Printed page: 4 **Subject Code: BMIAS0203**

Roll No: | | | | | | | | | | | | | | |

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

M.Tech(Integrated)

SEM:II- THEORY EXAMINATION (2023-2024)

Subject: Engineering Mathematics-II

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

General Instructions:

IMP: Verify that you have received question paper with 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 general solution of differential equation $y'' + y = 0$ is : (CO1) 1

(a) $c_1\, cosx + c_2 \sin x$

(b) $c_1\, cosx - c_2 \sin x$

(c) $c_1\, cosx - c_2 \sin 2x$

(d) None of these

1-b. The degree of differential equation $y'' + \sqrt{y - x} = 0$ (CO1) 1

(a) 1

(b) 2

(c) 3

(d) None of these

1-c. The period of $f(x) = cosx + \frac{1}{2}cos2x + \frac{1}{3}cos3x$ is : (CO2) 1

(a) 2π

(b) π

(c) 3π

(d) None of these

1-d. The sequence $\{n^2\}$ is : (CO2) 1

(a) Divergent

(b) Convergent

(c) Oscillatory

(d) None of these

1-e. The Laplace transform of $F(t) = 1$ is: (CO3) 1

(a) $1/s$

(b) $2/s$

(c) $1/s - 1$

(d) None of these

1-f. The inverse Laplace transform of $f(s) = \frac{1}{\sqrt{s}}$ is: (CO3) 1

(a) $\frac{-1}{\sqrt{\pi t}}$

(b) $\frac{-2}{\sqrt{\pi t}}$

(c) $\frac{1}{\sqrt{\pi t}}$

(d) None of these

1-g. Find the unit normal vector at t=2 on the curve $x = t^2 - 1, y = 4t - 3, z = 2t^2 - 6t$, where t is any variable. (CO4) 1

(a) $\frac{1}{3\sqrt{5}}(2i + 2k)$

(b) $\frac{1}{3\sqrt{5}}(2i - 2k)$

(c) $\frac{1}{3\sqrt{5}}(2i + k)$

(d) None of these

1-h. A vector field F with curl having zero value is called an (CO4) 1

(a) Rotational vector

(b) Irrotational vector

(c) Solenoidal vector

(d) None of these

1-i. If $a : b = 3 : 4$ then $3a + 4b : 4a + 5b$ is: (CO5) 1

(a) 25/32

(b) 4/25

(c) 3/10

(d) 32/25

1-j. What will be simple interest on Rs 600 at the rate 3 ½ % per annum for 4 year ? 1

(a) Rs. 84

(b) Rs. 80

(c) Rs. 87

(d) Rs. 90 (CO5)

2. Attempt all parts:-

2.a. Find solution of differential equation $\frac{d^2y}{dx^2} - 5\frac{dy}{dx} + 6y = 0$ (CO1) 2

2.b. Test the Convergence of the infinite series 1+3+5+7+…… . (CO2) 2

2.c. Evaluate Laplace transform of $e^{3t}sint$ (CO3) 2

2.d. Find the value of $Curl\ (gradf)$, where $f = 2x^2 - 3y^2 + 4z^2$. (CO4) 2

2.e. Introducing a boy, a girl said, "He is the son of the daughter of the father of my uncle." How is the boy related to the girl? (CO5) 2

SECTION – B 30

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

3-a. Apply method of variation of parameter method to solve $\frac{d^2y}{dx^2} + 4y = 4\tan 2x$. (CO1) 6

3-b. Solve the simultaneous equation : $t\frac{dx}{dt} + y = 0,\ t\frac{dy}{dt} + x = 0,$ given $x(1) = 1,$ $y(-1) = 0$. (CO1) 6

3-c. Develop $\sin\frac{\pi x}{l}$ in half range Cosine series in the range $0 < x < 1$. (CO2) 6

3-d. State Alembert's test. Test the series: $1 + \frac{x}{2} + \frac{x^2}{5} + \frac{x^3}{10} + \cdots$ ... ... (CO2) 6

3-e. Express the following function in terms of unit step function and obtain its Laplace transform. 6

$F(t) = \begin{cases} t-1, & 1 < t < 2 \\ 3-t, & 2 < t < 3 \end{cases}$ (CO3)

3-f. Find the work done when a force $\overline{F =}(x^2 - y^2 + x)i - (2xy + y)j$ moves a particle from origin to (1,1) along a parabola $y^2 = x$. (CO4) 6

3-g. One year ago the ratio between Samir and Ashok age was 4:3. One year hence the ratio of their age will be 5:4. Find the sum of their present ages in years. (CO5) 6

SECTION – C 50

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

4-a. Solve the differential equation by changing the independent variable 10

$cos\ x\ y'' + y'\ sinx - 2y\ cos^3x = 2\ cos^5x$. (CO1)

4-b. Solve the differential equation $(D^2 - 6D + 13)\ \ y = 8\ e^{3x}\sin 4x + 2^x$. (CO1) 10

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

5-a. Expand the function $f(x) = x\ sinx$ as a Fourier series in the interval $-\pi \le x \le \pi$. 10
Deduce that $\frac{1}{1.3} - \frac{1}{3.5} + \frac{1}{5.7} - \frac{1}{7.9} + \cdots = \frac{\pi-2}{4}$. (CO2)

5-b. Test the convergence of the series 10

$1 + \frac{x}{2} + \frac{1.3}{2.4}x^2 + \frac{1.3.5}{2.4.6}x^3 + \cdots, \quad x > 0$ (CO2)

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

6-a. Use Convolution theorem to evaluate $L^{-1}\left\{\frac{s^2}{(s^2+1)(s^2+4)}\right\}$. (CO3) 10

6-b. Solve the differential equation by Laplace transform $y''' + 2y'' - y' - 2y = 0$, where $y = 1, y' = 2, y'' = 2$ *at* $t = 0$. (CO3) 10

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

7-a. Verify Stake's theorem for the function $\overline{F} = x^2\,\hat{\imath} + xy\,\hat{\jmath}$ integrated around the square whose sides are $x = 0, y = 0, x = a, y = a$ in the plane $z = 0$. (CO4) 10

7-b. Use the Divergence theorem to evaluate $\iint (xdydz + ydzdx + zdxdy)$ over the surface S, where S is the portion of the plane $x + 2y + 3z = 6$ which lies in the first octant. (CO4) 10

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

8-a. (i) Sanjeev walks 10 m towards the South. Turning to left, he walks 20 m and then moves to his right. After moving a distance of 20 m, he turns to the right and walks 20 m. Finally, he turns to the right and moves a distance of 10 m. How far and in which direction is he from the starting point? 10

(ii) There are two containers of equal capacity. The ratio of milk to water in the first container is 3:1, in the second container 5:2. If they are mixed up, then find the ratio of milk to water in the mixture. (CO5)

8-b. (i)The difference between Compound Interest and Simple Interest on a certain sum of money at 10 % per annum for 3 years is Rs. 930. Find the principal if it is known that the interest is compounded annually. 10

(ii) The area of a trapezium shaped field is 480 m^2, the distance between two parallel sides is 15 m and one of the parallel sides is 20 m. Find the other parallel side. (CO5)