Printed Page:- 04 **Subject Code:- BAS0301B**
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. Solution of the P.D.E $(D^2-3DD'+2D'^2)z=0$:(CO1,K1) 1

(a) $f_1(x-y)+f_2(2x-y)$
(b) $f_1(y-x)+f_2(2x+y)$
(c) $f_1(y+x)+f_2(y+2x)$
(d) $f_1(y+x)+f_2(y-2x)$

1-b. Solution of the P.D.E *(D+2D')(D-D'-1)z=0* (CO1,K1) 1

(a) $f_1(x+y)+f_2(2x-y)$
(b) $f_1(y-2x)+e^x f_2(y+x)$
(c) $f_1(y-2x)+x f_2(y+x)$
(d) $f_1(y+2x)+e^x f_2(y+x)$

1-c. The inverse Z − transform of $F(z)=\frac{z}{(z-2)}$ is: (CO2,K1) 1

(a) $2^{(k+1)}$
(b) 3^k
(c) $2^{(-k)}$
(d) 2^k

1-d. If $f_1(p)$ and $f_2(p)$ are the Fourier transform of $F_1(x)$ and $F_2(x)$ the $F\{c_1F_1(x)+c_2F_2(x)\}$ is (CO2,K1) 1

(a) $c_1 f_1(p) - c_2 f_2(p)$

(b) $c_1 f_1(p) + c_2 f_2(p)$

(c) $c_2 f_1(p) + c_1 f_2(p)$

(d) None of these

1-e. f(z) satisfies Cauchy Rinmanns equations everywhere then f(z)(CO3,K2) 1

(a) May be analytic everywhere

(b) Analytic everywhere

(c) Analytic except at origin

(d) None of these

1-f. The expression $ad - bc$ for the transformation $w = \frac{(az+b)}{(cz+d)}$ is called (CO3,K1) 1

(a) Determinant of bilinear transformation

(b) Cross ratio

(c) Inverse mapping

(d) None of these

1-g. **The residue of the function $f(z) = \frac{z+1}{z^2(z-2)}$ at $z = 2$ is ..**(CO4,K1,K3) 1

(a) 3/4

(b) 0

(c) 1

(d) None of these

1-h. Zeros of $z^2 - 3z + 2$ *are* (CO4,K1) 1

(a) 1,1

(b) 1, 0

(c) 1, 2

(d) None of these

1-i. The value of P(n, n-1) is (CO5,K1) 1

(a) n

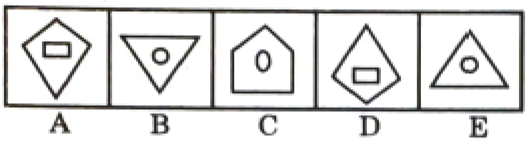
(b) n!

(c) 2n

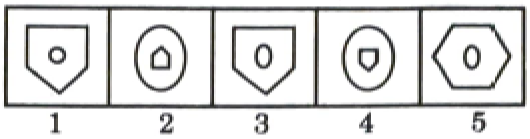
(d) 2n!

1-j. Select a figure from amongst the answer figure which will continue the same series as stablished by the five-figure problem. (CO5,K2) 1

Problem Figure



Answer Figure



(a) 1
(b) 2
(c) 3
(d) 5

2. Attempt all parts:-

2.a.	Classify the P.D.E: $\frac{\partial^2 u}{\partial t^2}+2\frac{\partial^2 u}{\partial x\partial t}+\frac{\partial^2 u}{\partial x^2}+2\frac{\partial u}{\partial x}+6u=0$.(CO1,K2)	2
2.b.	Determine the $Z-$transform of $f(k)=k$ for $k\geq 0$. (CO2,K3)	2
2.c.	State the necessary and sufficient condition for function to be analytic. (CO3,K1)	2
2.d.	Evaluate $\oint_C (y-x-3x^2 i)dz$, where C is straight line from $z=0$ to $z=1+i$.(CO4,K3)	2
2.e.	Define Bijective Functions. (CO5,K1)	2

SECTION-B 30

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

3-a.	Find the solution of the heat flow in one dimension $\frac{\partial u}{\partial t}=c^2\frac{\partial^2 u}{\partial x^2}$ which is consistent with the physical nature of the problem. (CO1,K3)	6
3-b.	Solve: $s+ap+bq+abz=e^{(mx+ny)}$.(CO1,K3)	6
3-c.	Using differentiation property ,find the $Z-$transform of $f(k)=ka^k u(k)$.(CO2,K1,K3)	6
3-d.	Find the Fourier transform of the following function: (CO2,K3) $F(x)=\begin{cases}\frac{1}{2\in}, & \lvert x\rvert\leq \in \\ 0, & x>\in\end{cases}$	6
3.e.	Show that $w=\frac{i-z}{i+z}$ maps the real axis of the $z-$plane into the circle $\lvert w\rvert=1$. (CO3,K3)	6
3.f.	Evaluate $\oint_C \frac{z}{(z^2+1)}dz$, where $C:\lvert z+i\rvert=1$.(CO4,K3)	6
3.g.	Two coins are tossed 500 times, and we get two heads 105 times, one head 275 times, no head: 120 times. Find the probability of each event to occur. (CO5,K2)	6

SECTION-C 50

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

4-a. Solve the linear P.D.E: $\frac{\partial^2 z}{\partial x^2} + \frac{\partial^2 z}{\partial x \partial y} - 6\frac{\partial^2 z}{\partial y^2} = y \cos x$. (CO1,K3) 10

4-b. **Solve the following PDE by method of separation of variables:** $\frac{\partial^2 u}{\partial x^2} = \frac{\partial u}{\partial y}$. (CO1,K3) 10

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

5-a. Find the Fourier cosine and Fourier sine transform of the function (CO2,K3). 10

$f(x) = e^{-3x} + e^{-4x}$

5-b. Using $Z-$transform ,solve the equation:(CO2,K3) 10

$6y_{k+2} - y_{k+1} - y_k = 0,\ y(0) = 0,\ y(1) = 1.$

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

6-a. Examine the nature of the function $f(z) = \frac{x^3 y^5 (x+iy)}{(x^6 + y^{10})}\ z \neq 0$ and 10

$f(0) = 0$ in the region including the origin.(CO3,K3)

6-b. If $u - v = e^x(\cos y - \sin y)$ and $f(z) = u + iv$ is ananalytic function of $z = x + iy$, 10

find $f(z)$ in terms of z.(CO3,K3)

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

7-a. **Evaluate by using Cauchy's Residue theorem:** $\int_C \frac{e^z}{(z+1)^2(z-2)}\,dz$, 10

where C is the circle $|z-1| = 3$.(CO4,K3)

7-b. Obtain the Taylor or Laurent series which represent the function 10

$f(z) = \frac{1}{(1+z^2)(z+2)}$ **in the region**

I. $1 < |z| < 2$

II. $|z| > 1$. (CO4,K3)

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

8-a. Justify Answer for the following Statement and conclusion: 10

Statements: (CO5,K2)

Statements: All the locks are keys. All the keys are bats. Some watches are bats.

Conclusions:

Some bats are locks.

Some watches are keys.

All the keys are locks.

8-b. Solve the following (CO5,K1,K3) 10

I. Find the unit digit of $(4137)^{754}$

II. Find the remainder when 3^{256} is divisible by 5.

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