

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech (ME-Working Professional)

SEM: II - 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. Solution of the equation $DD'z=0$ is...: (CO1,K2)

1

(a) $z = f_1(0) + f_2(x)$

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

(c) $z = f_1(y) + f_2(0)$

(d) None of these

1-b. The partial differential equation $\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}$ is of type: (CO1,K3)

1

(a) Parabolic

(b) Elliptic

(c) Hyperbolic

(d) None of these

1-c. The Fourier cosine transform of $\frac{\partial^2 u}{\partial x^2}$ is given by (CO2,K1)

1

(a) $\left(\frac{\partial u}{\partial x}\right)_{x=0} - p^2 \bar{u}_c$

(b) $-\left(\frac{\partial u}{\partial x}\right)_{x=0} - p^2 \bar{u}_c$

(c) $-\left(\frac{\partial u}{\partial x}\right)_{x=0} - \bar{u}_c$

(d) $-\left(\frac{\partial u}{\partial x}\right)_{x=0} - p^2$

1-d. The Fourier Sine transform of $\frac{\partial^2 u}{\partial x^2}$ is given by: (CO2,K1)

1

(a) $pu_{(x=0)} + p^2 \bar{u}_s$

(b) $pu_{(x=0)} - p^2 \bar{u}_s$

(c) $-\left(\frac{\partial u}{\partial x}\right) + p^2 \bar{u}_s$

(d) $-\left(\frac{\partial u}{\partial x}\right) + p^2 \bar{u}_c$

1-e. A function $f(x,y)$ which possesses continuous partial derivatives of the first and second orders is called a harmonic function if it satisfies (CO3,K1)

1

(a) Heat equation

(b) Wave equation

(c) Laplace equation

(d) None of these

1-f. The function $f(z) = \bar{z}$ is... (CO3,K3)

1

(a) Analytic everywhere

(b) Analytic nowhere

(c) Analytic at origin

(d) None of these

1-g. In essential singularities, principle part of Laurent's series contains ----(CO4,K1)

1

(a) Finite no of terms

(b) Infinite no of terms

(c) No terms

(d) None of these

1-h. Value of the integral $\int_C (x+y)dx + (x^2y)dy$, along $y = x^2$ is having (0,0), (3,9) end points is (CO4,K3)

1

(a) 256

(b) 256.5

(c) 257.10

(d) NONE

1-i. Probability of getting doublet when throwing two dice is... (CO5,K2)

1

(a) 1/6

(b) 1/2

- (c) $2/36$
 (d) None of these

1-j. The number of triangles in the given figure are... .(CO5,K3)



- (a) 12
 (b) 18
 (c) 22
 (d) 26

2. Attempt all parts:-

- 2.a. Solve the P.D.E $(DD' + aD + bD' + ab)z = 0$. (CO1,K3) 2
- 2.b. Find the Fourier sine transform of the function $F(x) = \begin{cases} k, & x < a \\ 0 & x > a \end{cases}$. (CO2, K3) 2
- 2.c. Find the image of $x = 2$ under the transformation $w = 1/z$. (CO3,K3) 2
- 2.d. Expand the function $f(z) = \frac{e^z}{(z-1)^3}$ about $z = 1$. (CO4,K3) 2
- 2.e. Find the sum of first 10 perfect cubes? (CO5,K3) 2

SECTION-B

3. Answer any five of the following:-

- 3.a. Solve: $(D^2 + 5DD' + 6D'^2) z = \frac{1}{(y-2x)}$. (CO1, K3) 6
- 3.b. Solve the following PDE by method of separation of variables:
 $\frac{\partial u}{\partial x} = 2 \frac{\partial u}{\partial t} + 2u$, given that $u(x,0) = 6e^{(-3x)}$. (CO1,K3) 6
- 3.c. Find the Z - transform of given sequence (CO2,K3) 6
- $$f(k) = \begin{cases} \frac{1}{3^k}, & k \geq 0 \\ (-2)^k, & k \leq -1 \end{cases}$$
- 3.d. Find inverse z-transform of $f(z)$ by using residue method: (CO2, K3) 6
- $$\frac{z}{(z-1)(z-2)}$$
- 3.e. Find the bilinear transform which maps the points $z = 0, -1, i$ into the points $w = i, 0, \infty$ respectively. (CO3,K3) 6
- 3.f. Evaluate by Cauchy's integral formula $\oint_C \frac{(2z+1)}{z(z+1)} dz$, 6
- where C is the circle $z = 1/2$ (CO4,K3)

- 3.g. Statements: Some tables are T.V. Some T.V. are radios. 6
 Conclusions:
 1. Some tables are radios.
 2. Some radios are tables.
 3. All the radios are T.V.
 4. All the T.V. are tables.
 Justify your answer. (CO5,K3)

SECTION-C

4. Answer any one of the following:-

4-a. Solve: $4 \frac{\partial^2 u}{\partial x^2} - 4 \frac{\partial^2 u}{\partial x \partial y} + \frac{\partial^2 u}{\partial y^2} = 16 \log(x+2y)$. (CO1,K3) 10

- 4-b. A string is stretched and fastened to two points L apart. Motion is started by displacing the string in the form $y(x,t) = A \sin \frac{\pi x}{L}$ from which it is released at time $t=0$. Show that the displacement of any point at a distance x from one end at time t is given by:
 $y(x,t) = A \sin \frac{\pi x}{L} \cos \frac{\pi c t}{L}$ (CO1,K3) 10

5. Answer any one of the following:-

5-a. Solve by Z-transform: $y_{k+2} - 3y_{k+1} + 2y_k = 0$, Given: $y(0) = 0, y(1) = 1$. (CO2, K3) 10

5-b. Find the Fourier cosine transform of e^{-x^2} . (CO2,K3) 10

6. Answer any one of the following:-

6-a. Examine the nature of the function $f(z) = \frac{x^3 y (y - ix)}{(x^6 + y^2)}$, $z \neq 0$ and $f(0) = 0$ in the region including the origin. (CO3,K3) 10

6-b. If $f(z)$ is an analytic function then prove that (CO3,K3) 10
 $\left(\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2} \right) |Re f(z)|^2 = 2f'(z)^2$, where $f(z) = (u + iv)$

7. Answer any one of the following:-

7-a. Verify Cauchy's integral theorem for the function $f(z) = z^2$ along the boundary of the square with the vertices at the points $1+i, -1+i, 1-i$ and $-1-i$. (CO4,K3) 10

7-b. Evaluate the residues of $\frac{z^2}{(z-1)(z-2)(z-3)}$ at $z=1, 2, 3$ and infinity and show that their sum is zero (CO4, K3) 10

8. Answer any one of the following:-

8-a. Solve the following (CO5, K3) 10
 (i) If the number $3422213pq$ is divisible by 99, find the missing digits p and q.
 (ii) Find the remainder when $(397)^{3589} + 5$ is divided by 398.

8-b. Solve the following (CO5)

10

1. Write the solution set of the equation $x^2 - 9 = 0$ in roster form.
2. Write the set $A = \{1, 8, 27, \dots\}$ in set-builder form.
3. Prove that set A and Set B are equal if A is the set of letters in "ALLOY" B is the set of letters in "LOYAL"

REG: JAN_JUN-2025