Printed Page:-04 **Subject Code:- AAS0401B**

Roll. No:

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech

SEM: IV - THEORY EXAMINATION (2023 - 2024)

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. Centre & radius of the circle $|z+2-i| = 2$ are: (CO1) 1

(a) $-2+i$, 2

(b) $-i$, 2

(c) $2-i$, 2

(d) 2 , 2

1-b. Which of the following condition implies for analytic function $f(z) = u + iv$ is constant? (CO1) 1

(a) u is constant

(b) v is constant

(c) Both A and B

(d) None of These

1-c. If there is no pole inside and on the contour, then the value of integral is (CO2) 1

(a) ∞

(b) 0

(c) -1

(d) None of these

1-d. The singular points of $f(z) = \frac{1}{z(z-1)^2}$ are: (CO2) 1

(a) 0,1,-1

(b) 0,1,1

(c) 1,-1

(d) None of these

1-e. The solution of PDE: $D'(D^2 - 2DD' + D'^2)Z = 0$ (CO3) 1

(a) $z = f_1(y) + f_2(y+x) + xf_3(y+x)$

(b) $z = f_1(y) + f_2(y+x) + xf_3(y+x)$

(c) $z = f_1(y+x) + f_2(y+x)$

(d) None of these

1-f. In one dimensional heat flow , the condition on temperature is: (CO3) 1

(a) Temperature always increases

(b) Temperature decreases as time increase

(c) Temperature always decreases

(d) Temperature remains same

1-g. $Z-\text{Transform of } f(k) = \frac{1}{k}, k \geq 1$. (CO4) 1

(a) e^z

(b) $e^{1/z}$

(c) $\log\left(\frac{z}{z-1}\right)$

(d) e^{-z}

1-h. Order of the difference equation $y_{k+2} + y_{k+1} - y_k = 0$ is: (CO4) 1

(a) 3

(b) 2

(c) 1

(d) 0

1-i. X, Y and Z complete a work in 6 days. X or Y alone can do the same work in 16 days. In how many days Z alone can finish the same work? (CO5) 1

(a) 12

(b) 16

(c) 24

(d) 36

1-j. A boatman rows 1 km in 5 minutes, along the stream and 6 km in 1 hour against the stream. The speed of the stream is : (CO5) 1

(a) 3 kmph

(b) 6 kmph

(c) 10 kmph

(d) 12 kmph

2. Attempt all parts:-

2.a. Check that the $\lim_{z \to 0} \frac{\bar{z}}{z}$ is exists or not ? (CO1) 2

2.b. Expand $\sin(z)$ about $z = \frac{\pi}{4}$. (CO2) 2

2.c. Find the P.I. of $(D^2 - D'^2)z = \cos(x+y)$. (CO3) 2

2.d. State the change of scale property of Z-Transform. (CO4) 2

2.e. A motor boat can travel at 10 km/hr in still water. It travelled 91 km downstream in a river a then returned taking altogether 20 hours. Find the rate of flow of river. (CO5) 2

SECTION B **30**

3. Answer any <u>five</u> of the following:-

3-a. Determine an analytic function $f(z)$ in terms of z whose real part is $e^{-x}(x\sin y - y\cos y)$. (CO1) 6

3-b. Find the bilinear transformation which maps the points $z = 0, -1, i$ into the points $w = i, 0, \infty$ respectively. Also, find the image of unit circle $|z| = 1$. (CO1) 6

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

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

3.e. Solve the PDE: $4r - 4s + t = 16\log(x + 2y)$. (CO3) 6

3.f. Find the Fourier sine and cosine transform of $F(x) = 2e^{-5x} + 5e^{-2x}$. (CO4) 6

3.g. Two trains start at the same time form A and B and proceed toward each other at the speed of 75 km/hr and 50 km/hr respectively. When both meet at a point in between, one train was found to have travelled 175 km more than the other. Find the distance between A and B? (CO5) 6

SECTION C **50**

4. Answer any <u>one</u> of the following:-

4-a. If $f(z) = u + iv$ is an analytic function of z and $u + v = (x+y)(2 - 4xy + x^2 + y^2)$, then find u and v and the function . (CO1) 10

4-b. Show that the transformation $w = i\left(\frac{1-z}{1+z}\right)$ transform the circle $|z| = 1$ onto the real axis of the w-plane and the interior of the circle into the upper half of the w-plane. (CO1) 10

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

5-a. Evaluate $\int_0^{1+i} (x^2 - iy)dz$ along the following paths: 10

(i) $y = x$

(ii) $y = x^2$ (CO2)

5-b. Evaluate $\int_C \frac{z^2+1}{z^2-1} dz$, where C is circles: 10

(i) $|z| = 3/2$

(ii) $|z-1| = 1$

(iii) $|z| = 1/2$ (CO2)

6. Answer any <u>one</u> of the following:-

6-a. Solve $(D^2 - 2DD' - 15D'^2)z = 12xy$. (CO3) 10

6-b. Solve: $s + p - q = z + xy$. (CO3) 10

7. Answer any <u>one</u> of the following:-

7-a. Solve by z – transform: $y_{k+2} - 6y_{k+1} + 8y_k = 2^k + 6k$. (CO4) 10

7-b. Find Fourier cosine transform of $\frac{1}{1+x^2}$ and hence find the Fourier sine transform of $\frac{x}{1+x^2}$. (CO4) 10

8. Answer any <u>one</u> of the following:-

8-a. **(i)** A car takes 15 minutes less to cover a distance of 75 km, if it increases its speed by 10 km/hr from its usual speed. How much time would it take to cover a distance of 300 km using this speed? 10

(ii) Two men starting from the same place walk at the rate of 5 kmph and 5.5 kmph respectively. What time will they take to be 8.5 km apart, if they walk in the same direction? (CO5)

8-b. **(i)** What was the day of the week on 17th June, 1998? (CO5) 10

(ii) London time is five and a half hours behind Delhi time. What time is it in London if it is 02:35 in Delhi?