Printed Page:- 04 | **Subject Code:- BAS0301A /BASH0301A**

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. The particular integral of the P.D.E $(D^2 - 7DD' + 12D'^2)z = e^{(x-y)}$ is: (CO1, K3) 1

(a) $\frac{1}{2}e^{x-y}$

(b) $\frac{1}{12}e^{x-y}$

(c) $\frac{1}{20}e^{x-y}$

(d) None of these

1-b. The P.D.E of second order $B\frac{\partial^2 u}{\partial x^2} + C\frac{\partial^2 u}{\partial x \partial y} + A\frac{\partial^2 u}{\partial y^2} + F(x,y,u,\frac{\partial u}{\partial x},\frac{\partial u}{\partial y}) = 0$ is hyperbolic when (CO1, K2) 1

(a) $C^2 - 4AB = 0$

(b) $C^2 - 4AB > 0$

(c) $C^2 - 4AB < 0$

(d) $B^2 - 4AC < 0$

1-c. By Simpson's 3/8th rule, the integral $\int_{x_0}^{x_3} y\,dx$. (CO2, K2) 1

(a) $\frac{3h}{8}(y_0 + 3y_1 + 3y_2 + y_3)$

(b) $\frac{h}{2}(y_0 + 4y_1 + 2y_2 + y_3)$

(c) $\frac{3h}{8}(y_0 + 3y_1 + 2y_2 + y_3)$

(d) $\frac{h}{2}(y_0 + 3y_1 + 3y_2 + y_3)$

1-d. Gauss Seidel method is applicable to _____________ matrix. (CO2, K1) 1

(a) Null Matrix
(b) Identity Matrix
(c) Triangular Matrix
(d) Diagonally Dominant Matrix

1-e. Laplace Equation for function u is (CO3, K1) 1

(a) $u_{xx} + u_{yy} = 0$
(b) $u_{xx} + u_{xy} = 0$
(c) $u_{xy} + u_{yy} = 0$
(d) $u_{xx} + u_{yx} = 0$

1-f. If real part of f(z) is given then Milnes Thomsen method is (CO3, K1) 1

(a) $f(z) = \int \{\Phi_1(z.0) - i\Phi_2(z.0)\} dz + c$
(b) $f(z) = \int \{\Phi_1(z.0) + i\Phi_2(z.0)\} dz + c$
(c) $f(z) = \int \{\Phi_1(z.0) - \Phi_2(z.0)\} dz + c$
(d) None of these

1-g. A singular point is (CO4, K1) 1

(a) A point at which *f'(z)* fails to be analytic.
(b) A point at which *f'(z)* fails to be equal to zero.
(c) A point at which *f(z)* fails to be analytic.
(d) A point at which *f(z)* fails to be equal to zero.

1-h. **In Laurent's expansion** $f(z) = \sum_{n=0}^{\infty} a_n (z-a)^n + \sum_{n=1}^{\infty} b_n (z-a)^{-n}$**, the first summation is called**(CO4, K1) 1

(a) Null Part
(b) Principal Part
(c) Analytic Part
(d) None of these

1-i. In ……. ways, a committee of 5 members can be selected from 6 men and 5 ladies, consisting of 3 men and 2 ladies. (CO5, K3) 1

(a) 120
(b) 200
(c) 220
(d) 240

1-j. The number of elements in the Power set P(S) of the set S = {1, 2, 3} is …. (CO5, K3) 1

(a) 4 (c) 8

(b) 3 (d) 6

2. Attempt all parts:-

2.a. Classify the P.D.E: $x^2\frac{\partial^2 u}{\partial x^2}+\frac{\partial^2 u}{\partial x^2}=0$.(CO1, K2) 2

2.b. Evaluate $\int_{0.5}^{1.5}\frac{dx}{x}$, by Simpson's 1/3rd rule with $h=0.5$. (CO2, K3) 2

2.c. Find the image of $x=2$ under the transformation $w=1/z$. (CO3) 2

2.d. Determine the poles and residues of the function $f(z)=\frac{z^2}{(z-1)^2(z+2)}$ (CO4, K3) 2

2.e. Find the maximum power of 15 in 100! (CO5, K3) 2

SECTION-B 30

3. Answer any five of the following:-

3-a. Solve: $(2D^2-5DD'+2D'^2)z=24(y-x)$.(CO1, K3) 6

3-b. 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-c. Using Newton's divided difference formula, find a polynomial function satisfying the following data: 6

x	0	2	6
f(x)	5	9	130

Hence find f(1) . (CO2, K3)

3-d. Find a real root of the equation $x\log_{10}(x)=1.2$ by Regula-Falsi method correct to three decimal places. (CO2, K3) 6

3.e. Show that the function $u(x,y)=e^x \sin y$ is harmonic. Find its harmonic conjugate. (CO3, K2) 6

3.f. Discuss the nature of singularity of $f(z)=\frac{(z-\sin z)}{z^3}$ at $z=0$.(CO4, K2) 6

3.g. Statements 6

All cats are dogs (CO5, K2)

some pigs are cats.

All dogs are tigers

Conclusions:

1. Some tigers are cats

2. Some pigs are tigers

3. All cats are tigers

4. Some cats are not tigers

Justify your answer.

SECTION-C 50

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

4-a. The vibration of an elastic string is governed by the PDE $\frac{\partial^2 u}{\partial t^2} = \frac{\partial^2 u}{\partial x^2}$. The length of the string is π and the ends are fixed. The initial velocity is zero and the initial displacement is $2\ (\sin x + \sin 3x)$. Find the displacement $u(x,t)$ of the vibrating string at any time $t>0$. (CO1, K3) 10

4-b. Solve: $\frac{\partial^2 z}{\partial x^2} - 3\frac{\partial^2 z}{\partial x \partial y} + 2\frac{\partial^2 z}{\partial y^2} = e^{(2x+3y)} + \sin(x-2y)$. (CO1, K3) 10

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

5-a. Solve the equation $3x - \cos(x) = 1$, by Newton-Raphson method upto four decimal places.(CO2, K3) 10

5-b. Solve the following system of equations by Gauss Elimination method: (CO2, K3) 10
$4x + y + z = 4,\ x + 4y - 2z = 4,\ 3x + 2y - 4z = 6$

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

6-a. Examine the nature of the function 10

$f(x) = \frac{x^3 y(x - iy)}{x^6 + y^2}$, z not equal to zero and $f(0) = 0$ in the region including the origin. (CO3, K3)

6-b. Find the transformation which maps the points $z = 1, -i, -1$ into the points $w = i, 0, -i$ respectively. 10
Also show that the transformation maps the region outside the circle $|z| = 1$ into the half space $\mathrm{Re}(w) \geq 0$. (CO3, K3)

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

7-a. Expand $\frac{z}{(z-1)(2-z)}$ in Laurent series valid for (CO4, K2) 10

I. $|z - 1| > 1$

II. $0 < |z - 2| < 1$

7-b. Evaluate by using Cauchy's Residue theorem: $\int_C \frac{(4-3z)}{z(z-1)(z-2)}\,dz$, 10

where C is the circle $|z| = 4$.(CO4, K3)

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

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

- A problem is given to three persons P, Q, R whose respective chances of solving it are 2/7, 4/7, 4/9 respectively. What is the probability that the problem is solved?
- Find the probability of getting two heads when five coins are tossed.

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

- Find the inverse of the function f(x) = 4x-3
- Let f(x) = 2x + 1 and g(x) = x^2. Determine g o f (x).