(z) = \frac{z}{z^2 + 7z + 10}$. (K3,CO4) 6

3.g. Prove that the calendar for the year 2003 will serve for the year 2014.(K3,CO5) 6

SECTION-C 50

4. Answer any one of the following:-

4-a. Show that $e^x \cos y$ is a harmonic function, find the analytic function of which it is real part. (K3,CO1) 10

4-b. Examine that the function $f(z) = \left\{ \frac{x^3(1+i) - y^3(1-i)}{x^2 + y^2}, \quad z \neq 0 \right\}, \; f(0) = 0,$ is analytic or not analytic at origin. (K3,CO1) 10

5. Answer any one of the following:-

5-a. Expand the 10

$f(z)=\frac{z+4}{(z+3)(z-1)^2}$ in the following region (K3,CO2)

1. $0<|z-1|<4$
2. $|z-1|>4$

5-b. **Determine the poles of the following function and residues at each poles:** 10

$f(z)=\frac{z^2}{(z-1)^2(z+2)}$ **and hence evaluate** $\int_C f(z)\,dz$ **where C is the circle** $|z|=3$.

(K3,CO2)

6. Answer any one of the following:-

6-a. Solve by the method of separation of variables: 10

$\frac{\partial u}{\partial x}+4\frac{\partial u}{\partial t}=3u,\ u=3e^{-x}-e^{-5x}$, when t=0. (K3,CO3)

6-b. Solve the PDE: $(D^2-7DD'+6D'^2)z=\sin(x+2y)+e^{3x+y}$ (K3,CO3). 10

7. Answer any one of the following:-

7-a. **Find Fourier cosine transform of** $\frac{1}{1+x^2}$ **and hence find the Fourier sine transform of** $\frac{x}{1+x^2}$. 10

(K3,CO4)

7-b. **Solve by** $z-$**transform:** $y_{k+2}-3y_{k+1}+2y_k=0;\ y_0=0,\ y_1=1.$ (K3,CO4) 10

8. Answer any one of the following:-

8-a. Six friends are sitting in a circle and are facing the center of the circle. Deepa is between Prakash and Pankaj. Priti is between Mukesh and Lalit. Prakash and Mukesh are opposite to each other. 10

(i)Who is sitting right to Prakash ? (ii) Who is just right to Pankaj ? (iii) Who are the neighbors of Mukesh ? (iv) Who is sitting opposite to Priti ? (K3,CO5)

8-b. (i)A can complete a certain work in 4 minutes, B in 5 minutes, C in 6 minutes, D in 10 minutes and E in 12 minutes. Find the average number of units of work completed by them per minute? 10

(ii)A can finish a work in 18 days and B can do the same work in half the time taken by A. Then, working together, Find the part of the same work they can finish in a day? (K3,CO5)